APPROACHES TO PLANNING AND DESIGN OF HEALTH CARE FACILITIES IN DEVELOPING AREAS

Volume 5

CROSS-NATIONAL ANALYSIS OF CASE STUDIES

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SUMMARY

The first part of this report lays down a framework for the analysis of health care facilities within national health systems on a basis of regionalization. It was found that in some countries unawareness of the defined and assigned functions of particular health care units led to duplication of services and lack of coordination between them. A model for the functional programming of regionalized health services offers means of remedying this.

Of the countries included in the case studies, Senegal, Sudan, and Zambia are examples of low-income countries with a market economy, whereas Venezuela is an example of a relatively affluent developing country with a market economy. Algeria and Cuba are examples of developing countries of the socialist type.

At the time of the studies, Senegal, Sudan, and Zambia were preparing and implementing national plans for health care facilities. The process was hampered by the multitude of public and private institutions involved. The interest and responsibility of particular ministries, donors, missions, etc. made it difficult for regionalized planning to succeed. In Venezuela, for example, more coordination between the Ministry of Health and the Social Security Institute would greatly enhance the efficacy of health facility planning. In Algeria and Cuba, fewer institutions were involved. Centrally initiated plans were checked by regional and municipal bodies and then implemented. In Algeria, unlike Cuba, the design and construction of health facilities depended largely on the private sector and sometimes the high targets set could not be fulfilled within the period specified in the plans.

The section on technical tools for the physical planning of health care facilities considers various type plans available in the countries studied. The universal use of standard designs over long periods of time is discouraged as demands on specific facilities tend to change and new needs have to be accommodated.

In the second part of the report, all the architectural findings are analysed.

In some countries access to health units presented problems. The causes lay not only in the number and location of the facilities but also in the lack of all-weather roads and of adequate means of transport for use by both the public and health workers.

The section on the design, flexibility, and layout of buildings of different sizes draws attention to a number of changes that could improve existing and future health facilities. At the hospital level simultaneous over- and under-utilization of space was frequent. Sometimes buildings had not kept pace with changes in population and in morbidity patterns. Sometimes existing buildings were too small for new developments in medical technology to be introduced, or room could not be found to house new services, such as family planning or community or environmental health. Shortcomings in respect of regionalization and referrals also contributed to excessive demands on space, for example in the accident and emergency departments. In Islamic settings, the cultural demand for segregation of men and women had been duly incorporated in the designs, but they did not reflect differences in utilization rates. This was particularly noticeable in the waiting areas, where the women's sections were overcrowded by comparison with the men's. Often individual departments had not been sited so as to maximize flows of patients and materials. In some units, clean and contaminated flows of materials and of staff and patients were not kept separate, thus increasing the risk of cross-infection. Multistorey buildings requiring lifts and other special installations had often been preferred to less complex horizontal structures. In countries still lacking the necessary maintenance networks and adequately skilled manpower, the frequent breakdown of the heavily used lift systems disrupted the operation of many hospitals. In outpatient facilities (e.g. polyclinics and health centres) too, problems relating to layout and lack of flexibility were found. Internal traffic flows were also in need of improvement as various movements of materials and people were intermingled. A problem of task definition and subsequent space allocation was observed in one country where both polyclinic and health centre facilities were available. Identical tasks were performed in both facilities but much more space had been allowed for individual activities in the polyclinic than in the health centre. In other countries, larger health centres at times shared the fate of hospitals in that diagnostic equipment could not be accommodated in purpose-built areas. In the concluding part of the design section, the need to update standard or type plans is duly documented.
In the market-economy countries, on the other hand, large amounts of materials had been imported, especially for the building of hospitals. Smaller units were often built with local materials, the use of which could be further increased. The hospital buildings seen were generally sound and safe. But, in the more remote areas of some countries, the construction of health centres was apparently not supervised, because of manpower shortages. Serious mistakes had been made at the construction stage, e.g., building on "unprepared soil" and inadequate protection of load-bearing structures against water penetration. Cracks in walls and uplifted floor tiles were the inevitable result.

Basic installations testified to the disparities between urban and rural areas in most of the countries, Cuba being an exception. Thus, water supply systems in the smaller facilities were often out of order. Lack of maintenance and spare parts caused problems in hot water and sewerage systems.

Almost all the facilities visited were connected to an electricity network. However, the regularity of the supply varied. Whereas hardly any difficulties arose in Zambia, Algeria, and Cuba, facilities in the other countries were affected by power cuts. Most larger units had standby generators, but few of the smaller ones had as yet been equipped with alternative sources of power.

The methods used to create an acceptable internal microclimate were also investigated. Hospitals had usually been designed to rely to some extent on artificial ventilation, although sometimes the orientation of the buildings made use of the prevailing winds so that only essential areas had to be air-conditioned. Almost every country, apart from Cuba, had difficulty in ensuring the permanent functioning of sensitive air-conditioning systems. Once again, the cause was inappropriate maintenance. In smaller facilities, too, there were sometimes problems of ventilation, for example when they were built around a closed courtyard permitting only limited air circulation. In some countries, the windows of the smaller units had also to be kept closed in the absence of wire mesh.

Fire precautions were looked into carefully, since they are essential in any building, particularly a health facility. Some serious problems were found; for example some designs failed to incorporate enough escape routes and external staircases for use should internal routes be blocked.

The penultimate section deals with medical and other equipment, and the final section with means of communication. Both record a number of failures that particularly affected the functioning of certain hospitals and of the regional health network they had to serve. In most of the countries, the smaller facilities simply lacked the necessary equipment. Remote rural units could sometimes be reached only by two-way radio, and in the absence of which messages had to be sent through drivers or supervisory staff.
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INTRODUCTION

"Approaches to planning and design of health care facilities in developing areas" is the title of a WHO project designed to bridge the gap between existing knowledge on the subject and its practical application. To this end, an advisory group consisting of suitably experienced architects and health managers was set up to gather relevant material for a series of publications of interest to all concerned with the planning of health care facilities in developing countries. The four volumes of these "Approaches" so far issued (in English, French, and Spanish) outline the basic principles involved and offer practical advice on all phases of the development of health care facilities, from area-wide planning to building, equipment, maintenance, and operation.1

In 1978, the advisory group mentioned above decided that it would be most useful to obtain complementary information through systematic national case studies. The intention was to provide a comprehensive picture of the development and operation of health care facilities in their local contexts, with emphasis on the problems and solutions encountered in countries with varied political and socioeconomic backgrounds. These studies were made possible by financial support from the Swedish International Development Agency (SIDA), and six developing countries (Algeria, Cuba, Senegal, Sudan, Venezuela, and Zambia) expressed their interest in taking part.

In each participating country the studies covered the main categories of health care facility, with emphasis on peripheral units. In addition, the relevant national and regional backgrounds were investigated. Joint national and WHO missions spent several weeks collecting data in each country. A much longer time was required to collate and analyse them and to produce the national reports. Each report was then submitted to the government of the country concerned for discussion and the formulation, if the governments so wished, of conclusions and recommendations by a high-level national workshop.

The series of case studies was expected to be useful for national health planning, since they would offer concrete alternatives, together with information on the performance of facilities in given settings. However, it soon appeared that the studies would also be helpful in providing information on the most appropriate technologies for developing the physical infrastructure of a national health care system and in disseminating them for wider application. These technologies cut across different specialties and different sectors and agencies.

So that valid interpretations of the case studies could be obtained, it was decided that data should be collected both on the physical aspects of the facilities and on the relevant health care system and health planning and management processes. The units observed could be compared to windows affording a view of the system at grassroots level, the impressions gained being checked against national information and the opinions and advice of senior national officials.

The participating countries offered good opportunities for the study and comparison of facilities developed and operating in a wide range of situations. Both centrally planned and market economies were represented; the per capita national product varied between US$ 320 and US$ 2900; the environments considered included the temperate hilly areas of Algeria and Venezuela, the tropical plains of Cuba and the savannah of Senegal, the steppes of the Sudan and the Sahara desert; some of the facilities examined were tiny grass-roofed huts and some were city hospitals.

The studies were based on certain assumptions. For example, it was postulated that the main criteria on which a health care facility should be evaluated are:

- its justification: should a facility of such a type have been built in that particular place?
- its functional adequacy and effectiveness: are the type and volume of activities performed in the facility relevant to the needs of the community?
- its economic efficiency: are the capital costs and the anticipated running costs of a facility affordable in the country concerned?

its flexibility: can the facility be easily modified or extended to adapt it to changing needs?

In addition, it was assumed, on the basis of previous experience, that the quality of a health care facility meeting the above criteria depends on the following interrelated groups of factors:

- the functions assigned to each unit, and the extent to which these functions are the result of proper health planning expressed in an adequately designed and effectively managed health care system

- the process of planning the facilities themselves: determining the types of units to be built, their number, and their location

- the economic factors: costs, financing, durability of the facilities, investment policies and planning

- architectural and related technological factors, such as siting, design, materials, building techniques, basic installations, equipment, and maintenance

- how the building and equipment are used and operated.

Another basic tenet was the realization that health care facilities account for only a part of a country's building activities. At least two sectors overlap here: health and building construction. There is, in fact, a real need for intersectoral and multidisciplinary participation and for the involvement of users and consumers, as appropriate, through every phase of the development and operation of health care facilities.

Bearing in mind the overall purposes and premises outlined above, the specific objectives of the case studies at both the national and the international level were identified.

In each participating country, the intention was:

- to produce information for the assessment of health care facilities in the context of the health care system and its management

- to develop and adapt to the national situation a method that might be applied in similar studies in the future

- to provide a basis for recommendations to planners and administrators in the areas covered by the studies

- to provide advice on the solution of concrete problems of immediate concern to the health services of the country in regard to the planning and improvement of their facilities.

In addition, it was intended to contribute to international cooperation in the development of health care facilities by making the main results of the study available to other countries.

In accordance with these objectives, this volume is addressed primarily to: national policy-makers and administrators in the fields of health and building; regional or provincial officers in the same sectors; professionals directly involved in the planning of health facilities; and teachers, and students in the relevant disciplines.

For many of these readers, this volume may appear limited from the strictly technical standpoint, but it is hoped that it will provide a broad framework for a rethinking of their own approaches. Because of this and its concern with the why and wherefore of health facilities, the book may also be of interest to leaders and representatives of the public.

In an endeavour of this nature, there cannot be a finished product. This is little more than a beginning, and it is also definitely a challenge. As developing countries increase their self-reliance they should be able to assess their experience with better methods and share it internationally on a more regular basis.
PART ONE

DETERMINANTS IN THE PLANNING OF HEALTH CARE FACILITIES
PART ONE

DETERMINANTS IN THE PLANNING OF HEALTH CARE FACILITIES

1. The place of facilities in national health systems

National health systems\(^1\) are made up of certain functionally interrelated components, which include:

- individuals, families, and communities acting as agents of their own health care and using, to this end, their skills, their houses, etc.

- formal health care delivery units, such as health posts, health centres, or hospitals

- "health offices", dealing with health care administration and with certain collective health measures

- supporting components, such as schools for training health personnel and health facility planning groups

- the health-related units and structures of other sectors of national activity, such as the health education programmes of the school system or the environmental health programmes of certain sectors.

The emphasis here is on health care delivery units, since it is a question of planning facilities for housing some of these units. Every health care delivery unit ("health unit" or "health institution") is a combination of resources designed to fulfil certain functions relating to people's health. These resources always include personnel, as well as some equipment and supplies; sometimes they also include buildings. The term health care facility, as used in this volume, means a building, or group of buildings, with the basic installations and equipment. Since health care facilities often constitute the most visible part of a health care delivery unit and are often designated by the same names, e.g., health posts, health centres, or hospitals, facility and unit are frequently confused.

Once built, health care facilities determine to some extent the type and volume of the activities performed in them, and it may be difficult to re-adapt the buildings to functional changes. They should therefore be planned with reference to the health needs that have to be met by the specific health care delivery units. In other words, the development of health care facilities should follow from the overall process of health planning - it should not lead to it as sometimes happens in practice.

Among the principles to be considered in selecting the type of health care facility to be provided and its location, the most important is that of the sufficient and uniform accessibility of the health care network to the entire population. Complementary principles include those of functional effectiveness, economic efficiency, and manageable unit size.

The simultaneous and balanced application of these principles naturally leads to a health care delivery system comprising more than one functional level. The first level satisfies those needs that imply frequent contact with the majority of the population, such as the care of common ailments, programmed health controls, and support for community health work. This level is therefore made up of activities that are carried out through a number of widely disseminated units easily accessible to everyone. Care for conditions that are less frequent (and usually more difficult to diagnose and treat) does not need to be fragmented to the same degree. Besides being unnecessary, it would be technically unsafe and economically inefficient to duplicate excessively the performance of complex techniques and the use of sophisticated equipment. Thus a second - and sometimes a third and fourth - level of health care delivery is generated.

The principle of regionalization\(^1\) means that everybody needing it, wherever he or she may live should have access to the appropriate higher level of health care. There must therefore be appropriate referral procedures, prompt transport, and technical support from the higher levels to the periphery of the health care delivery system.

However, in order to ensure uniform accessibility throughout the country, the health care delivery system must be adapted to the geography and population distribution of each particular area. In any country there are several geo-demographic situations, and these should be reflected in the health care delivery system. Typical and contrasting examples of such situations are those of (a) rural areas with widely dispersed small villages, and (b) large cities. In the case of (a), many small units are needed to make primary and secondary care accessible. In that of (b), there may be fewer and larger units for ambulatory care and community health and a few large hospitals. Many other patterns of population distribution exist, each offering a particular challenge to those seeking to design an adequate health care subsystem.

In the rural areas of developing countries, it is common to find a number of different types of health care delivery unit. In one of the countries participating in the case studies, every rural district had:

- a rural hospital
- rural health centres
- dispensaries
- primary health care units
- village midwives operating from their homes.

The following questions arise: are all these types of unit really necessary? What are the specific functions of each? Is there any justification for the costs this situation entails in terms of administrative complications, diversified types of staff and buildings, confusion on the part of users, and fragmentation of services?

Some countries have given special thought to the definition of what might be called "type units" of their health care systems. When these definitions are compared and the type units and their functioning in real life appraised, many problems and alternatives emerge.

A specific example is that of health posts, which are small but are needed in great numbers. Their cost varied between less than US$ 300 each (plus community labour), if built in local traditional materials, and US$ 20,000, if built of bricks, wood, and asbestos. It is therefore essential to define the role of these posts within a country's various subsystems for rural care: how long should they be expected to last and how solid should they be? What functions and equipment will they have? What are the attitudes of the local population? What is going to replace the posts in the future? Are new roads and better transport going to make some of them unnecessary?

Other factors pertaining to rural health care delivery that must be taken into account when planning the system and its facilities include: the contribution of village midwives and trained traditional healers, operating from their own houses; the role of private vendors of medicines using the public market place; the use of school premises or of rooms in the houses of local leaders; mobile clinics; health care camps; estate, plantation, or mine hospitals or clinics; and, last but not least, the provision of accommodation for the staff.

It is urgent for each country to define the functions of rural hospitals. Fig. 1 gives a breakdown of hospital functions into modules that can be combined in various ways to determine the type of hospital required. Is a rural hospital a "health centre with beds and doctors", turned outwards towards the entire territory and population of a well defined catchment area? Or is it just a miniature version of a city hospital, extending its wards every time extra resources come to hand? What can be the outreach of town and city hospitals into the surrounding rural area? How many rural hospitals can the country avoid building (by using this outreach properly), without reducing the accessibility of secondary care?

Fig. 2 indicates the possible functions of a "non-hospital" or ambulatory health care delivery unit and should be of help in determining the type of unit needed in a particular situation. Some of the modules shown merit further specification so that requirements may be ascertained more precisely. For instance, module B — personal medical care — may be provided by personnel with different qualifications, ranging from an auxiliary worker to a whole team of physicians and paramedical staff representing all the basic branches of medicine. Module D may include different combinations of the following: maternal and child health, family planning, disease control, nutrition, immunization, health education, school health, and occupational health. Home visits may be included, to a varying extent, in modules A, B, C, D, and E. Module I (technical auxiliary services) usually comprises statistical, pharmaceutical, laboratory, and X-ray services, but more specialized procedures such as electrocardiography or phonauiology may also be offered. The physical support services (module L) may include storage, maintenance, transport, and sterilization.

A small health post, for example, may include modules A, B, C, and D at the simplest levels of technology; in module D the main emphasis will probably be on health education, environmental hygiene, nutrition, and maternal and child health. At the other end of the spectrum, an urban health centre may comprise all the modules and perform every function at a highly sophisticated level. In some of the collaborating countries, module E — dental care — is found in small peripheral units; in others, it is not included at all in the rural subsystem. In several countries, units specialized in B, C, and I (pharmacy) and usually called "dispensaries", coexist with others that emphasize A, B, C, and D and come under the category of health centres or subcentres.

**FIG. 1. FUNCTIONAL MODULES THAT MAY BE COMBINED IN DIFFERENT TYPES OF HOSPITAL**

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In cities, the key issue is the definition of the units that should provide the first level of care. It is generally accepted that these units - the urban health centres - should make care accessible to people in every part of the city and that they should relieve the hospitals of their work-load. However, the precise implications of this need to be clarified in order to have guidance on the number, location, size, staffing, building, and equipment of the health centres. Here are some of the relevant questions, which have been answered in different ways in different countries:

- **Area and population to be served.** Are the boundaries clearly marked on the map of the city? Depending on the density of population in each district, how large a population can have ready access to the health centre? Ten thousand, a hundred thousand? Does everybody in the catchment area have the right to go to the health centre, or have different parallel subsystems been organized for different groups?

- **The staff providing care.** Are they organized around general practitioners or around a team of specialists in the basic branches of medicine (paediatrics, obstetrics and gynaecology, internal medicine, stomatology, psychiatry) as in Cuba? In Venezuela, practically all specialities are foreseen in the "ambulatorios". In Cuba, specialists from the hospital hold consultations in the "policlinicos".

- **Sectorization.** Are the staff providing care grouped into small teams, each with responsibility for a sector within the overall catchment area of the health centre? If so, are they physically grouped by sector team in the facility? Or, as is more frequently seen, are they grouped by speciality?

- **Diagnosis and treatment.** Should the health centres aim at self-reliance in this area and have their own X-ray, laboratory, rehabilitation, electrocardiography, and minor surgery services, beds for rehydration, delivery rooms, observation rooms? Or should they refer patients to the hospital for such services? Each possibility deserves special consideration, and different formulae will be adopted in different cities and boroughs. Every solution will have implications for the design of the facilities.

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*a For a more complete presentation of the subject, see: Montoya-Aguilar, C. Hospitals and primary health care. World hospitals, 17 (3): 22-25 (1981).*
- **Domiciliary care.** This is a small part of health centre work in most cities, but even so it may be essential for community satisfaction, for controlling environmental factors in disease, and for managing serious cases while economizing on hospital beds. It requires extra transport facilities and thus more garage, parking, vehicle access, and workshop space.

- **Working hours.** These have a decisive influence on the space to be provided and on the overcrowding or underuse of the facilities. Sometimes a centre works for only a few hours a day. The problem is one of staff organization.

- **Emergencies.** In some countries, such as Cuba and Venezuela, health centres have emergency departments where patients are seen after normal working hours. In fact, these "emergency cases" are to a large extent manufactured by the system. They do not represent true medical emergencies, but consist of people who felt ill outside the working hours of the centre and did not wish to wait until the next day or who waited until evening in order not to be absent from work or because they expected to receive prompter service as emergency cases. Changes in the health system would probably reduce or eliminate the need for building separate emergency departments in health centres.

- **Waiting space.** The need for large waiting areas and the problem of overcrowding in these areas arise, to a large extent, from the absence of an appointments system. Such a system can be very effective if the health centre provides programmed care on a continuous and well-organized basis. This is a normal requisite of good quality care and pays dividends in terms of reduced building investment, less waste of time by users and staff, and a more pleasant atmosphere in the centre.

- **Teaching.** Health centres may have a teaching function, which should be taken into account in the plans by making some consultation rooms larger, by including a classroom and lockers for the students, and by providing for appropriate entrance and circulation arrangements.

- **Multiservice modules.** These are small health centres built in the same compound, with social services, an adult education room, and a store selling basic commodities. They have been developed in Venezuela as part of the community infrastructure in the poorer neighbourhoods. The idea is an interesting one that raises the question of the place of health delivery units within overall urban development of a "crisis" type. It also raises the issue of a certain "ruralization" of care for migrants from rural areas to the cities.

The place of city hospitals in the system also requires definition. Like the health centres, they should be responsible for a specific area and population at the higher levels of health care delivery. They function as national, or at least provincial, hospitals and therefore they also have to provide services for more distant populations under the principle of regionalization. The total extent of these responsibilities depends on the size of the hospital. There is much argument about the maximum capacity of these institutions, which was usually considered in the collaborating countries as being 600 beds. However, several hospitals of this capacity can be grouped to some advantage so as to serve an urban population of 300,000 to 500,000, in addition to catering for a more distant regional population.

Such large facilities are the concern not only of the health care system but also of urban planners. Since every city has had hospitals for a long time, the development of these facilities involves a great deal of remodelling of the city neighbourhoods concerned, of the local health care system, and of the buildings themselves.

One very important issue in modern city hospitals is whether they should receive only referred cases in their wards and specialized outpatient sections. Such cases may come from urban health centres in the area linked with the hospital, from the provinces in the regional system, and from emergency departments. The adoption of such a policy means that hospitals would have no "general" outpatient department open to the public and that the units providing the first level of urban care would have to be suitably located and strong enough to bear the brunt of the demand.

Another issue is that of emergencies, as seen from the viewpoint of the hospital. Barring the public from direct access to the outpatient department may mean an increase in the demand on hospitals' emergency departments if the health centres cannot cope. On the
other hand, there are two main options for organizing specialized emergency care in a large city. One is to provide it in the city hospitals, extending the existing surveillance of normal in-patients to emergency cases. Another is to have a network of emergency hospitals with their own organization and transport. In either case, a single communications centre is needed to receive calls and direct ambulances to the patients, and then to the appropriate places of care, with the minimum loss of time. Planners of facilities should also know where the ambulances are to be garaged and what the capacity of the garages should be.

There are many other aspects of the health care delivery system of interest to planners of urban health facilities. Progressive care, day-hospitals, early discharge policies - these are only some of them. However, the examples given above may suffice to illustrate some of the problems highlighted by the case studies.
2. The national setting

This section deals with the national processes determining what health care facilities are to be built and how many, where, when, and how. It deals also with the main factors that were seen during the study as influencing those processes. The decision to build is logically followed by the stage of physical planning in each case and this will be the subject of later sections.

Decisions on the development of health facilities are determined by the social, political, and administrative structure of each country; by the level of economic resources; by the degree of community participation in decision-making; by the place of health among national priorities and the effectiveness of coordination between health-related sectors; and by national capabilities in planning and administration.

In the overall planning of the physical infrastructure for health care, several national and local planning processes intersect, notably those relating to health, building construction, and investment. Since it takes time to finance, project, build, and equip the facilities, and provision has to be made for their staffing and for their running costs, they belong to the realm of long and medium-term planning.

The planning of the facilities must be closely coordinated with planning in certain other areas namely: territorial or physical development (e.g., urbanization and improvement of communal services); public works (which provide the "infrastructure for the infrastructure" in the form of potable water, sewerage, electricity, roads, etc.); the design of the health system (since this determines the categories of health unit required and their organization into regional networks); the allocation of the skilled manpower required for planning, building, and operating the facilities; construction and equipment technology; acquisition and production capacity; and foreign trade (since imported items may be needed).

The overall context, the problems arising within it, and the solutions developed with varying success differ considerably from one country to another. Findings in this regard are summarized separately for three subgroups of study countries but it must be emphasized that there are no clearcut divisions between them and that the breakdown used has been adopted mainly to facilitate the presentation and analysis of extremely complex situations.1

Low-income countries (Senegal, Sudan, Zambia)

This group of countries is characterized by:

- low national income

- a single-party government

- formal planning of socioeconomic development at the central level, producing medium-term plans

- a presidential regime with decentralization of political and administrative authority to the provincial and regional levels

- an official policy of community participation and of social welfare (e.g., the "human promotion" of Senegal and the "humanism" of Zambia)

- a marked social duality between urban and rural society, and, within each society, between the modern monetary stratum and the traditional subsistence stratum (this was clearest in Senegal and Zambia)

- an economic dualism based on the coexistence in different proportions of private and public sectors, and substantial external financing of social investments

- a predominance of the poverty pattern of mortality and morbidity.

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Among the study countries, Senegal, Sudan, and Zambia share these characteristics, though with subtle differences.

In this general context, the planning system for medium-term social and economic activities concerns only the public sector. Policy guidelines are initiated by the Party and plans are basically developed by the executive bodies, which include a national planning board or council, and approved by the Legislative Assembly. Other inputs into the overall planning process come from the provincial and district levels of government and even from the villages. In Sudan, for example, these are channelled through the Ministry of Local Government, whereas in Zambia they are generated by the "development committees" that exist at all levels. The planning of health care facilities being essentially a response to the needs established for the health system by the health planning process, it is important to consider the situation regarding this system and this process in the countries studied.

At the time of the study, Senegal's development plan did not include a national health plan; health policy pronouncements referred mainly to the extension of the system at the periphery through the construction of health huts by rural communities. Sudan had worked out the initial phase of a health plan involving the "first line" of rural units. Zambia was in the process of drafting a national health plan. All three countries had endorsed primary health care as the basis of their health policies; the health care system was fragmented into a variety of subsectors and institutions with many sources and channels of financing. In Senegal, for example, there was the conventional pyramidal structure of government health services under the general aegis of the Ministry of Health; but two of the three national hospital groups in Dakar belonged, respectively, to the university and to the armed forces; some municipalities had their own clinics, some public and private enterprises offered health care benefits to their employees, missions and other external agencies operated various health establishments and projects, and there was a large private (profit-making) subsector. The result was a multiplicity of decision-making agencies, among which it was difficult for the Ministry of Health to play a decisive leading role. The regional and district establishments were administratively dependent on the governors and prefects, so that communications between them and the Ministry of Health were indirect; and in the Ministry itself the responsibility for the smaller facilities lay in a division different from that in charge of hospitals. Communities had been persuaded to build small facilities and designate health workers and were going ahead with this task, while the network of health centres and health posts remained the weakest link in the chain, unable to provide support for itself and insufficiently supported by the hospitals and regional directorates. To this was added the emergent role of the social security system as an additional decision-making agency. In such a complex situation, it was obviously difficult to make plans for health facilities as a whole from a truly national standpoint; in fact, the formulation and implementation of national budgetary plans was a problem in itself.1

In health planning as it relates to the physical infrastructure in Senegal, other instances come into play: the Ministry of Planning, Finance, and Coordination, the Ministry of Urbanization, Housing, and Environment, the semi-official Society for Development Studies, and the private construction sector, as well as the regional, district, and communal governments.

In Sudan and Zambia, there are similar complexities in the planning environment. In Sudan, the part played by donors in the construction of certain facilities was particularly noticeable; although their contribution was considered positive and officially encouraged, it was also recognized that they generate problems by deviating from national norms and priorities regarding the location and construction of facilities; they also oblige the government to use up parts of its scarce budget in staffing and operating the buildings donated. In Zambia, the copper companies which are part of the public sector have their own separate health services, alongside those of the missions and the government; thus it is more difficult to achieve equity of health care benefits in the Copperbelt Province, and this has repercussions on the allocation of the country's total health expenditure. In Zambia, one of the principles of government policy is that the State, while respecting the value of every individual, must direct the development process for the benefit of all; as a result, private practice by government-employed physicians is prohibited. Since there is a shortage

of doctors in Zambia, this measure may have reduced their influence on decision-making. In Sudan and Senegal, however, the organization and influence of doctors and also of paramedical staff had to be taken into account by the government in the planning process.

In Senegal and Zambia, annual programming and budgeting were clearly divided into two compartments: development and current expenditure, the first being handled mainly by the Planning Board and the second by the Ministry of Finance and by local government. This division was also noted in Algeria and is found in many other countries. It creates the impression that development may be equated with growth of the physical infrastructure, and the actual satisfaction of social needs is thus partly lost sight of.

The process of decision-making is also influenced by quality of management. In the countries of this group, serious weaknesses in management were reported, at least in the health sector. The symptoms included: absence or inadequacy of job descriptions (Senegal, Zambia); lack of clarity in organizational relationships and of proper authority to carry out assigned responsibilities (Sudan, Senegal); and difficulties in budget implementation (Senegal).

Affluent developing countries (Venezuela)

Venezuela may be considered to belong to a group of developing countries that:

- are in the middle bracket of per capita national income
- have a multiparty political system, institutions of a liberal-democratic nature, and a presidential regime
- formulate broad strategies for their overall national development
- have a substantial body of skilled manpower
- are undergoing an urban explosion, accompanied by the growth of periurban slums
- are in a transitional situation as regards demography and morbidity, with a low death rate, diminishing fertility, and coexistence of the morbidity patterns of poor and industrialized countries
- share with the preceding group of countries the policies of decentralization and community participation, and the same marked social and economic dualities, while not being significantly dependent on external sources of financing for social investment.

The overall planning process takes into account the demands and proposals of the state (or provincial) and district governments and those transmitted through the hierarchies of the various ministries. In the light of the programme of the party (or parties) in power, these proposals are consolidated by the Office of Coordination and Planning of the Presidency and the Ministry of Finance. They are then sent to the Legislative Assembly for approval, promulgated by the President, and distributed to the Ministries and local government authorities for implementation. A more limited process takes place in the case of decisions to be made at other levels of government or by state legislative assemblies.

Although there is a five-year National Development Plan, the annual programming and budgeting for each sector is of greater importance; it is based mainly on an incremental approach. It is difficult to identify a long-term perspective, given the periodic presidential elections and the resultant changes in government policy.

Health planning falls within the framework of general planning. As in other countries in this group, there have been periods of active health policy formulation and attempts to use a systematic health planning method based on needs. In Venezuela this resulted (around 1958) in the creation of a rural health care network based on centres staffed by doctors doing a period of rural service and on the system of "simplified medicine" practised by auxiliaries stationed in dispensaries. More recently, in the seventies, multisectoral service modules have been created to serve the poor periurban population and an approach based on "participatory medicine" has been developed. Indeed, Venezuela has faced a tremendous increase in the demand for health care, as well as rapid changes in the
distribution of this demand. This is reflected in the disparities between localities in the utilization of facilities: in some places they are overcrowded, in others underused. It is also reflected in the high proportion of emergency consultations. It appeared, however, that there had been no overall updating of the health policy and system developed in the late fifties and early sixties.

The national health system is divided into two strong subsectors, public and private. The public sector includes: (a) a basic network that comes under the Ministry of Health, but for parts of which the state or municipal governments have some administrative and financial responsibility; (b) the health services of the Social Security Institute, which come under the Ministry of Labour; (c) the hospitals of the capital, which belong to the Public Welfare Directorate of the Federal District; (d) the health services of the armed forces; and (e) a large number of smaller services. The construction sector is also quite complicated, with a public subsector under the guidance of the Ministry of Urban Development, as well as a large private area. In view of the problems generated by the fragmentation of the health sector, a proposal for a National Health Service amalgamating the health institutions of the public subsector has been studied and formulated. However, this proposal has not yet been adopted.

As regards the managerial environment, there were, side-by-side with examples of efficiency, some areas where delegation of authority, referral of patients, supervision, coordination, programming, and procedural norms were in need of improvement. There was plenty of information, but not enough of the simple information required for health planning and evaluation. The rural medical services were functioning but, in the areas observed, they lacked priority support from the overall system. On the other hand, active efforts towards reorientation on the part of most medical and paramedical schools, coupled with the positive tradition of the country in the area of public health and with its recent wealth, were positive factors.

**Socialist developing countries (Algeria and Cuba)**

Two countries in the study, Algeria and Cuba, belong to the subgroup of developing countries that, broadly speaking:

- have a centrally planned economy, planning being inherent in their political life
- have a single-party system
- are in the middle national income bracket
- have a presidential regime and elected legislative assemblies at various levels
- have a policy of gradual decentralization of executive authority (at least down to the provincial level) and foster organized community participation in decision-making (including the participation of workers in their own work centres)
- have policies aimed at reducing the urban-rural, modern-traditional, public-private, and class dualities inherited from previous systems
- are experiencing a shift in their demographic and health status from that characteristic of poor countries to that of industrialized countries
- have highly organized national health systems, with health explicitly recognized as a responsibility of the State and as an end in itself.

In these countries, medium-term plans for socioeconomic development include detailed objectives for health and the building of health facilities. Their preparation begins several years in advance, when the proposals for each branch of activities are collected at grassroots level to be finally consolidated at the centre by the respective ministries. The central planning body is responsible for intersectoral consolidation, providing "directive" or "indicative" figures which, after consultation at all technical and government levels, are elaborated into a proposal for a national medium-term plan. The bodies responsible for examination and approval of the proposal are the Party Congress and the National Assembly. The plan thus becomes law; its contents are later specified for each annual period by geographical/administrative units. The consultation process is enacted again at all levels for each annual plan budget.
In Cuba, the Central Planning Board includes an Institute of Physical Planning. This is entrusted with the preparation of the physical plan included in the long-term economic and social plan and specifying, among other things, the "macrolocalization" of the large facilities in regions and cities. All localizations of facilities, large or small, must be approved by the legislative assemblies concerned, with advice from the corresponding health directorate and the Institute of Physical Planning.

A degree of separation was observed between investment planning and the planning of recurrent activities. Thus, in Algeria, the Ministry of Health acted in coordination with the Ministry of Planning on investments and with the Ministry of Finance on recurrent expenditure. In the Cuban Ministry of Health, the Directorate of Investment was in the Vice-Ministry in charge of Policy and Development, which was distinct from the Vice-Ministry in charge of Planning and Management.

Planning in these countries tends to concentrate on the generation of resources. This was particularly clear in Algeria, where the functions of several departments of the Ministry of Health were focused on resource development for health care and there was apparently no individual, comprehensive planning unit.

On the other hand, support for plan coordination was provided through several intersectoral mechanisms. In Algeria there is an Advisory Medical Commission and an Administrative Commission for Health at the central level and in each province. In Cuba, an important part is played by the Health Commissions of the National, Provincial, and Municipal Assemblies of the People.

The health facility plans of these countries were very ambitious in terms of the number and complexity of the units scheduled to be rapidly built. In spite of this, Cuba was achieving its targets. This success could be attributed to: a strictly integrated planning process, in which the health, building construction, and other relevant sectors were brought under unified guidance; the use of norms and control methods; an industrialized system of construction; and the high degree of urbanization and geographical and demographic homogeneity. In Algeria, the targets were achieved only in part. This can be explained to some extent by a degree of dependence on private, national, and foreign enterprises in regard to design and construction, and also by the geographical diversity of the country and the uneven distribution of its population.

The health care system and its financing are much more integrated in these countries than in those of the other subgroups; as a result, the decision-making process is well defined and coherent. In Cuba the integration is complete; in Algeria, there were still some health services coming under the Social Security Institute and mutual insurance groups, as well as private physicians' offices. However, the social security system had recently been brought under the jurisdiction of the Ministry of Health, and its clinics and budget were being integrated into the national system. All Algerian doctors have to work for the Government, although general practitioners can have part-time private practices. Practically all Cuban physicians work full-time in the public sector.

Cuba enjoys a full complement of health personnel; a nucleus of health architecture and engineering staff was still being developed and increased. Algeria had a shortage of national staff at the professional level in both health care and health architecture, but the paramedical staff appeared to be well oriented and productive.

In both countries, the design of the health care system was found to be clear and based on well-defined units of area and population: the "secteur sanitaire" in Algeria is a model concept. However, the adaptation of the design to each of the different local situations found in Algeria has possibly lagged behind the rapid construction of facilities: this may reduce the final effectiveness of the investment made.

Overall management conditions in the health sector seemed adequate; there was "management consciousness", combined with good information, coordination, budgeting, transport, communications, and drug availability. However, there was room for improvement in the evaluation of activities in terms of outcome and efficiency and a need for a more comprehensive community health orientation at all levels.
3. National machinery for the physical planning of health care facilities

Two main aspects of the national machinery for the physical planning of health care facilities in the countries studied will be described here: the structures, and the process.

The structures involved in physical planning

In most countries the two branches of socioeconomic activity mainly involved in the physical planning of health facilities are building construction (the producer) and health (the buyer and user). In many countries also, one or other of a variety of organizations, such as the social security system, development institutes, and local self-help groups, may be additional participants. Table 1 shows the main structures involved in the six countries studied. The wide spectrum of situations found in different types of developing areas is readily apparent. At one end, the government health sector had a very limited role in physical planning as such. Obviously, health administrators and clinicians expressed their wishes concerning the functions and spaces for specific units, particularly for hospitals and other large facilities. But they did not take upon themselves the formal preparation of programmes or briefs. The whole responsibility lay with the construction sector, except perhaps for some private medical undertakings and some private donors who were more precise in specifying space needs to suit their financial plans. Local self-help groups were involved in the building of some small facilities. In other low-income countries the health sector played a small role at the subnational or national level. In the higher-income countries, the physical planning structures of the Ministry of Health were stronger and more clearly differentiated: as well-informed buyers, they entered into an active partnership with the construction sector, which tended to be confined to the role of producer.

Simply as a working hypothesis, two trends may be discerned. The first is the development of increasingly large and self-sufficient structures for physical planning within the government health sector, where the programming and control functions are assumed, after which active coordination with the construction sector is established. Preparations were also being made — for example, in Cuba — and for the health sector to take over the actual construction of facilities. It is opportune to recall here that for many years the Cuban Ministry of Health did all project work through its own architectural unit and had control over the Public Hospital Building Corporation; the Ministry of Housing had responsibility only for the construction of health centres (following the type plans of the Ministry of Health) in new housing estates. This may be considered as part of the overall tendency towards the strengthening of ministries of health, which are in themselves relatively new structures in many countries. It also reflects and supports the tendency towards the development and specialization of multidisciplinary teams of architects, engineers, and other professionals involved in planning health facilities, in ever closer contact with the health system and its workers.

The second trend appears to be towards early decentralization of the physical planning and construction of health facilities. Regional health directorates in Senegal and provincial medical officers in Zambia seem to have been active in the programming and even building of rural facilities before such functions were organized at the Ministry of Health. In some instances, this development may have been facilitated by previous decentralization of the government public works sector; in Zambia, however, the provincial commissioners of works were just beginning to provide support to their health counterparts and to local self-help groups in order to improve the building of dispensaries and small health centres.

The decentralization trend is part of a general one towards politico-administrative autonomy and seems to be stronger in countries with a large territory and with a federal or semifederal constitution, such as Algeria and Venezuela. It is also appearing, however, in highly organized countries such as Cuba, where investment units were being organized in the provincial health directorates.

The participation of the private construction sector is strong in the countries with a market economy and also in some of the socialist developing countries (e.g., Algeria) that wish to advance quickly and are accordingly prepared to import the necessary technology.

Where independent social security institutions exist (e.g., Algeria, Senegal, and Venezuela), they produce their own programmes and even project designs for health care facilities and contract them out to private construction firms, subject to the approval of the relevant government bodies.
<table>
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<th>Health sector</th>
<th>Construction Sector</th>
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<td><strong>CUBA</strong></td>
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<td>Health Facilities Department, Technical Services Department, building enterprises</td>
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<td>Office for Control, Advice, and Coordination (1978)</td>
<td>Provincial health directorates</td>
<td>Private Central Office for maternities, studies on Public pharmacies, Works, Architecture, structure and doctors’ Town Planning offices</td>
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<td><strong>VENEZUELA</strong></td>
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<td><strong>ZAMBIA</strong></td>
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<td>** SENEGAL**</td>
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In most cases, linkage between the health and construction sectors in regard to the physical planning of facilities is ensured by mutually agreed procedures and division of labour. However, some countries have created specific machinery to strengthen coordination at central level, and their experience may be of interest elsewhere. In Venezuela there is a Committee for Medical Facility Programmes, which contains members from the Ministry of Health and the Ministry of Urban Development and comes under the Ministry of Health. It brings together people from three different units in the Ministry of Health: the Health Planning Bureau, the Projects Division of the Engineering and Maintenance Board, and the Programming and Equipment Division of the Medical Care Establishments Board. Its tasks are to formulate the programmes for new facilities, review and approve preliminary project designs, set norms, and carry out evaluation.

In Cuba, preliminary project designs are evaluated by a Joint Expert Committee of the Ministries of Health and Construction; the building work carried out by the enterprises of the Ministry of Construction is supervised by a technical inspector from the health sector; and facilities are handed over to the latter on completion, an evaluation being performed at that stage by a Joint Commission of both Ministries.

The process of physical planning

From the organizational point of view, the process of physical planning comprises several functions and tasks, namely:

- formulation of a programme of functions, space needs, and spatial relationships, as well as financial and technical specifications for the facility, including its equipment (architect's brief)
- assignment of the task of preparing the project design
- preparation of the project design
- review and approval of the project design
- award of building order or contract
- construction of the facility
- inspection of the building works
- takeover of the completed facility and/or the authorization to operate it.

Some of these functions may involve several steps. In Cuba, for example, the programme of each facility is first presented in broad terms to the National Planning Board, and only then is it transmitted as a "project assignment" to the architects and engineers of the Ministry of Construction. In Cuba and Venezuela there are two formally differentiated stages in the project design: first a preliminary or technical project is produced and reviewed, then a final or executive project is submitted for approval.

The actual process in each country is determined by the structures involved and the division of labour among them. The simplest process was in Cuba, where there was no private sector and very little decentralization. It can be represented (Fig. 3) by a series of "loops" between the Ministry of Health, which clearly acts as the investor, generating the programme and controlling the product, and the Ministry of Construction, which carries out the project design and the building work.

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FIG. 3. PROCESS OF PHYSICAL PLANNING IN CUBA

MINISTRY OF HEALTH

For every facility, an "Investment proposal" is submitted to the National Planning Board, than an "Investment assignment" is developed into a

"Project assignment" (programme)

Approval

Inspection

Take-over

MINISTRY OF CONSTRUCTION

"Technical project"

"Executive project"

Construction

The simplest process for a country with a private sector and significant decentralization is that employed in Algeria. The health administration at the provincial level takes the responsibility for programming the "non-hospital" facilities such as health centres and polyclinics. The public works administration at the provincial level carries out the project design for some of the "non-hospital" facilities, the rest being left to private architects. Construction work is carried out by private firms. The process is set out in Fig. 4.

In Venezuela, the process follows essentially the same model as in Algeria. An added feature is the execution of preliminary project designs by private medical firms, the Social Security Institute, and other agencies; these require the approval of the Committee for Medical Facility Programmes. Another difference from Algeria is that both the Ministry of Health at central level and the government construction sector at state level engage directly in minor construction work. State health offices do not themselves prepare programmes, as in Algeria, but they are required to give the Committee for Medical Facility Programmes their comments on preliminary projects for facilities in their respective states.

A common feature of decentralization is that variations of the planning process occur between provinces or states. In this situation, some provinces may show the way to others.

A third type of process used in planning health facilities is one involving exclusively or mainly the public and private construction sectors. In the case-study countries where this type was found, local communities played a significant role in the design and construction of small facilities. The process in Sudan may be taken as a prototype (Fig. 5). A health project unit in the Sudanese Ministry of Public Works produces type plans and project designs; these are then contracted out to private building enterprises, which are supervised during the job by the Health Projects Unit. Contracts may also be awarded to "public construction corporations". Donors and private medical undertakings order their
FIG. 4. PROCESS OF PHYSICAL PLANNING IN ALGERIA

**HEALTH SECTOR**
(Government)

- Central
  - Programmes
  - Control of approval
  - Take-over

- Provincial
  - Programs for "non-hospital" facilities

**CONSTRUCTION SECTOR**

- Central
  - Type plans of hospitals
  - Building order
  - Project design of "non-hospital" facilities
  - Supervision

- Provincial
  - Construction
  - Project design of "non-hospital" facilities
  - Construction

FIG. 5. PROCESS OF PHYSICAL PLANNING IN THE SUDAN

**HEALTH SECTOR**
(Private)

**CONSTRUCTION SECTOR**
(Government)

- Project design and type plans
  - Construction
  - Supervision
  - Project design
  - Construction
  - Design and construction by self-help groups

**OTHER SECTORS**
(Private)

- Construction by Public Construction Corporation

- Orders from private medical firms and from donors
  - Review and authorization
  - Guidance, review, and authorization

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project designs from private firms; these have to obtain the authorization of the Health Projects Unit before building can start. Self-help groups may design and build primary health care units, dispensaries, and rural hospital wards; they are supposed to have technical guidance from the Health Projects Unit, but arrangements for this have not yet been completed. The involvement of the government health sector was minimal, but the organization of a multidisciplinary ad hoc team to programme and monitor the development of large facilities was envisaged.

In Senegal there is a similar process, in which the regional public works departments undertake the project design of health centres and health posts. The functions of programming, project design, and supervision of important facilities, at the central level, are delegated by the Ministry of Public Works to a semi-official entity, the National Society for Development Studies (SONED). The Ministry limits its direct participation to the review and approval of the project design prepared by SONED, the issue of building orders, and joint supervision (with SONED) of the construction work.

The Zambian model was similar to that found in the Sudan. However, a planning unit was created in the Ministry of Health in 1979, and this has begun to prepare programmes and to do some inspection and evaluation work. As a result of this development, the planning process employed may now approach the Algerian type. Another peculiarity of facility planning in Zambia is the fact that most provincial health offices have, for some years had their own building teams, which collaborate with communities in the construction of some rural units.
4. Technical tools for the physical planning of health care facilities

Five kinds of tool employed by the countries studied for the physical planning of large numbers of health care facilities will be reviewed here: type programmes and norms for design, type plans, norms for selected indicators, cost estimates, and principles for remodelling.

Type programmes and norms for design

In Algeria, functional programmes were prepared by the Ministry of Health for the smaller facilities. These began with the nursing station, the smallest fixed facility, which would have one room for consultations and treatment, one room for a dispensing pharmacy, waiting areas, and the essential general services. In the next largest facility - a health centre - the functions of general medicine and of maternal and child health care are handled by individual units. With the addition of units for specialized medicine, radiology, and laboratory work, such a centre could become a "polyclinic". A rural maternity unit and/or a tuberculosis unit could be integrated into a polyclinic where necessary. As the facility grows, so does the need for general services: reception, administration, basic installations, circulation, staff dressing-rooms, and staff lodgings.

For each function (for example, general medicine), the activity and the users are described, the staff that will work in the unit is indicated, and the rooms needed are listed, together with their minimum and maximum surface areas. The characteristics, basic installations, equipment, and furniture of each room in the unit, are then indicated in detail.

Fig. 6 is from an Algerian document; it shows the spaces required for general medicine and pharmacy, as well as their functional interrelationships.

FIG. 6. GENERAL MEDICINE AND PHARMACY: FLOWS AND RELATIONSHIPS (ALGERIA)
The areas proposed for specific services in the programme document are given in Table 2.

**TABLE 2. EXAMPLE OF AREA PROPOSALS FOR PERIPHERAL HEALTH FACILITIES (ALGERIA, 1974)**

<table>
<thead>
<tr>
<th>Type of unit</th>
<th>Areas for specific services</th>
<th>Total area&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing station</td>
<td></td>
<td>84-110 m²</td>
</tr>
<tr>
<td>Health centre</td>
<td>General medicine 94-147 m² (including two consulting rooms and radioscopy)</td>
<td>300-400 m²</td>
</tr>
<tr>
<td></td>
<td>Maternal and child health 110-145 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pharmacy 37-45 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General services 69 m² (Circulation 25 m²)</td>
<td></td>
</tr>
<tr>
<td>Polyclinic</td>
<td>As above, plus: Specialized medicine (ear - nose - throat, 1000 m²)</td>
<td>approximately</td>
</tr>
<tr>
<td></td>
<td>Ophthalmology, dentistry 61-81 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radiography 53-76 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laboratory 19-24 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extra space for additional consulting rooms, general services, and circulation - possibly a rural maternity unit and/or a tuberculosis clinic</td>
<td></td>
</tr>
<tr>
<td>Rural maternity unit</td>
<td>125-156 m² (+ circulation; + some general services, if not attached to a polyclinic)</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis clinic</td>
<td>38-51 m² (+ circulation; + some general services, if not attached to a polyclinic)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> These areas do not include staff housing; apartments of 50-70 m² are foreseen for each staff member entitled to lodgings.

<sup>b</sup> Editor's assumption (not given in the programme document).
A programme for urban maternity centres was also completed. It provides for model working units which can be combined in different ways. It is based on modules measuring 3.5 x 3.5 m and includes illustrations, for each department of the maternity centre and for the centre as a whole, indicating possible layouts and explaining flows and contact needs between departments. Detailed programmes are also being prepared for the installation of separate rooms, such as milk-kitchens, in maternity centres and hospitals. Such programmes, which are illustrated with detailed plans, include list of needs; organization for each working area; list of equipment; and proposals for organization and layout.

A type programme was being followed in the construction of four psychiatric hospitals.

FIG. 7. EXAMPLE OF RECOMMENDATIONS FOR THE RATIONALIZATION OF THE PATIENT FLOW IN AMBULATORY CENTRES (VENEZUELA, 1973)

Venezuela has produced and adapted a considerable number of programmes and norms for the design of health care facilities. Fig. 7 shows the flows of patients in an ambulatory centre; a centre for maternal and child health care; and Table 3, criteria for defining the catchment area of an urban health centre.

The Committee for Programming of Health Facilities in the Ministry of Health has produced programmes (basically room lists) for each of the type facilities designed in the country. The states have been issued with recommendations on the minimum quality of staff housing. About 10% of the furniture used in the larger facilities is standardized. Standards are applied in the fields of water supply, electricity, fire protection, and earthquake security measures. The research unit of the Ministry of Urban Development issues a quarterly bulletin indicating the latest costs and the providers of building materials.

In Senegal, French standards for construction and detailing are used. The training manual for community health workers in the Sine Saloum Region includes norms, with drawings, for pit latrines, wells, and incinerators. There is a central laboratory in Dakar for the examination of building materials.
TABLE 3. CRITERIA FOR DEFINING THE CATCHMENT AREA AND THE LOCALIZATION OF URBAN HEALTH CENTRES IN VENEZUELA

<table>
<thead>
<tr>
<th>Health care needs:</th>
<th>Given an average need for three consultations per person per year, one daily session providing an average of 12 consultations is required per 1000 inhabitants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space needs:</td>
<td>If two sessions can be held in a room every day, then one consulting room is required for every 2000 inhabitants. Three alternatives for the size of a health centre (ambulatorio) are:</td>
</tr>
<tr>
<td>Type</td>
<td>Population</td>
</tr>
<tr>
<td>AE</td>
<td>100 000</td>
</tr>
<tr>
<td>A</td>
<td>50 000</td>
</tr>
<tr>
<td>B</td>
<td>25 000</td>
</tr>
<tr>
<td>Localization criteria</td>
<td>Health programme areas into which the city is divided</td>
</tr>
<tr>
<td></td>
<td>Existing health care services</td>
</tr>
<tr>
<td></td>
<td>Availability and characteristics of possible sites</td>
</tr>
<tr>
<td></td>
<td>Possibility of remodelling existing facilities</td>
</tr>
</tbody>
</table>

---

In Sudan, design norms were developed in 1979 by the Health Projects Unit of the Ministry of Construction and Public Works. The same unit encourages the production of modular-size building materials. The Ministry of Health had lists of standard furniture and fittings, but these were hardly being used. By-laws on health buildings exist and were being updated in 1979.

**Type plans**

Type plans for the main categories of health care facility were found to exist in all the countries studied. In many cases the process of type planning had been going on for ten, twenty, or even thirty years, and several generations of designs for the same category of facility had been implemented.

The main reasons for resorting to type plans were: (a) the shortage of specialized professionals in the field of health architecture, and (b) the greater economic efficiency achieved through the standardization of plans, construction methods, building materials, basic installations, furniture, and equipment. In the exceptional case of Cuba, where industrial methods are used for the construction of virtually all health care facilities, standardization of design is a must. In addition, it should make it easier to learn from experience in the use of facilities, but this advantage had not been sufficiently exploited.

The use of type plans has some risks. If they are employed indiscriminately, the units built may lack the necessary flexibility to adapt to specific functions and to the local physical and cultural environment. In countries that have undertaken extensive building plans (e.g., Cuba, Algeria, Sudan), errors that have slipped into type plans may be reproduced a number of times before they can be corrected. This has led some health architects (for example, in Venezuela) to reject the use of type plans for hospitals and to rely exclusively on specific design criteria. This is also the reason for discarding the term "standard plan" in favour of "type plan".

The real importance of type plans lies in their role as convenient instruments for planning the health facilities of a country as a coherent set of resources integrated within the overall health care system. They are most relevant in countries that have a unified
national health service; they are most helpful in countries where there are few persons specialized in health project design and where geodemographic and cultural diversity is moderate. As countries develop the rigidity of type plans may be minimized by creating subtypes adapted to different situations.

In the study countries, type plans were found for the following categories of facility:

- rural health posts
- small health centres (for rural areas, small towns, and the urban periphery)
- large health centres (mostly urban)
- rural hospitals
- 200-bed hospitals
- 600-bed hospitals
- staff and student lodgings.

Such categories will now be briefly discussed and some of them illustrated.¹

Rural health posts (Fig. 8). The type plans do not vary greatly. Three countries have opted for compact square buildings of 50-60 m², with three or four rooms. The largest posts have been built in Cuba: 120 m², with six rooms, including nurses' quarters.

FIG. 8. TYPE DESIGNS FOR RURAL HEALTH POSTS

¹ The comparative diagrams of type plans in this section are only for rural health posts (Fig. 8) and 200-bed hospitals (Fig. 9). Other type plans are fully documented in the national case-study reports. Specific examples of type plans of large health centres can also be found in Figs. 39-41 in the next section, which deals with the general design of buildings.
The walls and floor are usually of concrete and the roof of wood and asbestos. The compact shape, besides being economical reduces the amount of radiation received. Ventilation difficulties are avoided in some designs by means of openings between the outer walls and the roof, as well as by making the internal partitions less than ceiling height. Corridors have been found unnecessary.

An exception to this construction and design pattern was that of the "health huts" of Senegal. These are smaller: 28-33 m², with three rooms and in traditional materials (wood and thatch).

FIG. 9. TYPES OF 200-BED HOSPITALS

\[ a \] A = Algeria, 240 beds; Se = Senegal, 210 beds; Su = Sudan, 120 beds; V = Venezuela, 200 beds.
Small health centres. The smallest type centre in this category is a part of the "service module" designed for the periurban areas of Venezuela, which also includes a small supermarket, a school, and a police station. The health care component is a compact house of about 80 m² and has six rooms. The largest health centre coming within this category is a Sudanese design consisting of two longitudinal blocks connected by two small pavilions (so that a central courtyard is formed), with a built area of 570 m². The Zambian type plan, with 180 m², includes two rooms with three beds in each.

A rough evaluation of the efficiency of these designs is possible by comparing them in terms of two indicators: (a) the number of consulting rooms, and (b) the number of square metres of floor space per consulting room. These indicators should be interpreted in the light of the type and diversity of technical support services provided. The values of the two indicators are shown in Table 4, from which it can be concluded that, among the four type plans considered, the Venezuelan service module is the most efficient; however, it does not include provision for observation beds, X-ray equipment, or a laboratory.

<table>
<thead>
<tr>
<th>Type plan</th>
<th>No. of consulting rooms</th>
<th>m² per consulting room</th>
<th>Technical support services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venezuela: services module</td>
<td>3a</td>
<td>27</td>
<td>Pharmacy, treatment, immunization, health education</td>
</tr>
<tr>
<td>(1973 type)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia: rural health centre</td>
<td>3</td>
<td>59</td>
<td>Six beds, pharmacy</td>
</tr>
<tr>
<td>(1979 type)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algeria: health centre (Omaria</td>
<td>4</td>
<td>100</td>
<td>Pharmacy, treatment, health education, X-ray</td>
</tr>
<tr>
<td>type)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudan: health centre (Rehad type</td>
<td>5a</td>
<td>113</td>
<td>Pharmacy, treatment, health education, immunization, X-ray,</td>
</tr>
<tr>
<td>(1974)</td>
<td>of which (38 are open</td>
<td></td>
<td>laboratory, minor surgery, environmental health</td>
</tr>
<tr>
<td>walkways)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Including a stomatology unit.

Large health centres. The smallest type plan for this category is that of the town health centre of Sudan (1120 m²), which is an enlarged version of the rural health centre mentioned above. It consists of linear, single-storey blocks, connected by open walkways and arranged as two "fingers" on each side of a longitudinal block. Venezuela has also developed a one storey health centre with a "three-finger" plan and ten inpatient beds. There are also plans on two levels, and the Venezuelan "ambulatorio" type A, for an urban population of 50 000 is on three. Some characteristics of the type plans are summarized in Table 5. The indicator "square metres per consultation room" has the lowest value for the Cuban polyclinic, even though it has the main technical support services available. The next most efficient design appears to be that of Venezuelan 1980-type of health centre, which includes the largest variety of support services in this category of facilities. Inspection of the table suggests that economic efficiency is directly related to the number of consultation rooms, an example of the economies of scale.
### TABLE 5. CHARACTERISTICS OF SIX TYPES OF LARGE HEALTH CENTRE

<table>
<thead>
<tr>
<th>Type plan</th>
<th>No. of consulting rooms</th>
<th>m² per consulting room</th>
<th>Technical support services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudan: town health centre (1976)</td>
<td>5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>224 (of which 119 are open walkways)</td>
<td>Pharmacy, treatment, health education, immunization, laboratory, environmental health</td>
</tr>
<tr>
<td>Sudan: &quot;mother&quot; town health centre (1978)</td>
<td>7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>214</td>
<td>Pharmacy, treatment, health education, immunization, X-ray, laboratory, minor surgery, and traumatology</td>
</tr>
<tr>
<td>Algeria: Media Polyclinic</td>
<td>9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>200</td>
<td>Pharmacy, treatment, health education, X-ray, laboratory</td>
</tr>
<tr>
<td>Cuba: Polyclinic</td>
<td>23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>78</td>
<td>Pharmacy, treatment, laboratory, X-ray, rehabilitation, emergencies</td>
</tr>
<tr>
<td>Venezuela: health centre (1980 type)</td>
<td>8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>288</td>
<td>Ten beds, pharmacy, treatment, X-ray, laboratory, pathology, electrocardiography, minor surgery, emergencies, delivery room</td>
</tr>
<tr>
<td>Venezuela: centre for ambulatory care (type A)</td>
<td>26&lt;sup&gt;b&lt;/sup&gt;</td>
<td>138</td>
<td>Pharmacy, treatment, X-ray, laboratory, pathology, electrocardiography, minor surgery, emergencies, immunization, health education, psychology, epidemiology, occupational health, social work, environmental health, animal health, and most medical specialties</td>
</tr>
</tbody>
</table>

<sup>a</sup> Including a stomatology unit.
<sup>b</sup> Including stomatology and psychology units.

**Rural hospitals.** The rural hospitals for which there are type plans have from 8 or 10 beds to 28 beds. The tendency is to design them as separate, interconnected blocks on a single level. Also included in this group is a Senegal rural maternity centre with 4 to 6 beds. The Venezuelan rural health centres with beds represent a transition between the health centre and the rural hospital and tend to have a compact design with an area of around 480 m². Although the number of beds sanctioned in the Jebel Awlia type of rural hospital of Sudan is 28, in practice many more beds have been crowded into the wards. Fifty would be a more realistic estimate of the current number. This brings the built surface per bed in this facility down to 45 m². Characteristics of three of these type plans are compared in Table 6.

**200-bed hospitals (Fig. 9).** These are provincial or district hospitals offering the basic specialities and diagnostic facilities (X-rays, laboratory, etc. and having comparatively large outpatient departments. Two very different type designs were seen: a hospitalization tower of 4 or 5 levels over a one-level slab housing the outpatient department and the emergency and general services (Algeria, Venezuela); and an arrangement of separate one- or two-storey pavillons connected by open passageways and occupying a very large site (Senegal, Sudan). The main characteristics are presented in Table 7.
**TABLE 6. FEATURES OF THREE RURAL-TYPE HOSPITALS COMPARED**

<table>
<thead>
<tr>
<th>Type plan</th>
<th>No. of beds</th>
<th>m² per bed</th>
<th>No. of consulting rooms</th>
<th>Technical support and public health services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuba: rural hospital (1961)</td>
<td>22 (in 2 wards)</td>
<td>19</td>
<td>3⁺</td>
<td>Pharmacy, treatment, laboratory, delivery room</td>
</tr>
<tr>
<td>Zambia: rural health centre with beds (1978 type)</td>
<td>15 (in 5 rooms)</td>
<td>40</td>
<td>2</td>
<td>Pharmacy, treatment, delivery room</td>
</tr>
<tr>
<td>Sudan: rural hospital, Jebel Awlia type (1967)</td>
<td>28 (in 2 wards)</td>
<td>80</td>
<td>3</td>
<td>Pharmacy, treatment, health education, laboratory, environmental health, delivery suite, surgical suite</td>
</tr>
</tbody>
</table>

⁺ Including a stomatology unit.

**TABLE 7. FEATURES OF FOUR 200-BED TYPE HOSPITALS COMPARED**

<table>
<thead>
<tr>
<th>Type plan</th>
<th>No. of beds</th>
<th>Total m² per bed</th>
<th>Ward m² per bed</th>
<th>No. of consulting rooms</th>
<th>Technical support and public health services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudan: general hospital (1976 type)</td>
<td>70-200 (wings with 10 beds each)</td>
<td>68 (for 100 beds)</td>
<td>47 (for 200 beds)</td>
<td>27</td>
<td>9⁺ The outpatient department housed in a separate building, contains the usual diagnostic and treatment services of a large health centre. These are intended to serve the needs of both outpatients and inpatients</td>
</tr>
<tr>
<td>Senegal: Thiès regional hospital</td>
<td>210 to be extended (rooms with 1, 2, and 6 beds)</td>
<td>38</td>
<td>27</td>
<td>..</td>
<td>Blood bank. There is no integrated outpatient department: ambulatory cases are seen in the wards of the pertinent specialities</td>
</tr>
<tr>
<td>Venezuela: general hospital (1970 type)</td>
<td>200 maximum (in rooms with 1-4 beds)</td>
<td>100</td>
<td>26</td>
<td>15⁺</td>
<td>Blood bank, physiotherapy, basal metabolism, isotopes, immunization, emergencies</td>
</tr>
<tr>
<td>Algeria: general hospital (240-bed type; modifiable to 120, 180, and 360 beds)</td>
<td>240 (in rooms with 1-6 beds)</td>
<td>64</td>
<td>41</td>
<td>8</td>
<td>Large emergency department, with three operating theatres, X-rays, and 16 beds</td>
</tr>
</tbody>
</table>

⁺ Including a stomatology unit. .. Not recorded.
It is remarkable that while the total area per bed ranges from 38 m² to 100 m² three very different designs for this category of hospital show the same area per bed in the wards. The speed with which inpatient rooms with few beds have become the rule in the developing world is also worth noting.

600-bed hospitals. These are provincial hospitals offering almost every specialty. Two type plans in this category were observed in the study. The Algerian one provides for a massive, four-storey stacked building. Cuba had built five 630-bed hospitals that have been restricted by the country's industrialized building system to a limit of four levels and have therefore had to be extended horizontally into three interconnected blocks. The main characteristics of the two type plans are presented in Table 8. Attention is again drawn to the recurrence of the same area per bed in the wards - between 25 and 30 m².

<table>
<thead>
<tr>
<th>Type plan</th>
<th>No. of beds</th>
<th>Total m² per bed</th>
<th>Ward m² per bed</th>
<th>No. of consulting rooms</th>
<th>Technical support and public health services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria: 600-bed hospital</td>
<td>600</td>
<td>55</td>
<td>25</td>
<td>..</td>
<td>Blood bank, intensive care, physiotherapy, emergencies</td>
</tr>
<tr>
<td>Cuba: hospital for adults</td>
<td>630</td>
<td>66</td>
<td>30</td>
<td>23</td>
<td>Blood bank, intensive care, rehabilitation and physiotherapy, stomatology, specialties, day-psychiatric hospital</td>
</tr>
</tbody>
</table>

.. Not recorded

Norms for selected indicators

Cuba has established norms for several types of indicator:

- productivity of personnel (e.g., 6 consultations per hour in paediatrics, obstetrics, and internal medicine)

- ratios between internal components of a facility (e.g., for every 100 beds in general hospitals: 5 consulting rooms, 1.5 surgical theatres, 1 obstetrical theatre, 1 X-ray unit, and 200 m² of laboratories)

- personnel/bed ratios (e.g., for every hospital bed: 1.3 to 1.5 staff of all categories, 0.15 medical staff, 0.71 intermediate technical staff, 0.33 auxiliaries, and 0.35 general services staff)

- areas per bed for specific functions

- requirements in specified building materials per m².
Cost estimates

In Cuba, the Cienfuegos general hospital for adults (630 beds) cost 230 pesos (US$ 300) per m² in 1975-79. This included the cost of fixed installations (35% of the amount). The cost of medical equipment was estimated at an additional 60%.

In Algeria, construction costs per m², including installation and fixed equipment, were:

<table>
<thead>
<tr>
<th>Dinar</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing station (1979)</td>
<td>1200</td>
</tr>
<tr>
<td>Health centre (1979)</td>
<td>1700-2300</td>
</tr>
<tr>
<td>Polyclinic (1979)</td>
<td>1190-1510</td>
</tr>
<tr>
<td>240-bed hospital (1979)</td>
<td>2400</td>
</tr>
</tbody>
</table>

In Venezuela, the corresponding costs were as follows:

<table>
<thead>
<tr>
<th>Bolivares</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small facilities (1980)</td>
<td>1200-1500</td>
</tr>
<tr>
<td>200-bed hospital (1973-76)</td>
<td>2600</td>
</tr>
<tr>
<td>Large hospitals (1980)</td>
<td>3000-4000</td>
</tr>
</tbody>
</table>

Mobile equipment cost (in 1980) 300 Bs., or US$ 69 per m², in small hospitals and 400 Bs., or US$ 92, in teaching hospitals.

In Zambia, information on building costs is very limited. In one example, the total cost of building and installing a rural health centre (with extensions and three staff houses) in 1978 was 42 000 Kwacha or US$ 54 600. An educated guess is that this may represent US$ 100-120 per m². Costs increase rapidly and are higher in the more remote areas.

In Senegal, the building and installation costs for various facilities were:

<table>
<thead>
<tr>
<th>per m² built</th>
<th>per bed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CPA</td>
</tr>
<tr>
<td>Regional hospital (1979)</td>
<td>100 000</td>
</tr>
<tr>
<td>Health post (1979)</td>
<td>59 000</td>
</tr>
<tr>
<td>Rural maternity centre (1979)</td>
<td>45 000</td>
</tr>
<tr>
<td>Health hut (local labour free) (1979)</td>
<td>1 400</td>
</tr>
</tbody>
</table>

In Sudan, the respective costs per m² were estimated as follows:

<table>
<thead>
<tr>
<th>SF</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town health centre (1977)</td>
<td>80</td>
</tr>
<tr>
<td>Dispensary (1979)</td>
<td>130</td>
</tr>
<tr>
<td>Primary health care unit (1979)</td>
<td>130</td>
</tr>
</tbody>
</table>
The mobile equipment of one dispensary was valued, in 1979, at SE 1088 (US$ 2176) and that of one primary health care unit at SE 216 (US$ 432).

Reliable estimates of costs are not easy to obtain. For small facilities, the range seems to be US$ 200-400 (1979) per m² in most cases. For hospitals, the range appears to be US$ 300-900 (1979) per m². These costs do not include mobile equipment and furniture.

Guiding principles for the remodelling of existing buildings

None of the study countries applied explicit principles in this area. However, some facilities that had been remodelled or were scheduled for remodelling were visited and discussed.

The first question is whether remodelling should be carried out or a completely new facility built. The answer depends upon such factors as: the extent of the changes required; the state of the existing building, or of parts of it; the availability of alternative sites and the price of land; the comparative costs of remodelling and of building anew; and how the two alternatives compare as regards functional value, potential durability, and running costs. All these economic aspects are especially important in times of financial crisis. It is possible that many countries may have to rely more on their already existing facilities and that, for this reason, physical remodelling will receive increasing attention.

Long-term considerations in the fields of urban development and of health care system development should also be taken into account. For example, plans for remodelling an entire neighbourhood may make it mandatory to remove or radically transform a large old hospital.

Decentralization of care in a city or province, through the construction of a network of health centres and new hospitals, may considerably reduce the work-load of some sections of an existing hospital. Sometimes, simple changes in zoning, circulation, or management may alleviate current problems and make remodelling less urgent. One example was contained in the suggestion, made during the study of a large hospital, that a special entry should be created for ambulances and the emergency area separated from the rest of the outpatient department as a means of reducing overcrowding and circulation bottlenecks.

Once it has been decided to remodel, some basic principles (drawn from experience) that should be observed are:

- to involve all people concerned, particularly the heads of departments and the chief nurses (this may be done by appointing a committee that will meet regularly with the architects and engineers)
- produce a master plan indicating the successive stages and priorities of redevelopment
- pay special attention to the preservation of adequate zoning and circulation, as well as to safety precautions and environmental conditions.
PART TWO

EXPERIENCE OF HEALTH CARE FACILITIES IN USE
PART TWO
EXPERIENCE OF HEALTH CARE FACILITIES IN USE

The findings of the case studies are reviewed in the pages that follow. It is obvious that there is a limit to the extent to which they can be dealt with here. A selection has therefore been made to allow for a detailed presentation of particular issues that could be helpful to a wide audience. It reflects the illustrative nature of the studies.

1. Access, catchment areas, and sites

Physical access of the population to health care depends not only on the number and location of facilities, but also on the availability of a road network and of appropriate transport to link the different units in which the various levels of health care are provided. It also requires a two-way referral system between units at local and regional levels. It is extremely important to improve flows of patients and materials from the periphery to the centre, and vice versa, in order to avoid over- and underutilization of space designed to accommodate particular kinds of case-load.

In some countries access to certain units proved difficult. On one hand, this was due simply to a lack of road links with the facilities. On the other, weather conditions cut off populations and supplies in tropical climates during the rainy season, as in some parts of Zambia. In the Sudan, the existence of good roads from rural areas to the city of Khartoum increased the actual catchment area of the city facilities. At the same time, population preferences and by-passing of referral units led to increased demands on secondary and tertiary health care delivery units. Multisectoral planning, which in some cases may mean the provision of an all-weather road to facilitate referral, cannot, of course, make up for lack of compliance with the referral system on the part of patients, lack of health education, and perceived or experienced differences in the quality of the medical care delivered by different units. In some of the participating countries, all-weather roads were provided through integrated development planning. Shortages of public transport and facility-based vehicles were noticed in some countries, causing operational havoc. The reasons lay either in a scarcity of spare parts, lack of maintenance, shortage of fuel, or all these factors combined. The well-known urban-peripheral phenomenon of generally worsening conditions as distance from the centre increases was once more confirmed. Cuba and Venezuela may be cited as countries with positive experience of solving access problems. Ambulances were stationed at particular units, or (in the case of Cuba) an ambulance dispatch service combined with public transport facilitated access to, and referrals from, units.

Catchment areas and their populations are the prime determinant of the number of activities to be performed and thus of the size of units. Countries varied widely in their approaches to the allocation of facilities and staff, which basically reflected the degree of socioeconomic development and of commitment to a health policy. From the smallest unit to the largest hospital, the demands made on space varied accordingly. In the poorest societies of the market-economy type (Senegal, Sudan, Zambia) catchment areas and populations were generally found to be too large in relation to the existing infrastructure. Lack of referral possibilities, inadequate staffing, and lack of supplies created further problems, particularly in rural areas. Venezuela, as a country within the developing world that is relatively advanced economically, had a generally appropriate catchment population assigned to the various units under study. But the wide range of state, social security, and private health facilities hampered rational, functional programming. Although Algeria had been constructing health facilities on a large scale, wide discrepancies between the targets of the 1975 national health programme and the existing number of units persisted, thus enlarging the actual catchment populations. In Cuba, as a result of a systematized approach to the provision of health services, there were clearly assigned catchment populations within the health care network, so that functionally inadequate demands on space were generally avoided.

Sites for all the types of health care delivery unit under study were usually well chosen. They tended to allow for future expansion which is one of the major requirements for
buildings that will have to meet many changing demands throughout their life-span. Some difficulties in adjusting to hilly sites were nevertheless experienced. Sites of some smaller facilities (health centres and rural health posts) had problems with flood control and protection of the premises. However, most of the hospitals were successfully adapted to their sites.

For example, the Kaolack Regional Hospital in Senegal had been erected with premises large enough to allow for future development. Some of the buildings date back to 1932, and the latest extension was added in 1973 in the form of a maternity unit. The original choice of site seems to have been excellent, as it still allowed for future expansion.

In the Sudan, an example of a site approaching its limits could be studied. In the course of nearly 80 years of development, almost all available space at the Khartoum Teaching Hospital had been covered with additional buildings. Its location in the densely built-up centre of the city of Khartoum made any further horizontal development difficult.

Another aspect worth considering is the use of idle land. In the rural areas it was noticed that sometimes part of the site was used for food production, which seems a good solution to the problem. This sensible use of hospital grounds was also observed at some facilities in Zambia, and was particularly successful at Mpungwe Mission Hospital in its Copperbelt Province.

Adjustment of the building to the configuration of the site sometimes caused problems of communication between departments. The site of the Zambian mission hospital just mentioned, for example, was a source of inconvenience for staff and patients as it is located on sloping land and there are changes of level in the walkways linking departments. The orientation of buildings newly added to the site is successful as it allows for the utilization of prevailing winds for ventilation. At Chipata General Hospital in Zambia, extensions had been added on a sloping site with levels within the area of the new hospital differing by more than 8 m, which creates problems of vertical communication. In Algeria, the regional hospital of Batna had been placed on a site that is relatively flat but is immediately flanked by a range of hills which could make future extensions difficult. Problems of land configuration were also encountered in Venezuela at the district-level hospital of La Victoria. Although the site has a total area of 20,000 m², the relief restricts its utilization, making it difficult, for example, to carry out the necessary extensions to access roads and vehicle parks. But this has to be weighed against the advantage of easy air circulation due to the elevated position of the site. In Cuba, the standard 630-bed hospital in Cienfuegos Province has been successfully adapted to the slope of the site by connecting the first floor of the outpatient block with the ground floor of the two inpatient blocks. Most of the sites of rural facilities allowed for future extension.

A requirement of appropriate siting is to avoid areas that are liable to flooding, or where floods are difficult to control during the rainy season. In this respect sites had not always been well chosen. The need for proper protection of the site was also apparent in various units studied. Sometimes it was difficult to stop animals wandering into the grounds or to prevent improper use of installations (e.g., standpipes or toilets). The type of site and facility protection chosen should, of course, reflect prevailing sociocultural attitudes and preferences.
2. Buildings: general design and its impact on functions, economy, and flexibility

Most of the architectural part of the enquiry was devoted to questions of flexibility, appropriate space utilization, and flows of people and materials, to and from functionally related areas. The discussion of these issues is not restricted to evaluation. Designs of existing facilities have been included for illustrative purposes, and sketches of alternative solutions offer readers an opportunity to compare their own experience of similar problems. Facilities of all types were studied, ranging from rural health posts to large national and provincial units. The designs encompassed single, purpose-built units and extensions, and it was possible to study the application of standard designs in practice. The participation of Cuba offered an opportunity to examine the use of prefabricated elements in health facilities. Most of the facilities visited in all the participating countries were first studied in a general way, then in more detail in particular departments (e.g., the outpatient department, the laboratory, and an inpatient ward), where the need for flexibility tends to be greatest because of changing demands on different units.

Regional hospitals

It is in the large regional hospitals that problems relating to the overall form and extension of the buildings are most obvious and have the most striking consequences. The following examples show the contrast between extended horizontal forms with scattered buildings, and high-rise towers, as well as intermediate concepts, some satisfactory and others still plagued with problems.

It is here also that studies of specific departments were most relevant. For instance, wards illustrate problems of function, while outpatient departments and operating theatres present different issues of traffic flow.

In Senegal, both the Kaolack and Thiès regional hospitals encountered problems relating to the functional layout of buildings on the site. Both facilities comprise a large number of separate buildings serving various functions and spread out over large areas (see Fig. 10 and Fig. 11 below). The designs of these hospitals require large distances - up to 300 m - to be covered between functionally related departments (e.g., wards and laboratory). This leads to losses in staff time and possibly to extra staff needs and costs (e.g., personnel may be needed to move patients and materials between buildings).

Kaolack Hospital was faced with an additional problem. The initial building of parts of the facility had begun in 1932. As the hospital developed, the walkways between buildings had not been covered, so that patients and staff were exposed to the external climate during movements to and from the different units. This problem had been solved at Thiès Hospital which had just been opened in 1979: there, covered walkways protected patients, staff, and materials against changing weather conditions.

The layout of Thiès Hospital is worth some consideration in view of the alternatives that existed at the planning and design stages. The final single-storey design is certainly welcome from the point of view of easy, ground-level access to departments and the consequent exclusion of lifts. However, the operational gains from this ground-level design should be weighed against probable increases in operating costs. A two-storey design, using ramps as the means of access to departments on the upper floor might have proved a happy medium between the horizontal and vertical approaches.

The design of buildings and their internal layouts had not always been ideal as regards the functional need for particular areas. The recently built maternity unit at Kaolack Regional Hospital in Senegal may serve as an example of excessive space provision. It is a three-storey building designed for 110 beds (Fig. 12). The inclusion in the design of corridors on either side of a long series of rooms increased the initial building costs, as well as the recurrent expenditure for maintenance and repair. At the time it was visited, 51 of the 110 beds were occupied. A further 15 beds were used for abandoned children. It is clear that the occupancy was too low for a maternity unit in a regional hospital of its size. The problem is not an architectural one but due rather to shortcomings in the overall organization of the health system in the region, notably lack of access for complicated maternity cases to the regional referral centre. As regards the allocation of beds for the care of abandoned children (assuming they are not medical cases), this seems to be acceptable only as an emergency solution since the function in question should be performed by more
FIG. 10. KAOLACK REGIONAL HOSPITAL, SENEGAL

Buildings

Nos.
1. Gate-house
2. Administration
3. Admissions and consultations
4. Disused maternity block
5. Ophthalmology; also office for maintenance
6. Laundry and linen store
7. General medicine "A"
8. Carpentry and masonry
9. Radiology
10. Mortuary
11. Canteen
12. Paediatric ward
13. General medicine "B"
14. Tuberculosis block
15. Disused
16. Paediatric annex (contagious cases)
17. Surgery/radiology/operating theatre block
18. Maternity block
19. Isolation
20. Pharmacy/central stores/laboratory for biochemistry
21. House for pharmacist
22. House for Assistant Director
23. Staff house
24. Epidemics; administrative block
25. Kitchen
26. Latrines
27. Stores for maintenance staff
28. Trades union/accounting office
29. Plumber's workshop
30. Garage
31. Garage
32. House for Deputy Chief of Surgery
33. House
34. Central washhouse
35. General environment and sanitation department

Legend:
- Building used by the hospital
- Disused building
- Building not used by the hospital
- Staff house
FIG. 11. THIES REGIONAL HOSPITAL, SENEGAL
FIG. 12. KAOLACK REGIONAL HOSPITAL, SENEGAL: FLOOR PLANS OF THE MATERNITY BUILDING

GROUND FLOOR

1st FLOOR

2nd FLOOR

0 1 2 3 4 5 6 7 8 9 10 METRES
appropriate programmes of the social welfare system. At the same hospital, the clinical laboratory was housed in premises which had been adapted for the purpose but without great success. The design had not envisaged the need for glazed windows, and metal shutters only had been installed. Dust therefore entered the laboratory, hampering the use of microscopes. A fan had been installed for cooling, but it could not be used as it blew away specimens under investigation.

In Algeria, the 630-bed five-storey regional hospital at Batna afforded an example of space allocation problems arising from the shape of the building, which is very disjointed. It is neither primarily vertical and compact, which could help to reduce distances between functionally related departments, nor is it horizontal and spread out, which would decrease the need to install lifts and air-conditioning equipment and could contribute to a reduction in building costs. The design falls between the two (see Fig. 13 and Fig. 14). This hospital also illustrates the need for flexibility in design during the various developmental stages of a facility. Many modifications had taken place since the building was designed. The area originally assigned to serve as an outpatient department now housed the administrative and support services. The space allocated for the radiology department had proved insufficient for the size of the equipment. The department had been moved to the ground floor, whereas the original design foresaw its location on the third floor. In some areas, the space allotted for corridors seemed excessive from a functional point of view, particularly when compared with the room sizes. It can also be argued that a certain degree of inflexibility has been introduced by using a core of stacked wards. Ward designs reflected the cultural preference for the separation of men and women, and a central "spinal" wall created two internal corridors for this purpose. However, space was wasted by having unnecessary parallel corridors built into wards that were assigned exclusively to either male (e.g., the male orthopaedic ward) or female patients.

Thiès Regional Hospital in Senegal displayed various good design features (see Fig. 11). It had just been built on the scale of a 210-bed facility in 1979. In the ward blocks, each pavilion consists of two units for male and for female patients respectively, comprising 20-30 beds each. They have been linked together in the shape of an H. The wards consist of single, double, or six-bed rooms. The latter can be extended to eight-bed rooms, should the need arise. The nurses' stations are located in the middle of the H shape, allowing for easy access to patients on either side. In the medical and paediatric wards, the sections for patients with infectious diseases have been hygienically located towards the far end of the building. An important problem was noticed in the operating block where non-sterile materials, e.g., used linen, have to be carried through the theatre, thus facilitating cross-infection. The problem could be easily overcome by the provision of outside access to the sterilization and storage room.

Ndola Central Hospital, one of the establishments at regional level visited in Zambia, offered an opportunity to study the stages of development and function-specific reassignment of space in the evolutionary process of a hospital. It was originally conceived, in the late nineteen-fifties, to serve a population of about 50,000. However, the population grew to about 160,000 in the late nineteen-sixties, and an eight-storey extension was completed in 1972. The latter houses a research centre on its two top floors for which no alterations were made to the original design providing for a series of wards. A large number of small rooms is included in the design, a reflection of the original separation between paying and non-paying patients.

The outpatient department offers an example of a successful internal layout. It is located on the lower ground floor, reasonably close to the site entrances. It is directly accessible to vehicles, and patients do not have to pass through other parts of the hospital to reach it. Fig. 15 indicates the various specialities and functions performed in the department, but increased demands for outpatient care could not be accommodated within the structure provided. Treatment demands for about 1000 patients daily, during a 9-1/2-hour opening period, have put an excessive strain on the available space. Only four consultation rooms exist in each of the male and female general outpatient departments, and the space is insufficient for a case-load of 150 per doctor per day. The original design envisaged curtains to screen off patients during the consultation and diagnostic procedures. Owing to overcrowding, they have lost their purpose, since they can easily be pulled aside by waiting patients. Patient-flows are organized in the following way. First-time patients arrive at the records section, which is situated in the main waiting-hall, covering its whole length. Depending on requirements, patients either wait in the hall or go on to subsidiary waiting areas within the different sections of the department. Overcrowding in the corridors and rooms reduces the speed of the flow.
FIG. 13. GROUND-FLOOR PLAN OF BATNA HOSPITAL, ALGERIA

FIG. 14. VERTICAL SECTION OF BATNA HOSPITAL, ALGERIA
FIG. 15. NDOLA CENTRAL HOSPITAL, COPPERBELT PROVINCE, ZAMBIA
THE MALE OUTPATIENT DEPARTMENT IS SHOWN ENLARGED BELOW
The male surgical ward of Ndola Central Hospital offered an example of flexible design. The location of the ward sister's office in the original design was impractical, as it was too far from the centre of the ward. The room was reassigned to serve as a clinical instruction area, and the ward sister now operates from the nurses' station. One room, originally designed as a side ward, is occasionally used by the sister but it operates mainly as a staff room. However, the present location of the nurses' station is such that the emergency spotlights above the ward room doors cannot be seen (Fig. 16). They must therefore be relocated.

In the outpatient department of Chipata General Hospital in Zambia a case of simultaneous over- and under-utilization of space was studied. In the adult department, the waiting space was unoccupied while corridor areas adjacent to the consulting rooms were crowded. The introduction of a call system could alleviate crowding in the corridor.

A problem in linking functionally dependent areas was also identified in the main buildings of Chipata General Hospital. Only two lifts have been installed in the multistorey buildings which house X-ray equipment, laboratories, etc. The pharmacy/central store has been located on the ground floor of one of the ward blocks, without access to the lifts. Supplies and medicines have to be carried up a staircase. The original design foresaw a ramp linking the central store/pharmacy department with the first-floor lifts but it had not yet been constructed (see Fig. 17).

The 600-bed hospital in Cienfuegos Province, Cuba, also demonstrated simultaneous under- and over-utilization of space. The facility was constructed with prefabricated elements, and is divided into three parallel blocks, one of three storeys and two of four. The latter accommodate the inpatient wards. Restrictions on building vertically meant that the design had to be extended horizontally, which lengthens the distances between functionally related areas and also between the two centrally situated points of vertical communication and certain areas. The dimensions of the building seem rather large in relation to functional space requirements, which may be due to the exigencies of the building system. Over-utilization occurred in the emergency department, where some congestion existed, especially in the main corridor. To some extent this can be attributed to a system that indirectly encourages the use of emergency departments. More effective ambulatory care in polyclinics and outpatient departments could reduce the pressure on the admission and emergency departments. A case of excess space provision was seen in the surgical centre. Ten operating theatres have been provided, and they seemed rather under-utilized (two operations each per day at the time of the visit). As apparently more than adequate time was allowed for anaesthesia to be given in the operating theatre, the anaesthesia rooms were not used. The situation may now have changed, as the hospital had been in operation for only one year.

The location of the outpatient department on the second floor of the building also caused some circulation problems. Patients enter through a hall on the ground floor and mix with flows from the diagnostic and treatment areas. They then proceed to the second floor via a staircase. The physically disabled are transported in lifts; the distances to be covered for these transfers are considerable and the routes cross those of other internal flows. In the surgical centre the layout does not allow for separate flows of people and of septic and aseptic material. The movement of patients in the operating theatre of the surgical centre is two-way. Patients enter and leave by the same door in each of the operating rooms. In hospital architecture, it is essential that staff and patients should leave by different doors from those by which they enter. The purpose of this is to obviate their re-entering areas kept strictly sterile, once surgery has taken place. Under such an arrangement staff would return to the dressing room by an external route, and instruments would follow the same route as at present towards the central sterilization unit. Other used material could be disposed of without passing sterile areas. An outer door could be used for these purposes.

Such problems might be avoided if diagrams of the type shown in Fig. 18, indicating the planned flow of people and materials in each of the departments discussed above, were to be included in the briefs for hospital architects.
FIG. 16. NDOLA CENTRAL HOSPITAL, COPPERBELT PROVINCE, ZAMBIA:
MALE SURGICAL WARD

- ESCAPE STAIRS
- TOILETS
- DAY-ROOM
- BATH
- 10 BEDS
- 10 BEDS
- DOCTOR'S OFFICE
- 1 BED
- NURSE'S STATION
- 4 BEDS INTENSIVE CARE
- STAFF TEA-ROOM/ OFFICE
- 1 BED
- SLUICE
- STORE
- FLOWERS STORE
- TOILETS
- BATH
- STAFF ROOM
  (ORIGINAL SISTER'S OFFICE)
- DAY-ROOM
- BALCONY
- DAY-ROOM
- STAIRS AND LIFT LOBBY
- KITCHEN
- LINEN STORE
- TOILETS
- RELATIVES
- STAFF TOILETS

0 1 2 3 4 5 10 METRES
FIG. 17. CHIPATA GENERAL HOSPITAL, EASTERN PROVINCE, ZAMBIA: SECTIONAL VIEW

FIG. 18. CLINICO-SURGICAL HOSPITAL, CIENFUEGOS PROVINCE, CUBA: FLOW DIAGRAM OF SURGICAL CENTRE
District hospitals

This section deals with hospitals designed to take from around 100 to 250 beds and regarded as serving the population of a district. Invariably there are differences between countries in the areas assigned and populations served by "district" facilities, so that only very broad guidance can be offered here.

The group of facilities under consideration is extremely interesting in that it provides abundant examples of the lack of, and need for, flexibility in architectural design. Their situation in rapidly growing towns and their increasing role as referral and support centres in the health care system give rise to continuous demands for their extension and adaptation. Planners may find themselves in a situation in which the initial facility is large enough to make demolition an unpalatable choice and small enough for gradual adaptations to seem easy to implement. The resulting problems for community health services, as well as for the care of outpatients, emergency cases, and inpatients, and for surgery and obstetrics, are illustrated below.

The need for a better and more flexible design was evident at Petauke District Hospital in Zambia (see Fig. 19). Extensions were both planned and under construction at the time of the visit, including a new maternity and paediatric ward, but these did not take the total space requirements into account. For example, no offices were planned for the public health inspector, the hospital administrator, and one of the practising doctors. A family planning unit and separate wards for tuberculosis and mental patients would still have to be housed in the extensions, inevitably creating bottlenecks in some other areas of the facility. The design of the paediatric/maternity blocks was not in accordance with any modular system, and room sizes for identical functions varied. This complicated construction procedures and added to building costs. Some alterations could improve the design of this hospital. For example, spaces for a staff room and a staff toilet, as well as a patient day- and dining-room facility, might be added. Toilets, now facing the main ward corridor, should be more separate from the wards in order to achieve sufficient ventilation. In another department - the operating theatre block - the rooms and corridors adjacent to the operating theatre have the same ceiling heights as the theatre proper, which has caused needless expenditure, as it is functionally unnecessary. The use of clear glass in the ground-level operating theatre may facilitate disturbance from outside. The sluice room is not well sited from the point of view of preventing cross-infection. In addition, there is no direct access from the scrub-up room to the operating theatre. After a surgeon has scrubbed up, the room can only be opened from the outside by other staff.

The outpatient department in Thompson Hospital, another district level facility studied in Zambia, offered an example of insufficient space provision provoked by external factors. Problems of overcrowding and excessive demands on available space had occurred since the arrival of six Chinese specialists in 1977 led to a substantial increase in the catchment population of the hospital. Waiting and consultation/treatment areas had not been enlarged prior to their arrival, and difficulties were encountered in accommodating the sudden increase in activities. There was no longer any room for emergency cases, since the area allocated to them had been transformed into an acupuncture room. Four consultants shared a small examination room. At this point it is worth pondering whether a functional programme should and could be so flexible as to cope with such a sudden redefinition of the unit's function within the health system. The upgrading of a facility, or the extension of its functions, should be a planned, step-by-step development. It should include the total environment of the hospital system in order to avoid the creation of bottlenecks and the negative consequences of unplanned evolution. Many of the problems experienced could have been avoided if the specialists had been gradually integrated, allowing time for the necessary spatial adjustments. A number of functional problems were also identified in the operating theatre block. There is, for example, direct communication between non-sterile and sterile areas. Access to the sluice room is via the theatre. In addition, no recovery room has been provided for the post-operative period. In some wards, mattresses had been placed on the floor to cope with the influx of patients. Inadequate provision of space was evident in most areas of the hospital, and extensions were quite clearly needed.
FIG. 19. PETAUKE DISTRICT HOSPITAL, EASTERN PROVINCE, ZAMBIA:
GENERAL PLAN

-54-

PLAN

0 1 2 3 4 5 6 7 8 9 10 METRES
The same kind of shortcoming was seen at the 200-bed hospital in Portuguesa State, Venezuela. It was planned to have a resident neurologist, but there was no space for another office or the requisite equipment. The design also omitted an assembly hall for staff meetings or religious and community activities, as well as smaller rooms for staff education, lectures, or group meetings.

As regards flexibility of design, experiences varied. In Zambia, the 110-bed Mission Hospital at Mpungwe, Copperbelt Province, offered an example of a flexibly designed facility. It had recently been extended, and some functional reassignments of space had taken place (see Fig. 20). The flexibility of the design allowed for some changes in space utilization since the last extensions. The medical officer's room was originally in the outpatient department, but, because of high utilization and congestion in the department, it is now located in the minor operating theatre. Both space and patient-flow requirements could be satisfied. The medical officer can receive patients from the outpatient department and the casualty department without blockages being created. Initially the child welfare clinic and the paediatric outpatient department were separate. This gave mothers no incentive to attend child welfare classes, as they could not obtain treatment for their children at the same time. The two departments were accordingly integrated in one area. As a shortage of staff prevented adequate use of the intensive care unit, it was used as an overflow waiting area for patients, which meant that toilet facilities, had to be installed.

In Venezuela, there were some problems at Guanare Hospital, the 200-bed district facility studied in Portuguesa State. Here, a planning detail in the paediatric ward, made the layout less flexible. Toilets had been positioned against the corridor wall, and it would not be easy to change the size of the wards within the present structure. If the toilets had been placed against the outer wall, this would have permitted not only greater flexibility, but also direct access to natural ventilation. Since the standard plan for 200-bed hospitals was drawn in 1970, the need to accommodate new services (e.g., for a haematology unit and a family planning unit) had arisen. These units had to be housed in improvised premises. Such examples show the need for continuous review and updating of standard plans in order to keep pace with changes in medical technology and health service concepts. This seems particularly necessary in view of the reorientation of health systems and technology towards primary health care. Otherwise the use of standard plans as an economy measure may mean a costly experience in the future. It follows that standard plans or, rather, type plans, should be as flexible as possible in order to facilitate functional redefinitions.

In the same country, the 90-bed "health centre" at Villa de Cura experienced operational problems because the consulting rooms were dispersed across the hospital. The centre was designed as a series of three interrelated, exceptionally long, parallel wings. It is a single-storey complex, apart from a group of rooms originally used as staff accommodation on the first floor of the original building and subsequently redesigned to house administrative and social services. Flexibility was improved, but not sufficiently. Staff have to spend additional time covering the distances between different areas. Interdepartmental boundaries have been blurred, and this has led to an intermingling of traffic flows in the building. Some consultations are conducted in the inpatient section, whereas others have been transferred to the accident and emergency department. Services have, in fact, been duplicated and space is misused. Furthermore, the location of the emergency department entails transit through already congested areas, and the layout of the premises means that long distances have to be covered. Several other problems of over- and under-utilization of space were recorded. The shortcomings observed arise from a misjudgement of the growth rate of the population and of its need for services, which subsequently led to demands on space in the facility that could not be met with short-term reallocations or quick extensions. On the other hand, since the medical personnel preferred to work only part-time for the government health services, there were excessive demands on space during certain hours and the premises were left idle at other times during the normal working day.
FIG. 20. MPONGWE MISSION HOSPITAL, COPPERBELT PROVINCE, ZAMBIA: WARD PLAN

- MALE WARD (28 BEDS)
- Toilets
- Library
- Office
- Toilets
- ADMISSIONS
- REGISTRATION
- ENTRANCE TO OUTPATIENT DEPARTMENT
- LABORATORY
- DRESSER
- Waiting
- MEDICAL ASSISTANT
- CHILD WELFARE CLINIC
- PHARMACY
- MINOR OPERATIONS
- MEDICAL OFFICER
- TREATMENT
- CASUALTY
- EXAMINATIONS

- INTENSIVE CARE
- Waiting
- STERILIZATION
- RESUSCITATION

- OPERATING THEATRE
- CHILDREN'S WARD (31 BEDS)
- Female Ward (28 Beds)
- Toilets

01... 5 10 METRES
The location of functionally interdependent areas has not always been successful; this has created circulation problems and hindered the separation of septic and aseptic flows. At Guanare Hospital in Venezuela, for example, several departments were investigated, including the surgical centre, the accident and emergency department, and some other areas. The operating theatres have been placed on the top floor of the building. Thus long distances have to be covered vertically from the accident and emergency department, which is situated on the ground floor. Any failure of the lifts is bound to aggravate the problem. In the surgical centre itself, all the components have been allocated to a circumscribed space. This inflexibility in the design will make it difficult to carry out future adaptations without functional upheaval. The surgical centre shares the general services with the obstetrical centre on the same floor (see Fig. 21). As already indicated, the separation of septic and aseptic flows had also not yet been adequately achieved. The general layout consists of a central corridor giving access to the different facilities with a side corridor to the staff dressing-rooms. Patients enter and leave along the central axis in both the surgical and obstetrical areas, on which staff and supplies converge. "Filters" are installed in the doorways. The design does not permit separation between non-sterile and sterile areas. The corridor giving access to the dressing rooms permits staff proceeding to the surgery section in operating suits to mingle with staff coming in from outside areas. The same problem occurs in the obstetrical section.

The accident and emergency department has been located on the ground floor towards the rear of the hospital. Patients arriving on foot have to walk between the main building and the boiler house in order to reach the department. Internally the unit had undergone some adaptations, e.g., the inclusion of a paediatric emergency department. Originally this should have been located on the second floor, and no extensions were made when it was decided to accommodate it in the premises below. The space assigned to accident and emergency services - now dealing with both children and adults - subsequently proved too small, as could be seen from the heavy congestion during the visit. In addition, staff shortages contributed to overcrowding in the vicinity of the consulting rooms and the case-finding, screening, and photofluorography services. It seems that the demand for services of this kind had been misjudged during the planning and construction phase, when the rapid population growth had not been foreseen. Fortunately the situation was under review and extensions were planned.

At La Victoria Hospital in Venezuela the initial design created difficulties as regards circulation and accessibility to dependent areas. An example is provided by the accident and emergency department. Long distances have to be covered because of the layout of the department and its location in a semi-basement. The labour, delivery, and recovery rooms have been located on three different floors, which makes access difficult for emergency obstetrical cases.

In Algeria, the 240-bed hospital at Jijel, which had been recently constructed according to a type plan, was notable for its well-located functional areas. All sectors in this four-storey building can be reached easily (see Fig. 22, Fig. 23, and Fig. 24). However, problems might arise later when the need for adaptation begins to be felt.

Block A (Fig. 23) is a building of rigid overall shape. It is "tailor-made" for one particular kind of function carried out in one particular way. The complex layout allows little in the way of possible modifications to allow for future change, apart from a lengthwise extension of the building, linked to the existing communication system. Artificial ventilation is required because of the numerous internal rooms. This approach has been abandoned in many countries, as it relies heavily on sophisticated equipment and is therefore expensive, and because it makes it difficult to adapt the building to changing needs. The very compact design has a large corridor surface compared with the total area (23%). The varied corridor widths appear satisfactory for the types and flow of personnel within the specific areas. Circulation and relationships within and between departments are logical and satisfactory. The arrangement of the outpatient consultation area and the separate accident and emergency department, with direct access to the wards, seems very good. There is a surprisingly small number of consulting rooms, but these are large. Part of the reason may be that the hospital is based on a module of 5.60 x 7.20 m, which is too large. Where the corridor is included within the same module, this gives smaller rooms that appear to be adequate.
FIG. 21. GUANARE HOSPITAL, VENEZUELA: PLAN OF THE SURGICAL CENTRE

List of rooms

CENTRAL STERILIZATION

1. Needles, syringes, solutions
2. Work zone
3. WC
4. Sterile supply delivery
4A. Sterile materials store
5. Supervisor
6. Sterile materials
7. Scrub-up
8. Gloves
9. Non-sterile supplies

SURGICAL DEPARTMENT

10. Mop closet
10A. Clean utensils store
11. Waiting-room
12. " "
13. Ventilation control
14. Minor surgery (septic)
14A. Hand scrub
15. Nurses' and physicians' room
16. Clean dressing-room for physicians and nurses
17. Shower
18. Clean dressing-room for physicians
19. Shower
20. Physicians' room
21. Major surgery
22. Soiled utility
23. Handscrub
24. Sterile materials store
25. Portable X-ray machine
26. Stretchers
27. Auxiliaries' WC
27A. Auxiliaries' dressing room
28. Head Nurse
29. Secretariat and records
30. WC

OBSTETRICAL DEPARTMENT

68. Doctors' and nurses' room
69. Doctors' and nurses' clean dressing-room
70. Shower
71. Doctors' WC and dressing-room
72. Doctors' room
73. Delivery ward
74. Clean utility room
75. Hand scrub
76. Sterile materials store
77. Mobile X-ray machine
78. Stretchers
79. Nursing auxiliaries' room
80. Nursing auxiliaries' WC
81. Clean clothing
82. WC
83. WC
84. Obstetrical consulting room
85. Mop cupboard
86. WC
87. Nurses' station
88. WC
89. WC
90. Linen store
91. Clean utility
92. Linen store
93. Store for cleaning gear
94. Soiled utility
95. Hand scrub
96. Nurses' station
97. Soiled utility
98. Delivery ward
99. Prepartum cubicle
100. " "
101. " "
102. " "
103. Delivery ward (septic)
104. Prepartum ward (septic)

Diagram showing the layout of the surgical centre within the hospital complex.
FIG. 22. JIJEL HOSPITAL, JIJEL DISTRICT, ALGERIA: GENERAL LAYOUT AND VERTICAL SECTION
FIG. 23. JIJEL HOSPITAL, JIJEL DISTRICT, ALGERIA: FLOOR PLANS OF BLOCK A (OUTPATIENT AND EMERGENCY DEPARTMENTS) AND BLOCK B (INPATIENT WARDS)
FIG. 24. JEBEL AWLIA RURAL HOSPITAL, SUDAN: FLOW OF PATIENTS

(Main directions and volumes of flow; mean waiting times, and mean examination and treatment times, as measured in October 1978)

Key:  
- Stations, with average time for examination and treatment, or waiting time, in minutes.
- Patient flows, with average number of persons per day

* Bystanders cause congestion before ward entrance
Block B (Fig. 23) has four floors above the ground floor. The ground floor houses the laundry, kitchen, garage, and morgue, as well as the staff changing-rooms. The arrangement of this service area is satisfactory and has the advantage of allowing for future extensions. The wards are very commendably laid out in two 30-bed wings per floor with 1, 2, 3, or 6 beds per room. The arrangement and location of patients' rooms, bathrooms, lifts, stairs, and service areas, including the nurses' station and provision for circulation generally, appear to be well thought out. There are alternative escape stairs. The block is well provided with day-rooms - four per floor. These allow people either to mix or have some degree of privacy, and they are no longer obliged to share one large day-space. One serious criticism is that the size of the courtyards, sufficient for a single-storey building, is totally inadequate for a multiple-storey building of this nature.

The 210-bed maternity hospital in Cuba has experienced some functional problems with its departments. This facility had been converted from a 100-bed general hospital to its present size in 1979. It was studied in detail as it offered an opportunity to gather experience of a remodelling exercise after a redefinition of functions. The location of the many functionally dependent areas created several problems of internal traffic flow between units. The administrative services, for example, had not been located in a single area so that long distances had to be covered for communication purposes. Although the main administrative block was well placed on an uneven site, there was room for improvement in its internal layout - for example, by allowing more space for the Director's secretariat, which was not only cramped but inconvenient by the fact that it served as a connecting link between other areas. On the second floor, the allocation of general services and some administrative services, of teaching and workshop areas, and of the pathology laboratory and other units was questionable from a functional as well as a hygienic point of view. The same passageways, for example, gave access to the incinerator, the pathology services, and lecture rooms. The food transport system for staff and patients was also unsatisfactory. Access to prepared food in the kitchen was via a hatch from the staff canteen, food for both patients and staff being delivered through this single hatch. The food trolleys had subsequently to pass the staff canteen area, causing blockages that slowed down delivery. Fortunately the situation was under review as part of a continuing process of adaptation. A problem of interior design was observed in the kitchen: no space had been reserved for the preparation of special diets and some dishes had to be prepared outside the kitchen premises. The kitchen utensils were kept at the far end of the preparation areas, which meant extra movement for the staff. The surgical centre furnished another example of the well-known problem of lack of separation between non-sterile and sterile areas. Staff, patients, supplies, and waste materials all had to pass through the same corridor. The problem of potential cross-contamination had also not been solved in the central sterilization unit. The space assigned to it was inadequate, and preparatory work had to be performed in unsuitable premises outside the unit. As in the surgical centre, both sterilized and contaminated materials were conveyed by the same routes. There was obvious underutilization of space in the curettag recovery area.

At this point, it is useful to recall that, whenever premises are to be converted, a carefully designed master plan can help to avoid shortcomings.

Rural hospitals and maternity centres

Facilities in this category include small-sized rural units (10-60 beds) offering impatient services along with outpatient and community health services.

The health care demands of rural populations in developing countries are in a state of considerable flux, and the planning of rural hospital facilities is beset with problems. In some areas, a rapid increase in demand makes it necessary to extend the facilities; in others, migration to the cities leads to the underutilization of existing units. In both cases, flexible, low-cost designs are called for. The concept of primary health care assigns vital supportive and community health functions to rural hospitals vis-à-vis large areas and populations. This was not reflected in the design of some of the facilities visited. The case studies also show how much the use of these facilities is dependent on the overall pattern of life of the area and the district health care system. Seasonal variations in agricultural work, transport conditions, the staffing and supplies available in the facility, the existence of other units in the area, and staff housing are only a few of the factors that make for the intensive utilization or extreme underutilization of rural health units. These factors should accordingly be taken into account in their planning.
In the Sudan the 50-bed hospital at Jebel Awlia and another 30-bed facility at Kamlin found themselves short of space as a result of environmental factors. Activity and patient-flow studies show (Fig. 24) the directions and volumes of patient flows and the mean waiting and treatment times. These flows are not uniform. Fig. 23 shows a very typical pattern of patients starting to arrive at 06h00 (6 a.m.) and accumulating in the waiting-room as the medical assistants begin to see them; the entire staff then takes its breakfast simultaneously with a resultant sharp increase in the number of people waiting. By 14h00 (2 p.m.) everyone has been attended to and the working day is effectively over. Such peaks in both waiting times and numbers of people waiting can be reduced by organizational and educational measures. The factors contributing to variations in demand in different hours, days, and seasons, include agricultural work patterns, public transport schedules, market days, and the distribution of labour between the sexes.

Staffing is another important determinant of the utilization of space, as in the case of a maternity and child health unit that was not being used because a health visitor could not be attracted to work there. The reason was not a shortage of suitable personnel but a lack of staff housing in the town concerned.

A study of Fig. 24 from another standpoint leads to the conclusion that, if the average time devoted to each patient were increased by only three minutes, the outpatient staff and space at present available would have to be doubled, or the system radically reorganized.

Several shortcomings in functional programming were found at a 26-bed rural hospital in Senegal (see Fig. 26). The inpatient unit is accommodated in a former store. There is only a low partition between the female and male units, and there is no means of isolating patients with infectious diseases. The laboratory has been placed next to the examination room, which makes for efficient functioning. A hatch connects the examination and laboratory areas. Access of patients to the laboratory is from the outside. Space demands in the centre varied. Close to the consulting room, some congestion was noticed during a brief activity study. In other outpatient units (e.g., the pharmacy and the rooms for injections and dressings), staff were sometimes found waiting for patients, as the flows were determined by the nurse in the examination and consulting room. The space provided for maternity cases was underutilized, as only one ward was occupied. On the other hand, there was not enough space for relatives accompanying patients. Relatives are expected to take care of some of the needs of patients, but only the maternity block offered them access to the kitchen or baths. Some patients in the general wards could not be cared for adequately.

FIG. 25. JEBEL AWLIA RURAL HOSPITAL, SUDAN: MAIN WAITING AREA

(Mean number of persons in one station at different times of the day)
The 22-bed rural hospital visited in Cuba was a good example of functional programming as expressed in the location of related sections of the building. Although important at the time of their construction, units of this size are no longer built owing to the increased availability of rapid transport. Nevertheless, the wards in the inpatient block were rather large, considering the low bed-occupancy rates. It might also be argued that there was little room for privacy, as only three subsections (for men, women, and children respectively) were provided. It was also noted that it was not possible to isolate patients. Furthermore, women in labour had to stay in the public ward.

**Large health centres**

These are usually urban facilities for the care of ambulatory patients. Most of them also serve as bases for preventive and environmental health activities. Beds, if any, are usually only those needed for emergency patients. The policy of creating health centres in addition to hospitals, in urban areas, is relatively recent and therefore most such facilities are modern and have been carefully designed and built. However, the cases that were studied are good illustrations of the difficulty of achieving a design that will be capable of accommodating a concentrated flow of ambulatory patients and their relatives.

For example, the polyclinic of Las Cruces in Cuba was found to be satisfactory in many ways, but the layout on two levels, with the consulting rooms on the first floor, meant that the main flow of patients, including children and pregnant women, to and from the consulting rooms had to be via the stairs. This was aggravated by the relative narrowness of the first-floor corridor that led from the stairs and served as the main traffic artery on that floor (see Fig. 27). A possible explanation for this may be a defective briefing process, with insufficient discussion of the question of circulation by the staff (particularly the nurses), architects, and the community. In the same facility, a problem of design was found in the emergency department. Changes in the use of space and an excess of partitions have created an undue criss-crossing of flows of staff, patients, and relatives (see Fig. 28). The inclusion of a separate emergency department in the polyclinic, in addition to the ordinary consultation and treatment areas, was in itself a debatable measure. The consequence has been additional building operations and therefore excessive capital and recurrent expenditure.

The Candelaria Outpatient Clinic in Venezuela was an example of good functional programming for a unit of its size. A particularly successful feature of the design is the short distance that needs to be covered to reach the accident and emergency department. Ample waiting space and smooth flows of people and materials are other characteristics. The only design shortcoming that could be identified was the absence of a staff dining-room.

The Ain Touta polyclinic in Algeria had three examination rooms, each served by a separate waiting area. The distances between the reception area and the waiting areas were long. Room sizes were excessively large considering the space requirements of the functions for which they were intended. This impression was gained when a comparison was made between this unit (550 m²) and Omaria Health Centre (approximately 400 m²) which performed almost identical tasks (see Fig. 29 and Fig. 30).

The new polyclinic of Medea Wilaya Province in Algeria was designed with a large inner courtyard from which there is access to the first floor located over a section of the ground floor (Fig. 31 and Fig. 32). The area built over is approximately 1800 m². The type plan allowed for a variation whereby a maternity unit was included in the location shown for maternal and child health services, these services being provided instead in the general outpatient department, while the layout for the upper floor (i.e., apartments and dental departments) remained unchanged. Problems of circulation are posed by the long distances from the entrance to the upper floor, and to the waiting areas on the ground floor. The inclusion of non-patient areas in the core of rooms facing the courtyard increases the distances that patients have to walk. Small differences of level necessitated steps at various points along the corridors. If these differences were absolutely necessary, i.e., if a design solution could not have been achieved without them, ramps should have been provided to make things easier for wheelchairs and trolleys. The rooms appeared to be excessively large. Fig. 33 illustrates an alternative layout within the original frame, bearing the above considerations in mind.
FIG. 27. POLYCLINIC OF LAS CRUCES, CUBA: PLAN OF THE FIRST FLOOR
Ibrahim Malik Urban Health Centre in the Sudan also experienced circulation problems (see Fig. 34). The building had been erected in 1977 with a donation from a philanthropist and according to plans provided by the Ministry of Works, but without sufficient supervision. After completion, changes in space allocation had to be introduced as some activities could not be performed satisfactorily in the areas assigned to them. This led to the overloading of other service areas and, in a chain reaction, to congestion and overcrowding, particularly at peak hours. This is illustrated in Fig. 34 by the number of persons waiting in front of each of the main work-stations at mid-morning on one of the days in which the facility was visited. In addition, as a result of inadequate design, a radiology unit had to be accommodated in unsuitable rooms. As adapted, the unit was unsafe and lacked a dark-room and changing-rooms for patients.

Small health centres

These facilities demonstrate the same types of needs, problems, and solutions as the rural hospitals. Sometimes too small for the population they have to serve, they tend to be overcrowded at peak times; adaptation to new functions and to increased demand may lead to the assignment of certain spaces to activities for which they were not originally intended. Sometimes two or more different functions have to be carried out simultaneously in the same room. In this process, some necessary features are neglected; for example, facilities for community and environmental health, waiting areas, the laboratory, labour, and postpartum rooms, toilets for the public, and the mortuary. These problems, coupled with the rigidity of some of the designs, create a paradoxical situation: in spite of the smallness of these facilities, they often suffer from circulation problems. In only a few cases was a functional redesign or an extension possible.

One such health centre (Biscucuy in rural Venezuela) had been opened in 1971, with a 10-bed capacity. The number of beds had since been increased to 27 (including 7 cots), without extending the very compact small building. Population growth had greatly increased the pressure on space.
FIG. 29. PLAN OF THE NEW POLYCLINIC IN AIN TOUTA, ALGERIA

Area: 550 m²

28.46

Emergency entrance

Colonnade passage

EXAM. ROOM GENERAL

RADIOLOGY

EXAM. ROOM

EAR, NOSE, THROAT

LAB. BLOOD SAMPLE

DRESSING-ROOM

STAFF CHANGING

SHOWER

WAITING-ROOM

WAITING-ROOM

WAITING-ROOM

WAITING-ROOM

WAITING-ROOM

WAITING-ROOM

WAITING-ROOM

RECESSION

ACCOUNTS

SECRETARY

SOCIAL ASSISTANT

RECORDS

WC WC

PLAY-ROOM

HEALTH EDUCATION

ANTENATAL

ENTRY M C H

0 1 2 3 4 5 METRES
In Kalindawalo Rural Health Centre, Zambia (see Fig. 35), several functions had not been incorporated in the design. For example, space had not been allocated for the child welfare clinics, and these had to be held on the verandah outside the registration/consulting room. Drug preparation and dispensing had to be performed in the registration/consulting room. Women in labour had to stay in the female ward. Likewise, the delivery room was also used for the postpartum phase. Patients in the isolation ward (pavilion not shown in figure) had access to a separate kitchen, but they had no separate toilet and bathroom facilities. The extension of the main building did not include space for a laboratory nor was its design flexible enough to accommodate one after completion. The laboratory has been assigned to an existing building which previously served as a mortuary. With a total area of only 4 m², in which to take specimens and perform analyses, it has no space left for a mortuary.

Chifubu Clinic, the small urban health centre studied in Zambia, served as a satellite to the provincial level hospital. The building had originally been designed as a cancer clinic before the country became independent in 1964, and no alterations had been made to the original layout. The facility incorporated most new functions successfully (see Fig. 36). overcrowding posed functional problems in the waiting-room and consultation area, but it was due to organizational factors rather than failure in design. Because of shortages of supplies and drugs, the vast majority of patients attended the centre in the morning, since stocks tended to run out in the afternoon. At the time of the visit, 10 a.m., 75 patients were counted in the waiting-room. It is clear that the solution of the problem depends on the organization and resources of the centre.

Ouzera Health Centre in Algeria faced some specific problems in satisfying increasing demands for services. The building was constructed in 1958 and no alterations had taken place since then. Extensions were called for but the confined area of the site created difficulties. The two-storey building accommodated health care activities on the ground floor, and living quarters for personnel on the first floor. Added to general lack of space was the dispersed allocation of waiting areas (see Fig. 37). An alternative solution, shown in Fig. 38, would be to rearrange the functional areas and build an extension. This would segregate the activities of the pharmacy and injection room. Patient toilets, used as storage areas might be reinstated by providing alternative storage space. The proposed design also enlarges the waiting area for females so as to meet the actual demand. A central corridor would conveniently separate different areas of activity. In addition, a better organization of consultation schedules might reduce congestion at peak hours. It was noticed that patients tended to attend the facility primarily before noon, whereas no patient was seen between 2 and 3 p.m. on the day of the visit.
FIG. 31. POLYCLINIC IN MEDEA WILAYA, ALGERIA: TYPE PLANS (LAYOUT)
FIG. 32. POLYCLINIC IN MEDEA WILAYA, ALGERIA: TYPE PLAN (SECTION)

SECTION A - A

0 1 2 3 METRES

FIG. 33. POLYCLINIC IN MEDEA WILAYA, ALGERIA: ALTERNATIVE LAYOUT WITHIN EXISTING BUILDING FRAME SHOWN IN TYPE PLANS
FIG. 34. IBRAHIM MALIK URBAN HEALTH CENTRE, SUDAN: GROUND PLAN AND PRESENT FUNCTIONS OF THE ROOMS

(This was the first centre of its type to be built in the Sudan.)

WHO 87737
FIG. 37. OUZERA HEALTH CENTRE, ALGERIA: PRESENT LAYOUT
FIG. 38. OUZERA HEALTH CENTRE, ALGERIA: PROPOSED LAYOUT

- New wall
- Existing wall (to be removed)
At the Taybia El Asanab rural health centre in the Sudan, an example of simultaneous over- and underutilization of space could again be studied. As indicated in Fig. 39, circulation routes could be improved, for example, by creating passageways between the centre and the wings of the building.

**FIG. 39. PLAN OF RURAL HEALTH CENTRE, TAYBIA EL ASANAB, SUDAN: CIRCULATION PROBLEMS AND SPACE UTILIZATION**

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**Rural health posts**

Rural health posts present a very important challenge to the designer. They must be very economical, since they are needed in great numbers. They must be simple to build, since the community is expected to collaborate by contributing materials and labour. They must also be simple to maintain. At this level of the health services, many of the health activities should take place in the community itself. All that is needed is a sort of pied-à-terre for the community health worker(s) and for the team from the health centre or hospital on its periodic visits. A stock of drugs and other supplies sufficient for a period of 1-3 months, should also be safely stored there. In this case, the architects' main role may be simply to provide advice to the community on how to improve lighting and ventilation, on how to make the structure more durable, and - in general - on how to make the facility as functional as possible within the means locally available.

The rural posts visited offer a variety of examples of the fulfilment of these criteria in different degrees. It is surprising how many different solutions to the problems of space distribution and circulation can be found in a house with an area of 60 m² or less. Some are, of course, better than others, and much can be learnt by comparing them. Some of the
rural health posts had eventually had to be upgraded to become small health centres and even rural hospitals. In some cases, the way of introducing the required extensions had been built into the type plans; in others, new functions had simply been crowded into the existing space.

All small-sized units in Senegal had been constructed according to type plans which were sometimes modified to suit local conditions. The type plan shown in Fig. 40 needed adaptation so that the traditional grass-roof construction could be used. But when measurements were simply reduced, the functional space requirements of the three health workers were no longer satisfied. In a different adaptation, both constructional and space needs have been accommodated in a successful way (see Fig. 41). As for flexibility, this adaptation can also be easily extended and rearranged.

FIG. 40. HEALTH HUT, SENEGAL: TYPE PLAN

FIG. 41. HEALTH HUT, SENEGAL: ADAPTED DESIGN
The type plan for health posts had been reduced in scale at one of the facilities visited in Senegal (see Fig. 42). The adaptation included a reduction in corridor width and did away with the internal dividing walls in the examination room. But the internal positioning of the rooms is not ideal. Access is via a small corridor which also serves as a partial waiting area. Unless the number of patients is small, congestion and irregular flow patterns will be difficult to avoid. An alternative design for health posts in Senegal gave evidence of a more functional layout (see Fig. 43). Here the premises had been adapted and areas for different functions (e.g., waiting, examination, injection) were clearly separated. Where a small maternity unit is attached to a health post this follows the standard design shown in Fig. 44.

FIG. 42. HEALTH POST, SENEGAL: ADAPTED DESIGN

A rural health post (a nursing station combined with a maternal and child health clinic) studied in Algeria offered an example of the need for careful functional programming, if particular sociocultural needs have to be satisfied (see Fig. 45). Islamic culture demands the separation of males and females, a requirement which was solved successfully by the design. But, to provide the same waiting area for each sex is to ignore the differences in utilization rates between males and females (a problem already discussed). On the day of the visit, 3 men and 4 children were counted in the men's waiting section at one point. Meanwhile, 24 women and 22 children shared similar waiting space, which was clearly unsatisfactory. As the women tend to seek advice more often, different ratios should be applied to the allotment of waiting space. This would increase functionality and economy in the use of space. In addition, the consulting room seemed to occupy too large a proportion of the total space available in relation to the functional requirements for consultations.

San Nicolas Rural Medical Centre in Venezuela had also been built according to a type plan. The centre was opened in 1966 after a two-year development period. Six observation beds form an essential part of the facility. The building was designed around a central courtyard (see Fig. 46). The design allowed for sufficient space for all the functions performed at the centre. Internal flexibility was considered to be low, but ample space on the site provided room for extensions.
FIG. 43. ALTERNATIVE DESIGN FOR A HEALTH POST, SENEGAL

FIG. 44. TYPE PLAN FOR RURAL MATERNITY UNIT, SENEGAL
FIG. 45. PLAN OF MUSTAPHA SID LOULI NURSING STATION AND MATERNAL AND CHILD HEALTH CLINIC, ALGERIA

Area: 164 m²
El Cortijo Rural Medical Centre in Venezuela was upgraded to its present function in 1978 after having served as a dispensary for 14 years. The simple design allowed for functional reassignment of duty areas, which has been successful, apart from the placement of the pharmacy (see Fig. 47). It seemed a little too small, especially when two people had to work in it at the same time. At the time of the visit, new diagnostic equipment for taking smears for cancer detection was expected to arrive soon. It could be foreseen that the existing balance between functionally dependent areas would be disturbed unless extra space were made available.

Dispensaries in Venezuela are constructed according to guidelines based on local conditions. Their design is generally of the type shown in Fig. 48. The units served their purpose well, and no problems related to design or layout were recorded.

The rural medical post visited in Cuba was set up in 1964. Its overall functional design elicited only a few comments from the investigators. The uncomplicated arrangement of the various components facilitated easy spatial relationships. However, the space allocated for storage was found to be too small, and the refrigeration equipment had to be moved into a corridor. Furthermore, the design left no space for a cloakroom or toilet facilities for patients.
FIG. 47. EL CORTIJO RURAL MEDICAL CENTRE, VENEZUELA

Consulting Room
Dressings
Control of basic functions
Nurses
General WC
Waiting room
Cleaning
Cold store
General storage, etc.
Pharmacy

Ground floor

Physician's house

Section A-A

Front elevation

Rear elevation
FIG. 48. VILLA COROMOTO DISPENSARY, GUANARE STATE, VENEZUELA

STREET

ENTRANCE

GARDEN

3.00m

GARDEN

2.25m

PORCH

7.00m

TREATMENT
(3.50 x 3.50m)

CONSULTATIONS
(3.50 x 3.50m)

DEMONSTRATION
MATERNITY SECTION
(4.00 x 3.50m)

PHARMACY
(3.50 x 2.50m)

WC
(2.3 x 2.50m)

SCHOOL

8.05m
3. **Construction materials and techniques, and building maintenance**

As regards the actual construction process, the main considerations were: the immediate and long-term costs generated by the types of material, manpower, and technology used; the constraints imposed by certain construction techniques on the design of facilities and, through it, on their functions; and the relationship between proper finish and hygiene. It is vital to ensure that decision-makers in developing countries appreciate the importance of the maintenance of the buildings in question. Adequate programming and budgeting for maintenance would greatly increase the effectiveness and durability of the physical infrastructure.

In general, the construction of health facilities in the study countries was sound. The main structural problems were inadequate foundations in "cotton-soil" terrain and filling-in of expansion joints. Clumsy finish was frequent in several countries; this was due to shortage of skilled manpower, either absolute or relative to the amount of construction undertaken. Intensive experience of the use of prefabricated elements to achieve a higher level of standardization has been gained in Cuba. In earthquake-prone countries, like Venezuela and Algeria, building technology might conform to more exacting standards. However, no obvious problems were seen in the case studies.

Basic building materials were produced in most countries. In a few cases there were problems due to the need to import certain materials, and consequent alterations in the building schedule; the use of inappropriate materials (e.g., certain types of ceiling panelling or bricks of non-standard size); and the difficulty of transporting materials to remote areas within a country.

In all participating countries, establishments at the provincial and regional levels had their own facility maintenance teams, and the progressive decline in maintenance levels from the central to the peripheral units in some countries was quite apparent. Often the teams stationed at major referral centres were also responsible for repair work at interconnected institutions. It is evident that shortages of technically skilled manpower greatly reduced the amount of immediate and preventive maintenance work that could be performed.

In Senegal, an extension to a rural maternity unit was built by a local contractor who had not been supplied with drawings. It was of a single pitched type, with concrete block walls erected on the site. It had not been foreseen that, once the truss wood dried out, contraction would occur and the joints would separate and no longer support the roof. Elsewhere it was noted that materials of low durability had been used for ceilings, e.g., fibre board, which was subject to water penetration and subsequently caused maintenance problems.

Positive lessons can be learnt by studying examples of the building of health posts and health huts. These were usually built by the village community and, in one region, supervision of the construction process was also provided by the health services. Local building techniques have been applied to certain features (e.g., roofs), and locally available materials have been used. Much of the low-quality work seen at the smaller facilities could be explained by an overall lack of supervisory manpower.

In the Sudan, some interesting observations of general relevance for building under extreme climatic conditions were collected. Both the Ibrahim Malik Urban Health Centre and an extension to a rural hospital had been built without due regard to the expansion of the underlying "cotton soil" during the rainy season, and this resulted in an upward movement of beams and walls, with subsequent cracks in the floors and walls. Incorrect protection of the foundations against the humidity of adjacent planted areas, as well as the fact that the expansion joints between the beams had been filled in instead of being covered from outside, contributed still further to the instability of the building.

In Cuba, a similar problem involving expansion joints was observed at the Provincial Clinico-Surgical Hospital, where they had been filled in with mortar on several floors. As the building settled, this produced cracks in some walls. In general, appropriate materials for the construction of units of all levels were used in Cuba. At some facilities — for example, the polyclinic and the provincial-level hospital — the impression of generally sound buildings was marred by the poor workmanship of some finishes and details. At the prefabrication stage, inadequate attention had been paid to the edges of reinforced concrete components, which were sometimes broken. Quite a few holes were also counted in the finish of the panels.
In Algeria, lack of supervision in the more remote areas of the country had caused some serious construction problems, especially in the smaller and middle-level outpatient units. A recently built polyclinic may serve as an example. Hollow clay-brick walls of differing thickness were badly broken, while ceiling panels were cracked or insufficiently fastened and hung down. The steel rods in the reinforced concrete beams were visible, and a door and window jambs were built at different angles. At other facilities (e.g., nursing stations), little care had been taken in fixing tiles to a work-top. Sometimes, cracks caused by the settlement of a building had not been filled in. In some nursing stations, not enough time had been allowed for the wall materials to dry out before they were painted. As a result, the paint flaked off and costly maintenance work had to be carried out. All the inpatient facilities studied were of quite recent origin. At the provincial level hospital, which had been opened just before the visit, paint was already flaking off the walls.

Experience in Zambia points to the need to use locally available materials. At some of the older facilities visited, poor workmanship during the construction stage and shortages in replacement materials (e.g., for roof insulation) caused some operational problems because of water penetration. In several inpatient facilities, skirtings and protective rails were found to be missing. The circulation of materials and beds accordingly led to damage that could have been prevented. Where less complex structures were involved (e.g., in rural health centres) and local expertise and materials had been employed, the problems of construction, workmanship, and maintenance were generally reduced. In addition, overhangs in the supporting pillars had been introduced as a solution to the problem of invasion by white ants.

In Venezuela, the buildings were generally produced with materials available in the country. Additional supplies of cement, floor-tiles, and steel sometimes had to be imported. Construction work was generally of good quality and conformed to the designs. Only a few cracks were noted at some facilities. The finish was usually sufficiently good to minimize maintenance work and expense.

The completed structure could not always be adequately maintained. In one of the district hospitals studied in Venezuela, a resident technician had developed a preventive maintenance scheme which had greatly reduced costs in the upkeep of the hospital, including installations and equipment. At some smaller units, repair work was delayed because of regulations requiring authorization by several levels of government.

In most of the facilities seen in Senegal, maintenance was carried out either by teams stationed at hospitals or by teams provided by local authorities. But lack of finance and manpower allowed only urgent repairs to be made, and the absence of preventive maintenance was quite apparent.

In the Sudan, parts of many of the facilities observed were in need of repainting because of cracks and the aging of surface materials, such as paint or tiles.

In Zambia, shortages of maintenance personnel meant that only urgent repairs could be undertaken and no programme of preventive maintenance was carried out. Problems, however small they were originally, were allowed to grow until repairs were urgently needed. To compound matters, the repairs were frequently carried out with inappropriate substitute materials.

In Algeria, repairs were usually carried out on request at all levels of the health facility network, but there was no indication of a preventive maintenance scheme extending to all facilities.

Cuba had maintenance teams stationed at the larger inpatient units, and monthly checks were carried out according to a programmed schedule. Only a few minor problems were seen (e.g., stains on some sections of roof panels at the provincial hospital). Overall, the well-functioning maintenance system resulted in a high degree of serviceability, and the importance of preventive maintenance schemes was once more underlined.
4. Basic installations and equipment, and their maintenance

This section gives an account of the many difficulties experienced by some countries in ensuring regular water supplies, adequate sewage and refuse disposal systems and energy supply, in addition to the maintenance of lifts, air-conditioning systems, heavy medical equipment and fire protection. The examples given below underline the need for multisectoral cooperation during every phase of the development and operation of medical facilities. They also illustrate the importance of choosing technology that is appropriate to the overall regional infrastructure, to the skills of available technicians, to the natural environment, and to the financial resources at hand, all the while being acceptable and useful in terms of the local culture.

Fresh water supply

The main problems in the area of fresh water supply lay in the adjustment of sources, storage, distribution, and heating to the facility's needs. Interesting expedients were observed, such as the use of solar heating. In difficult areas, staff and users needed instruction in maintaining hygiene with the available water resources. The need for local authorities to assign higher priority to water supplies for health care facilities was also apparent.

Wide disparities in regularity of water supply were found in Senegal. Large urban facilities generally did not have any lack of fresh water as they were usually connected to the public supply. Storage tanks were generally provided for times when there were cuts in the public system. In the more remote rural areas, geographical and financial reasons were responsible for partial failures in supply. In the region visited, the level of the water-table required drilling for 30 m to 50 m or more, and the cost of installing and running mechanical pumps was often prohibitive. On many occasions it was noticed that wells were not adequately covered, which resulted in contamination of the water.

The situation was similar in Sudan, where urban facilities enjoyed a piped water supply from the city network. District and rural hospitals depended on piped water supplies from wells on the premises. Here, there were stoppages in the system whenever electricity cuts prevented the electric pumps from functioning. One of the rural establishments also had access to fresh water from a reservoir. The smaller facilities were supplied either from wells or stand-pipes, but supplies were sometimes irregular.

Urban/rural disparities in fresh water supply were also apparent in Zambia. Climatic conditions affected the rural health centres. Towards the end of the hot and dry season, wells tended to dry up, the situation being worsened by the fact that local villagers turned towards the health centres' wells once their own fresh water sources vanished. The subsequent overutilization of pumps resulted in frequent breakages of the equipment.

Hot water supplies posed problems in almost all the units under study. Lack of maintenance, unobtainability of spare parts for pipes, geysers, etc., and the utilization of inappropriate substitute materials were the causes of frequent failures in hot water systems. At one of the hospitals visited, a commendable solution that evades most of the potential problems of hot water supply was found: namely a simple solar-heated device (see Fig. 49), particularly suited to tropical climates, where supplementary energy is needed only during the cold season. Aided by the orientation of the building, this almost maintenance-free system served the hospital adequately and at low cost.

Urban/rural disparities could also be observed at the units studied in Venezuela, but the problems were relatively minor. Facilities at every level were connected to piped water supplies, and there were storage tanks to counteract irregularities in the public networks. Sometimes, as was observed at one health centre, the storage capacity was not large enough to make up for shortages. Smaller-sized units, which had no storage tanks and depended entirely on the public supply system, suffered the same cuts as the surrounding community. Hot water supplies, when needed, were generally satisfactory. At a district-level hospital, however, one of the two compressors in the boiler-house was out of order for lack of spare parts, creating a potentially critical situation.
The cold/hot circulation to the storage tank is separate from the water supply to the house.

In Algeria, problems of fresh water supply also occurred in the more remote areas. Irregularities of supply were in the process of being remedied at two of the three nursing stations studied. At the health centre and maternal child health clinic, an irregular supply of clean water and a lack of hot water facilities were recorded. The medical officer had to use antiseptic solution instead of soap and hot water to clean his hands.

The Cuban case study revealed no water supply problems.

**Sewage and waste disposal systems**

In Senegal, sewage disposal was a problem in a number of facilities, especially those relying on piped installations, where there were frequent breakages due to the age of the pipes. At one facility an insufficient number of manholes had been provided, and it was therefore difficult to identify the spots where underground pipes were blocked. Some of the facilities at health-centre level had been equipped with flush toilets, but because of their frequent misuse - for example, for the disposal of solid items beyond their capacity - they had had to be closed to avoid further damage. This problem did not arise at rural facilities, where pit latrines were used. At the smaller units, solid waste was either buried on the premises or incinerated. Larger facilities were usually connected to reasonably efficient municipal services.

Khartoum Teaching Hospital in the Sudan had serious problems of sewage disposal because of the age of the existing structure. Blockages also frequently occurred at the district hospital visited. There was an acute shortage of toilet facilities at Ibrahim Malik Urban Health Centre, where only six public toilets and two staff toilets had been installed for a staff of 122 and a daily turnover of 500 patients.

The Zambian facilities studied faced two problems in connection with sewage disposal, i.e., blockages, and the misuse of European-type toilets. At Ndola Central Hospital, blockages sometimes led to overspill on to office floors. The misuse of European-type toilets was similar to that observed in some Senegalese facilities, and it also led to closures. However, such misuse apparently did not occur in urban areas, which suggests that, in designing facilities, behavioural differences between urban and rural dwellers should be taken into account.
A special situation arose at one of the district-level hospitals in Venezuela. It had been built at the foot of a hilly area and, during the rainy season, water from the hills ran into the drainage system, which became overloaded. The result was a flooded corridor.

No problems relating to sewage systems were found in Algeria and Cuba, but it was noticed in Algeria that, in the smaller-sized units, the toilets for patients were locked and used as storage space, which, though much needed, had apparently not been provided for in the design. There was no regular water supply.

**Electricity supply**

In Senegal, every urban facility was connected to an electricity supply. At one provincial hospital, there was a standby generator, but it had been out of order for three years. Variations in voltage were observed at an urban health centre and maternity unit, which were supplied with both 110-V and 220-V current.

The Sudanese authorities provided all their units, down to the level of the rural health centre, with generators for electricity, but dispensaries, dressing-stations, and primary health care units were dependent on help from the community. For example, at the dispensary visited, the sterilizing equipment was connected to a neighbour's electricity supply. Vaccines and sera were likewise kept in a neighbour's refrigerator. Electricity cuts and occasionally inadequate voltage affected almost all units, making it difficult to ensure the necessary cooling of vaccines and other medicines.

All the installations visited in Zambia, with the exception of the rural health centre, enjoyed a more or less regular electricity supply. Hospitals had standby generators for use when there were power cuts, and these were generally in working order.

The picture was different again in Venezuela, where all units were connected to supply lines but had to face frequent power cuts. In addition, few units apart from the larger hospitals had yet been equipped with standby generators. The repercussions of the breakdown of a single component were demonstrated at a health centre offering inpatient services, where the electricity generator was out of order. This in turn affected the water supply, since the storage tank was filled by an electric pump.

The situation in Algeria and Cuba was similar to that in Zambia. With the exception of some small rural units, all facilities were adequately provided with electricity and the supply was regular.

**Ventilation, air-conditioning, and lighting**

Ventilation, air-conditioning, and lighting are in many ways related to design. In more complex buildings (e.g., multistorey hospitals), the attempt to make maximum use of daylight and natural air circulation comes up against problems of finance and space. These arise from the desire to minimize both initial capital expenditure and recurrent expenditure once the facility starts operating. However, as previous sections have shown, a higher initial investment in the building structure may reduce running costs later on. In times when the high cost of energy has a negative effect on many countries' external trade balances, the service sector of any national economy should depend as little as possible on energy imports. The units under study have been evaluated with these considerations in mind. But, to be fair, it must be added that many of the buildings seen were designed and constructed at a time when low energy consumption was not assigned high priority in the architect's brief. The criticisms made here should therefore be taken as indicating the need for a shift in priorities in the future development of health service buildings at all levels of care.

To avoid the duplication of graphic material in the text, the reader is invited to refer back to the paragraphs dealing with sites and design and take a quick glance at the figures. Many of the problems encountered in trying to ensure adequate ventilation and lighting should be evident from the site plans and designs.
Regional and district hospitals. Kaolack and Thiès Regional Hospitals in Senegal consisted of various buildings spread out across sites of adequate size. This layout facilitated air circulation and afforded good opportunities for natural lighting. An air-cooling system had been installed in sections of Kaolack Hospital, but some of the equipment was out of order.

Khartoum Teaching Hospital in the Sudan likewise had few problems regarding the lighting and ventilation of buildings. However, in areas where air-conditioning was needed (e.g., the operating block), difficulties arose from problems in the maintenance of the installations. The other Sudanese hospitals had some air-coolers installed, but at the time of the visit most of them did not function.

A major problem at the multistorey hospital in Ndola, Zambia, was that of providing air-conditioned sections with adequate amounts of treated air. The situation was especially serious in the outpatient department, which had been designed to depend on artificial ventilation and had numerous inner rooms without windows. The air-conditioning system had been out of order for several years and, with heavy patient loads, the microclimate became unbearable in several of the waiting and consultation areas. This hospital was also without a heating system, and patients were said to suffer during the cold season. At the Chipata General Hospital, Eastern Province, Zambia, there were serious air-conditioning problems in the operating theatre and sterilization department. At the time of the visit, the air-conditioning equipment had been working irregularly for two years and during the hot, dry season, operations had to be interrupted because of the heat inside the building. The sterilization equipment produced a lot of steam and heat that were not absorbed by the air-conditioner. At one of the district-level units in Zambia, there was also a serious air-conditioning problem. The equipment had been sent away for repair some time previously, but had not yet come back, and the operating theatre could accordingly function only on a reduced scale. The ventilation of wards was difficult in some sections where a design failure resulted in unacceptable levels of heat. Fig. 50 shows alternative cross-ventilation possibilities in adjacent wards in a one-storey building. It is evident that the initial building costs would have been higher with the alternative design (B) than they were with the one actually used (A). But, considering the obvious problems of equipment and maintenance, the alternative might have represented quite a cost-saving investment in the long run. Combined fanning and heating equipment had been installed in some wards, but much of this was out of order at the time of the study. However, some replacements had recently been received.

FIG. 50. ALTERNATIVE CROSS-VENTILATION POSSIBILITIES IN ADJACENT WARDS
In the 630-bed hospital at Batna, Algeria, there were some air-conditioned sections that did not seem to be functionally necessary. Frequent breakdowns of the system negatively affected the microclimate in the operating theatres, as well as in the intensive care units. The newly erected 240-bed hospital in Algeria faced problems of cooled air supply in some of its outpatient areas. Otherwise the design allowed for the maximum use of natural ventilation.

The Cuban facility studied was air-conditioned in its main areas. Three compressors served a central supply system, which could be switched off in areas where it was not required. In sections of the hospital without access to the central system, individual air-conditioning equipment had been installed. At the time of the visit, there was some difficulty in obtaining spare parts.

Apart from the ward areas, almost all other parts of the standard-plan 200-bed hospitals in Venezuela needed air-conditioning. At one of them, there was found to be an insufficient supply of cooled air in the accident and emergency department, the X-ray areas, and the pharmacy and medical records section. This seems to have been due to unrealistic forecasts, at the time of installation, of the pressure required. The outpatient department did not need to be air-conditioned. However, it was not possible to create an acceptable microclimate there, because the windows were not provided with wire mesh to keep out insects and had to stay shut.

**Rural hospitals.** The rural maternity hospital in Cuba was equipped with an air-conditioning system similar to the one used at the provincial facility discussed above. This system functioned satisfactorily, and there were no problems of ventilation, but some of the wire mesh in the windows needed repair so that the windows could be left open without letting in insects.

In the Sudan, the rural hospitals studied housed between 30 and 50 inpatient beds. In view of their activities, air-conditioning had to be provided, but serious problems with equipment were noticed at one of the units. The small Zambian rural health centre had no ventilation problems, since it had been designed with air vents in the outer walls below the ceiling. As in other Zambian facilities, the absence of wire mesh on the windows sometimes made ventilation difficult. The Venezuelan facility studied depended on artificial ventilation in the minor surgery, the delivery room, the central supply room, and other areas, but the system was out of order when the centre was visited.

**Health centres and health posts.** The polyclinic in Cuba is basically rectangular in shape and has a central courtyard; natural ventilation of this two-storey block is therefore difficult to achieve. Health huts and health posts in Senegal usually had no ventilation problems. One of the health posts, however, had a roof of corrugated zinc, which proved a bad choice from the standpoint of heat insulation. The corrugated asbestos roofs observed at other facilities of this kind seemed to provide a more temperate internal climate. The design and construction of health centres usually took account of the need for all rooms to be well ventilated. The smaller Senegalese facilities were usually simple structures which did not require air-conditioning. However, not all the units had been designed with a view to providing good cross-ventilation, so that the resulting microclimates were unacceptably hot. But a simple design solution was seen at a rural maternity unit, which had been provided with air vents below the roof.

Urban health centres and other large units depend in tropical climates on air-conditioning but the equipment, where it exists, is not always functioning. At the urban health centre in Zambia, a table-fan had once been used to improve the internal microclimate, but it was out of order because it had not been possible to obtain spare parts. Well-oriented buildings that made use of the direction of the prevailing winds and the provision of air vents below the ceilings were characteristic of the smaller Venezuelan health facilities. When facilities or areas within them were overcrowded, as in one health centre, the demand for ventilation could not always be satisfied. In Algeria, too, nursing stations and health centres had to cope with problems of ventilation. At one of the nursing stations, the crowded waiting-room for females could not be ventilated adequately and the atmosphere during the visit was stifling. As has already been pointed out, in places where it is necessary to have separate waiting-rooms for men and women, their relative sizes should take differences in utilization rates into account. This should be helpful in solving ventilation problems. All the facilities were equipped with kerosene stoves which provided sufficient heat during the cold season.
Lifts

Vertical structures may help make the maximum use of valuable urban land. A multistorey building can also reduce the distances to be travelled between functionally related departments, thus economizing on the total number of personnel needed and on labour costs. But to exploit all these advantages of a high-rise structure, reliable and well-maintained lifts are required. It is extremely important that this vital link between the departments of a hospital should be in working order at all times, as otherwise the savings envisaged will be transformed into losses. The findings reported below show how, in some countries, this highly utilized installation has created rather than reduced costs and made facilities functionally inadequate. The costs are human as well as financial. Personnel have had to work harder to keep up the level of services and patients have suffered discomfort from being carried up and down stairs. The implications for the future design of secondary and tertiary level health establishments are outlined in the Annex.

There were several examples of lift failure in the case studies. The lift of a three-storey maternity block at Koolack Hospital had long been out of order. Maintaining lifts was also a problem at Khartoum Teaching Hospital in the Sudan. In Zambia, the problem of maintaining lifts was aggravated by the fact that it was difficult to obtain import licences for the necessary spare parts. One regional hospital, opened in 1976, contained two lifts, which were often out of order. Their repair and maintenance posed serious problems since servicing was not provided by the manufacturer, and there were no skilled persons in the province who could carry it out. As a result, patients had to be carried up and down stairs to reach individual departments, which badly hampered the internal functioning of the hospital. At both the 200-bed hospitals in Venezuela, faulty lifts hampered the movement of patients, staff, and material. At one of them, there was a lift that had never worked since its installation and two others that broke down frequently. At the second hospital, repair work had been carried out but one of the lifts still did not function. At Batna Hospital in Algeria, six lifts had operational problems one month after the completion of the building. The foreign contractors had left after the installation of the lifts, and it proved extremely difficult to obtain spare parts. None of these problems were experienced in Cuba (except during the remodelling of a maternity hospital, when only one elevator was left for all vertical traffic and there was a consequent risk of cross-contamination).

Fire precautions

Fire precautions are an essential consideration in the design of any building. Depending on the complexity of a health facility's structure, the design must include easily accessible fire-escape routes, and fire-fighting equipment should be installed visibly at central points. Once this has been done, the equipment must be well maintained and checked regularly to see that it is in working order. Finally, personnel should be trained to know and use fire-escape routes and equipment. Only if all these requirements are fulfilled will it be possible to evacuate a building safely and with minimum loss of life and materials in case of fire. The case studies show that in some countries there is a real need to review existing fire precautions in health facilities, and to ensure that adequate attention is paid to the matter right from the design stage to the operating stage of all units in the health system.

Provincial and regional hospitals. Fire-escape stairs had been omitted from the design of a newly added extension to a 400-bed hospital in Senegal. Many of the Sudanese facilities were inadequately equipped with fire-fighting materials. In Zambia, fire-hoses were well placed at the end of corridors, extinguishers were readily available, and escape doors were signposted; but at one facility the escape door was found to be locked, probably to keep out intruders. The hospital of this kind visited in Algeria had been designed without external escape staircases and had no plan for emergency evacuation. At the clinico-surgical hospital in Cuba, there was no drill for the evacuation of patients; otherwise, fire precautions were satisfactory as regards installations and equipment. Hydrants were located around the building and systematically positioned in every ward and in other areas. These were backed up by fire extinguishers, and equipment was tested regularly to see that it was in working order. A special workers' brigade had been trained in fire-fighting and hurricane protection.
District and rural hospitals. At one of the Sudanese rural hospitals, the buckets used in cleaning the building could be identified as having once contained sand for fighting fires. In the Zambian district and rural hospitals under study, two contrasting situations were observed. In one of them, hose-reels and buckets of sand were located at corridor walls, easily accessible and ready to be used. At another, some equipment had been provided but the buckets were empty and, although two fire extinguishers had been placed in the building, their working order could not be established as no regular checks had been carried out on them. A failure to provide fire-escape stairs in the design was observed in one of the 200-bed units in Venezuela; in another facility of similar size, emergency stairs had been provided but the fire-escape doors had been locked to prevent burglary. An electrical device for opening the doors in case of emergency could have been installed at the nurses' station, but this had not been done. Installations and equipment (fire detectors, hydrants, and extinguishers) were otherwise well placed and maintained. The 90-bed "health centre" at Villa de Cura, Venezuela, however, had no fire-fighting equipment. Evacuation drill took place once a year at the hospitals. The newly erected 240-bed hospital at Jijel in Algeria had been designed with fire-escape stairs. The 200-bed maternity hospital in Cuba was housed in an adapted building, to which no fire-escape stairs had been added. Otherwise, it had installations similar to those at the regional hospital, as well as a workers' brigade trained to protect the building in the event of fire or natural disaster.

In less complex structures (e.g., health centres and health posts), the design should of course include alternative exits, while regularly checked and overhauled fire extinguishers and full buckets of sand should be available at all times. In more complex outpatient facilities, such as the larger health centres and polyclinics, hydrants and hose-reels are essential for adequate fire protection.

Medical and other equipment

The saddest sections of some of the case-study reports are those on medical and other equipment - a situation that once more underlines the need for appropriate technology. The experience of individual facilities in some of the participating countries varies according to their age, their location in the country, the availability of access routes, and a host of other factors and so cannot be taken as typical. Nevertheless, it is very probable that most other units at similar levels face similar problems in having to cope with scarcity of resources, semi-ignorance on the part of donors, and the impossible task of keeping highly sophisticated equipment in working order.

Provincial and district hospitals. The older Senegalese unit studied had a heavy case-load in the X-ray department. Its 500 milliamperes X-ray machine was functioning but needed repair. Although the machine still worked well, films were sometimes adversely affected by changes in voltage. The department also contained portable X-ray equipment, which was out of order during the visit and deemed to be in need of extensive repairs. The safety of the X-ray technician was at risk. No protective apron was available. The diagnostic equipment in the clinical laboratory was inadequate. The sterilization facilities did not seem adequate either, and the laboratory produced highly unreliable results.

The 1000-bed hospital in the Sudan had quite a few shortcomings in equipment, as could be seen from the case study and the subsequent master plan for the teaching hospital. The inadequacies of the medical equipment led to a whole series of setbacks. In the laboratory, the shortage of diagnostic equipment delayed results. Sometimes outpatients had to be admitted, as results could not be obtained the same day or because medical services were not available at the time of their appointments. Thus the inpatient load increased unnecessarily, while the length of stay was extended for lack of adequate diagnostic equipment. The X-ray apparatus was old and often out of order. Shortages of film and lack of maintenance compounded the problem, causing further increases in the length of stay.

Experience in Zambia also reflects the urban/peripheral dichotomy. The facility situated in a conurbation of about 230,000 inhabitants (1974 figure) gave rise to hardly any comment concerning equipment, whereas quite a few problems in that area were observed at the regional hospital in a smaller city in the country. In the sterilization unit, the autoclave had been out of order for two years for lack of spare parts. A completely new autoclave had been donated, but was accompanied by neither instructions nor funds for its installation. Hot water boilers were being used instead at the time of the study. The air-conditioning equipment had not functioned adequately for two years, and it could not absorb the steam of the existing sterilizer. This meant that operations had to be interrupted, particularly
during the hot, dry season. In addition, the operating lamps no longer functioned in one of the theatres, which meant that it could hardly be used. The equipment situation in the laundry was also characterized by breakdowns. Two out of four washing machines, the spin-dryer, two tumble-dryers, and one out of three roller presses were not working when the facility was studied. The cold-storage room in the kitchen did not function either, as part of the machinery had been sent away for repair. Food boilers were also affected, with broken components rendering two out of five inoperable. In the physical rehabilitation department, some imported wheelchairs were seen but most of them could not be used as it was impossible to obtain spares for broken parts. It seemed that the prevailing lack of adequate maintenance and the impossibility of securing it had already determined the fate of some excellent dental and X-ray equipment, which appeared to be in need of a general overhaul. Many of the problems experienced could be attributed to a lack of coordination between donors, administrators, and users, and to the absence of service networks and maintenance personnel. The situation might be greatly improved if the attention of donors could be drawn to the need for the coordination and coverage of recurring expenditure on donated equipment.

At the 630-bed facility in Algeria, which had been opened in 1979, only a few equipment-related problems were noted. There was, for example, a central sterilization unit that was not operating adequately, and the services of two autoclaves on the surgical floor and two in the maternity department had to be called upon. The food delivery system was also affected by an equipment problem. Electrically heated trolleys had been provided to ensure the temperature of food while it was being conveyed from the central kitchen to the wards. However, the connecting cables had not been delivered with the trolleys, and the food had to be heated in the wards. These examples show once again the relative ease with which a highly complex internal hospital system can be upset by the absence of just one item. In this particular case, delays in the organization of food distribution are likely to affect the daily diagnostic and therapeutic routine.

Experience in Zambia may serve to illustrate problems of equipment in the poorest market-economy countries. X-ray machines in need of repair and broken equipment in kitchen and laundry in the general absence of spare parts were typical features of one of the district hospitals. Sterilizing equipment gave rise to maintenance problems at another establishment. The equipment at the rural hospital was in working order, though a refrigerator run on paraffin could not be used, as it was impossible to obtain fuel.

In the district-level units in Venezuela, experience with medical and other equipment was similar. A high proportion of equipment had either never worked since it had been installed or had been out of order for a long time. The non-functioning equipment included a steam sterilizer, an electromyograph, an ultrasonic machine, a duostat, and a flame photometer. Most of the spare parts had to be ordered from North America, which meant long delays between ordering and delivery. Occasionally the importing firms had gone bankrupt and replacements could no longer be obtained.

In the Cuban hospital, the equipment was recent and its unquestionably good condition did not call for comment. Provision had been made for regular maintenance and repair work.

Health centres and health posts. The more complex units, such as the polyclinics in Algeria and Cuba, contained well-functioning equipment, as might be expected in such relatively new facilities. In Cuba, sufficient technical manpower and a preventive maintenance scheme contributed to the satisfactory condition of medical and other equipment. Experience in health centres, dispensaries, and health posts again varied from country to country. In some instances, the familiar urban/rural disparities within countries were once more in evidence. It was nevertheless observed in the Sudan that the X-ray equipment in a health centre serving a large conurbation could not be adequately maintained, while in smaller units there were problems with refrigerators and sterilizing equipment. In Venezuela difficulties with incinerators were experienced at the smaller units. These had been delivered and installed by a foreign firm, but had never functioned, as an essential component was missing. Meanwhile the firm had gone bankrupt, and the necessary part could not be procured.
Means of communication

Telephones or two-way radios are essential to the functioning of facilities of various types and sizes within a regional network. Without adequate means of communication, the reciprocal referral system between units may easily become unbalanced, with some facilities experiencing excess demand for services and space, while others are idle.

In all the countries studied, the larger institutions were equipped with telephones, but the availability of means of communication for both public and internal use varied widely. In Senegal more installations were required. In Sudan, connections through the public network were sometimes difficult to establish, while in Zambia users at the regional hospital in the Eastern Province could only make phone calls to two neighbouring cities, and district headquarters could only be reached by telegram. The Cuban facility had been equipped with public telephones, and wards and other areas were connected to a push-button call system.

At the level of the district and rural hospital, there were wider discrepancies between countries. The small Senegalese rural hospital and maternity unit had no telephone or other means of communication. The telephones at the Sudanese district hospital were out of order at the time of the visit, and messages from the rural hospitals were sent with drivers. In Zambia, one of the district hospitals had an efficient telephone link with the outside world, but only four extensions had been provided internally. The mission-run district facility had good internal connections, but external communication was limited to radio contact with the mission's embassy twice a week. The third district unit was connected by an efficient internal and external network to major towns in the vicinity, but the subordinate referral units in these towns could not be reached by telephone. The Zambian rural hospital was also cut off from the communication network. Telephone systems had been installed in all Venezuelan hospitals and seem to have been trouble-free, except for a failure in one of the health centres. The installations seen in the district and rural establishments in Cuba also functioned satisfactorily. The smaller Algerian inpatient health centres and nursing stations also had access to an adequate telephone network.

Disparities between urban health centres and rural health posts in the resources allocated for telephones were apparent almost everywhere, though not in the case of the polyclinic and health post in Cuba. In Senegal, none of the village facilities visited had access to either a telephone or a two-way radio. The equivalent Sudanese units depended on the postal system or drivers to transmit messages. The urban health centre visited in Zambia had a telephone installation, but connections were sometimes difficult to establish. There was no telephone at the rural medical centre in Venezuela, which depended on a police radio system that could send but not receive messages. In Algeria, health workers in the smaller facilities used the telephones of village authorities to communicate with health institutions at higher levels.
CONCLUSIONS

The case studies demonstrate, first of all, the importance of national policies for health and for investment in physical infrastructure. The clear formulation of such policies should provide a sound basis for the planning of health facilities. Through pertinent laws and regulations, they should allocate responsibilities and create the structures necessary for the planning and development of health care facilities.

The planning processes in the health and construction sectors are the next factor to be considered, since they serve to determine the number and types of health facilities to be built and the types of technology they should incorporate.

The case studies include interesting examples of low-cost technology, which may be taken into account by planners in developing countries. For example, the construction of health huts (cases), as in Senegal, is within the means of rural communities and offers the possibility of effective coverage if adequate support can be provided to the community health workers manning them. Another promising approach is the use of a combination of advanced technology from abroad and local traditional materials and know-how, perhaps in the context of genuine south-north cooperation. An example of this is the mission hospital studied in Zambia (Mpongwe Hospital in Copperbelt Province).

The findings summarized here are bound up with the vital question of the kinds of health care system that countries have and those they are now endeavouring to develop in order to achieve the goal of "Health for all by the year 2000". Analysis of the problems found in the studies led very often to the conclusion that their causes lay in the nature of the health care system rather than in the field of architecture alone. Among other things, this indicates the need for a directing and coordinating agency for the reorientation and balanced development of the health system, including coordination of the planning of health care facilities. This is particularly urgent in those countries where the system is fragmented among a variety of institutions and financial sources and, in fact, subject to many-sided decision-making.

Analysis of the case studies also suggests that there is a risk that some developing countries may set themselves overambitious targets for the construction of facilities. It seems tempting, given the money or the credit, quickly to dot the country with the facilities that the people always demanded and never had. It is also easy to equate construction with development and to assume that the distribution of facilities and equipment will in itself lead to equity and to "Health for all". In fact, it may be preferable to phase the growth of the physical infrastructure for health care in a way that will allow for the development of the necessary national teams of personnel skilled in design, building, and maintenance. This should facilitate the planned coordination and synchronization of building progress with the procurement of equipment and supplies and the training of staff for each unit. Phasing should be coupled with evaluation of the facilities as they begin to operate; in this way errors may be corrected and each new generation of facilities be made more appropriate. Step-by-step expansion offers an opportunity for periodic reviews of the health system itself, permitting better adaptation of area-based groups of health care units to the geographical and demographic conditions of each area. In addition, the construction of redundant or ill-adapted individual facilities, or even of entire categories of wrongly conceived facilities, may be avoided. A final advantage is that there are wider possibilities of coordinating health plans with the plans of other sectors. For example, a road that is planned to be ready in five years' time may eliminate the need for some facilities; on the other hand, it may be found that it is planned to build a large industrial or residential centre next to a village where at present a small health post seems to be sufficient.

The entire process of adapting and reorienting the health care system - and within it, the network of facilities - should be greatly enhanced if decision-making and programming are decentralised and the population and health staff concerned are involved. This is, in fact, the official policy of the participating countries. However, decentralization and participation should be achieved within the framework of national policy and the overall design of the health system. They thus require the simultaneous strengthening of planning, norm-setting, and evaluation capacity at both the periphery and the centre.
The possible advantages of phased development should not exclude careful consideration of bold alternatives. The largely successful application of industrialized construction methods in Cuba is a good example.

The case studies have, in addition, brought out some features of system design — including the related physical infrastructure — at the local or district level that originated in the countries concerned and are of great potential value for the practical implementation of the concept of primary health care. Examples are: the "health area" (secteur sanitaire), the basic cell of the Algerian health services; the Cuban polyclinic, which is responsible for community and ambulatory medicine for a defined population; the rural health care complex of the Sudan; the health centre and health hut combination in Senegal; and the multiservice modules for health care, environmental hygiene, education, and social welfare now being built in the mushrooming urban and periurban barrios of Venezuela.

All these are based on the principle of the duty of each local subsystem to reach out to the entire population of the area it is intended to serve. This has crucial implications for the planning of the respective health care facilities, e.g., in weighing the more passive components, such as wards, against the more active ones requiring transport, communications, community meeting-rooms, and so on.

At this level, the case studies demonstrate the advantages of integrating plans for building health care facilities into more comprehensive regional plans dealing with the entire infrastructure of the communal services for a given area. At least one of the participating countries has shown that this is feasible.

As regards the functional programming of the facilities, it is recommended that, as far as the scarcity of specialized personnel in developing countries permits, all the relevant disciplines should be involved: architecture, health planning, engineering, management, clinical medicine, nursing, economics, and others, depending on the scope of the programming to be done. Manuals on functional programming and other stages in the planning of health facilities could usefully support the multidisciplinary and multisectoral teams, provided that they are adapted to the national situation.

Concerning the stage of site selection, the main point to emerge is the need to assess soil conditions (including flood control and drainage requirements), geographical accessibility, and proximity to water supply, sewerage, and electricity systems.

In connection with the stage of project design, the case studies draw useful conclusions (illustrated in Part Two) about the importance of planning the shape, size, and layout of the facilities in such a way as to ensure the maximum flexibility and rationality in functional relationships and circulation that existing economic constraints permit. Designs based on modules offer the greatest scope for adapting to the functional changes demanded of a health unit throughout its lifetime. In deciding on the location of departments, it must be borne in mind that the distances between functionally interdependent areas should be as short as possible and the traffic flows of staff, patients, and visitors should interfere with each other as little as possible. Circulation routes, particularly in surgical and sterilization departments, should clearly separate septic from aseptic traffic of persons and materials, in order to reduce the risk of hospital infection. The design should also allow for the maximum use of natural light and ventilation.

One of the problems most frequently seen is that of utilization of space; some areas are too crowded, some are underused, some are used for purposes that are different from those for which they were planned. One of the lessons learnt from analysis of the case studies, is, as suggested earlier, that such problems may not stem from the actual architectural design, but from earlier phases of planning and programming, or from the design of the health system itself. For example, underutilization may be due to a lack of staff or of equipment or drugs; the lack of staff may itself be due to a lack of accommodation (in rural areas) or to questions of remuneration or training. Overcrowding may be due to the presence of less skilled staff who have to work close to a supervisor; many times it is due to professional staff cramming their activities into only a few hours each day. Reprogramming of activities and other management measures may alleviate such problems of space.
As regards the building stage, it seems appropriate in many cases to use local materials and skills as much as possible. There should be adequate site supervision throughout the construction period: this will prevent more costly repair work later on. A very important requirement in the study countries is an improvement in building skills: many more technicians, masons, and other workers should be trained, thus avoiding faulty work and possible damage to various parts of the structure and its finish.

Basic installations present a delicate problem in many facilities. Measures that might alleviate them, where appropriate, include: the provision of standby electricity generators; frequent checking of electrical wiring in climates conducive to the premature deterioration of insulating materials; careful assessment of the capacity of air-conditioning installations in relation to the cooling needs of the areas they are to serve. The risk of problems of this nature should be borne in mind at the design stage and when choosing the site. For example, low buildings with ramps will reduce the need for lifts. Siting, overall shape, orientation, design, materials, and landscaping should be such as to take maximum advantage of opportunities for natural ventilation and lighting, sound-proofing, and exposure or protection (as the case may be) in respect of sunlight and prevailing winds.

The fact that adequate fire precautions are an absolute requirement for health buildings should be impressed on those responsible for their planning. Examples of very serious omissions in this respect are given in Part Two.

Communication equipment should be provided in large facilities and should also be available in or very near the smaller local facilities of the rural hospital, health centre, or subcentre type.

As regards heavy medical equipment, the conclusion to be drawn from the case studies is that it should be carefully selected by the multidisciplinary team responsible for functional programming. Criteria include: the actual need for the equipment in the facility; the availability of training for those who will operate and maintain it; and reasonable certainty of a dependable supply of spare parts. Countries should try to become self-reliant as regards the production of hospital furniture and types of equipment that are within their industrial capability.

In several countries, the management and operation of the facilities and their installation and equipment call for better orientation and more guidance, supervision, and training. Maintenance is a vital requirement with an enormous potential impact on the functional effectiveness of health care units, on their running costs, and on the reinvestment needed for replacing equipment and repairing buildings. Maintenance should be considered as a continuous process that has to be programmed and provided for in the regular budget at all levels of the health care services.

Training and reorientation of personnel for the planning of health care facilities

In the economically less developed countries a decisive obstacle to progress in planning health care facilities is the great shortage of suitably qualified professional staff. Moreover, some of those with the requisite training and experience are not readily available for building up a useful pool of experience that will increase national self-reliance. It is of paramount importance that personnel should be oriented towards the goal of health for all the people and have an understanding of primary health care. It is also necessary to develop attitudes that will permit collaboration between the traditional and modern sectors involved, i.e., between the community and the professionals. An approach that is being implemented in several parts of the world is the development of training centres guided, by and large, by principles of the type enunciated here. It is anticipated that these centres will accumulate and develop national experience and eventually complement each other in a global network.

Follow-up, evaluation, and information

There is a widespread need to establish machinery for the follow-up and evaluation of existing health care buildings and equipment.
There are several ways of collecting the necessary information. A national inventory of facilities and heavy equipment, periodically updated by means of surveys, visits, or reports, should provide, for the entire country, basic information on the number and types of facilities and their age, present condition, and main problems. In-depth studies of limited samples of facilities, such as those carried out in the case-study project discussed here, have proved to be a useful method for the evaluation of programmes, layouts, materials, construction, basic installations, and equipment. The basic criteria employed are: justification of the facility, functional adequacy, satisfaction of users, economic efficiency, and flexibility. These case studies are also useful as educational matter for the specialized staff and provide reference and background material for the improvement of existing practice.

A complementary source of information is the accumulated experience of other developing and developed countries. The national training centres mentioned above could pool and disseminate the information at the national level. In the context of technical cooperation among developing countries, regional information centres could serve groups of countries with similar backgrounds. At the global level, WHO, the International Hospital Federation, the International Union of Architects, and other organizations could consider how to strengthen their information systems, and particularly how to make the relevant information easily accessible to all.
The case studies have brought out the need for the evaluation of health facilities as part of a continuous process of health programme evaluation. WHO has repeatedly stressed the importance of such evaluation and issued appropriate guiding principles. The purpose of evaluation is seen as "a systematic way of learning from experience and using the lessons learned to improve current activities and promote better planning by careful selection of alternatives for future action". In the light of the case studies, the evaluation of health facilities must be further refined as part of general health programme evaluation. This annex therefore seeks to identify the subjects of evaluation, together with the institutions and persons to be involved, and to present simple methods for evaluating the functional adequacy of health facilities.

**What should be evaluated?**

The main factors to be evaluated in a health care facility, as indicated in the introduction to the case studies, are briefly recapitulated below:

- its justification: should a facility of this type have been built in that particular place?
- its functional adequacy and effectiveness, both in providing shelter in a general sense and in facilitating the technical functions of health care
- its economic efficiency
- its flexibility.

In addition, there are five factors that determine how facilities comply with these four fundamental criteria; these should also be evaluated. They are:

- the functions assigned to the units housed in the facilities
- the process of planning the facilities
- the cost, financing, and durability of the facilities
- architectural and related technological factors
- the operation and maintenance of the buildings and equipment.

**When should the evaluation be carried out?**

Facilities can and should - if possible - be evaluated at the various stages of the planning process. At the end of this process, evaluation is a necessary step in the commissioning of the facility. Functioning facilities should be periodically evaluated, not only for guidance in management and maintenance, but also as a source of experience that may be utilized in planning new establishments, in training personnel, and in ascertaining research needs.

**Who should carry out the evaluation?**

The technical aspects of evaluation should preferably be entrusted to a multidisciplinary and multisectoral team of the same type as the team that should plan the facilities. Similarly, there should be the same kind of involvement of the users - i.e., the community and the health staff - in the evaluation process as in the planning process.

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Who will use the evaluation?

Evaluation activities and reports would be worthless if they were not used by the right people at the right time. In this instance, the right people are:

- national policy-makers who decide on health policies and plans, on health care systems, and on public works and their financing

- representatives of the community and of its mass organizations

- the administrators concerned in the health and construction sectors, and in other relevant sectors such as social insurance, industry, and communications

- provincial and local governments

- interested groups, such as building enterprises, professional associations, and patients' associations

- the health care facility planners themselves

- persons undergoing training in health care facility planning or engaged in related research.

For an evaluation to be useful, the main requisites are: clarity of presentation and of the main conclusions; timeliness in relation to decision-making cycles and public interest; and the inclusion of concrete, practical options for solving the problems identified.

How should the evaluation be carried out?¹

Different methods should be used according to the stage at which the evaluation is done, its purpose, and its scope.

For example, for the evaluation of a large number of functioning facilities in a developing country, it may suffice to make an inventory based on a questionnaire covering such items as: type of facility, location, date of construction, functions, departments, built area, main problems, etc.

For a detailed evaluation of a selected sample of functioning facilities, the methods followed in the case studies might be used. These have the merit of having been tested under field conditions in six countries. Using them, professional teams of three or four investigators each were able to observe and analyse 6-10 facilities in periods of 6-8 weeks, part of their task being to set the groups of facilities in their national and regional contexts. The main features of the method will now be described.

Collection of data. A check-list was used to guide the observations and their organization into country reports. The main headings of this check-list are:

- Situation description:

  - national: general background of country: population, geography, government, economy, health situation

  - health care: policy, institutions, resources, programmes, structures, and processes for planning health care facilities

  - organization for programming, designing, and building facilities, and technical and economic factors involved.

- regional and local: general context

  health situation
  health care
  local physical factors relevant to the building of facilities
  (climate, terrain, infrastructurcr, etc.)

- Description of the facilities:

  . description of the groups of facilities and the local health care systems:
    map of catchment areas and facilities
    the communities
    health care functions
    administration, resources, activities, and coverage

  . description of each individual facility:
    identification
    history
    site and surroundings
    general shape
    design
    construction materials and techniques
    basic installations
    equipment and furniture
    utilization of space
    flows of persons and materials
    present condition and maintenance

  . description of selected departments (for larger facilities).

The main sources of information were:

- the study of relevant publications and other existing documents, including maps,
  facility plans, and statistical tables

- interviews with national officers in the Ministries of Health and Construction, local
  government officers, directors and other staff of the facilities, community members
  and others

- direct observation of the facilities and their environment (this was the main source
  of information).

In observing and recording the facts found during the visits to the facilities, certain
tools were found useful, namely:

- sketches drawn in the facilities

- photographs

- the measurement of flows of persons in terms of direction and volume, which shed light
  on the actual organization of work and problems of circulation (for an example of a
  flow diagram, see Fig. 32 on page 71)

- the study of activities, which made it possible to obtain data on the use of space in
  the different units, architectural and constructional aspects, the equipment available
  for the technical functions being carried out, and quality of care (for examples of
  the format used and of observations on two units, see the end of this Annex)

- room questionnaires, which aimed at securing detailed information on the uses and
  functional adequacy of available space; these were seldom filled out.
Analysis of the data. This consisted in the organization, selection, and interpretation of the facts in such a way as to arrive at an evaluation of the facilities in terms of the criteria set out above under the heading "What should be evaluated?".

The general pattern of the analysis was as follows:

- From the architectural standpoint:
  
  . Main issues and critical areas identified in the study:
    
    (i) issues connected with the health care system
    (ii) issues outside the health care system
    (iii) issues relating to the design, the buildings, the installations, the equipment, and technical supervision during construction
    (iv) issues relating to the operation and maintenance of the buildings.
  
  . Main requirements (as observed in the facility)
    
    (i) functional adequacy
    (ii) affordable cost
    (iii) flexibility.
  
  . Conditions for the fulfilment of the main requirements:
    
    (i) training
    (ii) studies
    (iii) cooperation within the health sector, among relevant sectors, and with the community, the health staff, and local government.

- From the standpoint of the health care system:

  . Main issues and critical areas:
    
    (i) in general: orientation, balance, and integration of the system
    (ii) in the environment of the system: needs, demands, etc.
    (iii) in the inputs to the system: resources
    (iv) in the components of the system: public and private; levels; etc.
    (v) in the regulation of the system: planning, management, etc.
    (vi) in the outputs and outcomes of the system: coverage, health effects.

  . Main constraints to the adjustment of the system: policy, technical, administrative, economic, social, or political constraints.

From the analysis of the data, the evaluation process went on to identify certain options for improving the situation found in the facilities and in the relevant aspects of the system. These options were presented as such - not as recommendations - to the national decision-makers. In several of the participating countries, high-level workshops were held, at which the options were discussed and the overall reports were subject to scrutiny and approval by consensus.
Examples of short observations in a rural hospital

Example 1

Name of unit XX Date Observer Y

Activity Outpatient consultations: done by Medical Assistant Mr N. N.

Times: start of observation 10.00h; end 10.15h; duration 15 min

No. of activity units produced 12; time per unit 1.2 min. idle time 0

Characteristics of patients (age, sex, social): 5 men, 2 women, 4 children, 1 infant

Procedures, tasks:

- Admission of patients into room: Continuous queue: between 1 and 10 people in the room at a time, others waiting close to the door. A student nurse regulates admission.

- Physical examination: Only the two women were examined on a couch, behind a curtain ("special patients"); the rest were not examined or cursorily examined while standing beside the medical assistant's desk.

- History-taking: Brief

- Recording: None

- Prescribing: All patients received a prescription written on blank paper.

The room:

- Size: 4 x 3 x 3.5 m

- Lighting and ventilation: One small window, open; one electric bulb, lighted

- Hygiene: Fair

Furniture and equipment: One table, one chair, one couch, no wash-hand basin, a ceiling fan (working), one stethoscope

Complementary explanations: The medical assistant says he sees about 85 patients per day.
Example 2

<table>
<thead>
<tr>
<th>Name of unit</th>
<th>XX</th>
<th>Date</th>
<th>Observer</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>Injections</td>
<td>done by one nurse and nurse students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Times: start of observation</td>
<td>9.34</td>
<td>end 9.58</td>
<td>duration 24 min</td>
<td></td>
</tr>
<tr>
<td>No. of activity units produced</td>
<td>8</td>
<td>time per unit 1.2 min; idle time 14 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics of patients (age, sex, social): Various ages, both sexes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Procedures, tasks:

- Admission of patients into room: Free

- Techniques:
  
  (a) Cleansing of skin: cotton soaked in boiled water

  (b) Handling of syringes and needles: needles and syringes kept in an open sterilizer with hot water (not boiling); the same water is used to rinse the syringe after injecting (with hands); then the syringe is thrown inside the sterilizer; any needle can be picked up for the next injection

  (c) Injecting: gluteal injection was done in a small child in standing position

  (d) Handling of injectables: no remarks

  (e) Washing of hands between patients: not done

- Recording: None

- Instructions to patients: No remarks

The room:

- Size: 3 x 4 x 3.50 m

- Lighting and ventilation: Adequate

- Hygiene: Fair

Furniture and equipment: Two tables, two banks, one couch with curtain, wash-hand basin in neighbouring room (seldom used), electric sterilizer (problem of low voltage)

Complementary explanations: Dressers have only half an hour for breakfast instead of the usual one hour.