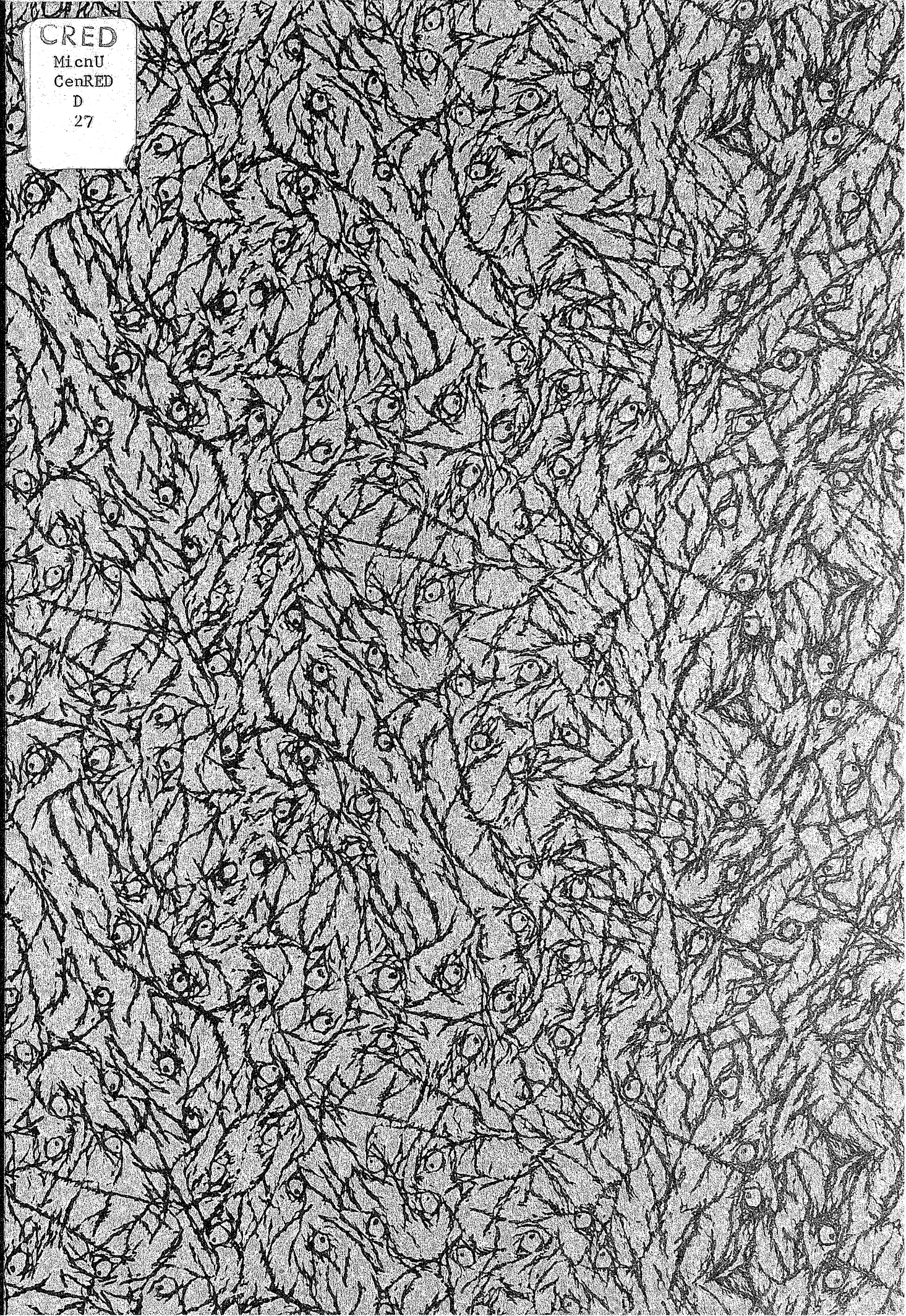
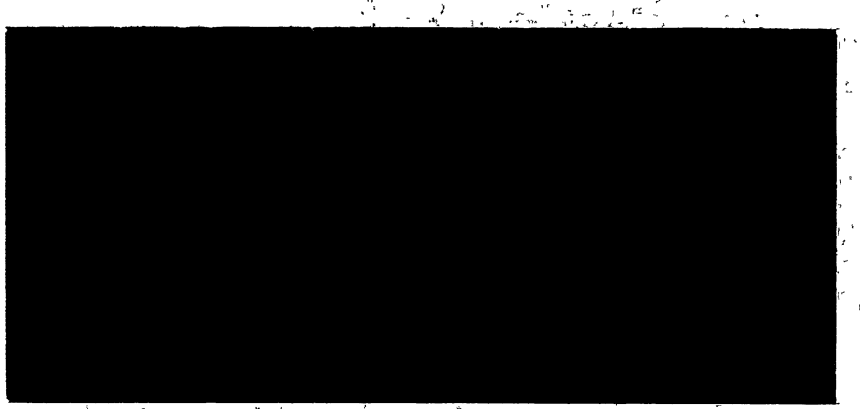


Center for Research on Economic Development

University of Michigan
Ann Arbor, Michigan 48104



Planning Public Health Expenditures
With Special Reference to Morocco

by

Robin Barlow

27

Discussion Paper 27
April 1972

This study was undertaken in fulfillment of task order No. 3, to A.I.D. Contract No. afr-675. This paper has also been translated into French (77 pp.).

Center for Research on Economic Development
University of Michigan
Ann Arbor, Michigan 48108

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter I

INTRODUCTION AND SUMMARY

This paper attempts to develop some techniques which may be useful in health planning. Ministries of Public Health are allotted substantial sums of money in the budgetary process, and it is obviously desirable to determine how these funds might be spent to best advantage. Should less emphasis be placed on curative activities and more on the prevention of disease? Should less effort be devoted towards the training of highly skilled physicians and more to the development of a paramedical corps? These and other health planning questions are explored in the context of the public health system which has evolved in Morocco.[1]

In the next chapter some facts and figures on health and health care in Morocco are presented as background for the later discussion of planning principles. The health conditions in the country are examined through the medium of the available statistics on mortality and morbidity. After some remarks on private health care, the system of public health care in Morocco is described, with respect to its organizational structure, its personnel, and its financing.

In Chapter III two main approaches towards health planning are discussed. The first of these can be termed the method of input norms. It forms the basis for many of the spending decisions made in the Moroccan Ministry of Public Health, and is widely used in other countries. The

---

[1]Many of the data presented in this paper were collected by the author during a stay in Morocco which extended from September 1971 to May 1972. Thanks are hereby expressed to personnel of the Plan Division and the Ministry of Public Health in Rabat for assistance received during this period, and to Stanley K. Smith of the Economic Demography Program, University of Michigan, for subsequent assistance with data-processing.

method consists of specifying norms for health inputs, like a certain number of hospital beds per capita, and inputs are then supposed to be purchased in accordance with the norms. The method has several serious shortcomings, and these are discussed. A plea is made for the alternative approach of output maximization, according to which inputs are purchased in order to maximize certain measures of the health sector's ultimate output. Four types of output are identified--the reduction of mortality, the reduction of morbidity, economic improvement, and palliative care.

In Chapter IV a verbal model of a public health system is developed, a model which identifies the relationships which must be known if spending decisions are to succeed in maximizing output. An attempt is then made in Chapter V to show that the model is not merely a theoretical exercise, but is potentially useful as a planning instrument. Two key relationships are selected--the respective contributions of general hospitals and mass vaccination programs towards the objective of reducing mortality--and methods of making quantitative estimates of these relationships are discussed. Some methods are tried, although more for illustrative purposes than with the intention of arriving at definitive findings. A comparison of the numbers of lives saved by the two types of program with their respective costs suggests that the preventive activities (the mass vaccinations) are in general a much cheaper way of saving lives than are the curative activities (the general hospitals).

The paper closes with an appendix which presents the results of a survey of hospital patient records conducted by the author. These records contain both medical and demographic information, and constitute a valuable source of data which other researchers may wish to investigate.

A major concern of this paper is to bring to the attention of public

health officials certain modes of thinking about budgetary problems. Emphasis is placed on the need to consider all feasible options before making budgetary decisions, and on the need to forego some appealing programs for the sake of achieving the best results possible with the limited resources available. Some of these thoughts are foreign to the physicians who almost invariably occupy the top positions in health ministries. They are not always accustomed to thinking in "trade-off" terms--the notion, for example, that an established program which is known to save lives should perhaps be abandoned because the resources absorbed by the program could save more lives if employed in some other way. But rational planning cannot proceed until this kind of thinking prevails.

A last point which should be stressed is that the input-output estimates made in this study are not intended to be definitive. The intention is to suggest some methodologies, and to show that with further research the methodologies could be readily implemented in practice. And the further research, if this is thought worthwhile, should obviously involve representatives from more than a single discipline. Physicians, as well as economists and others, should participate.

Chapter II

HEALTH AND HEALTH CARE IN MOROCCO

This chapter outlines the health conditions prevailing in Morocco and describes the system of health care which attempts to improve those conditions. The health conditions are examined through the medium of the available statistics on mortality and morbidity, and the health care system is divided into its private and public segments for the purposes of our discussion here.

MORTALITY AND MORBIDITY

Comprehensive and regular registration of deaths does not yet exist in Morocco, except in the larger towns, and so it is difficult to obtain an accurate, detailed, and up-to-date picture of mortality conditions. A nationwide sample survey conducted in 1962 reported a crude death rate of 19 per 1,000, a figure typical for countries at Morocco's level of economic development.[1] The rate was found to vary in the expected manner between the richer and poorer areas of the country as follows:

Urban population	15 per 1,000
Rural: plains and foothills	18 per 1,000
Rural: deserts and mountains	24 per 1,000

Causes of death are reported in detail for the larger towns, and a breakdown of these urban deaths by cause and age for the years 1960-62 is presented in Table 1. Well over half of the total number of deaths occurred among infants and young children under the age of five. The leading causes of these deaths, or at least those that were identified with some precision, were gastro-enteritis and a variety of infective and parasitic diseases.

---

[1] Plan and Statistics Division, Résultats de l'Enquête à objectifs multiples, 1961-63, p. 75.

Table 1

Percentage Distribution of Deaths by Cause and Age
for 28 Moroccan Towns, 1960-62

Cause of Death	Age of Decedent						
	Under 1 yr.	1-4	5-14	15-44	45-64	65 & over	All ages[1]
Tuberculosis	0.3	0.9	0.5	3.6	1.7	0.5	7.5
Other infective and parasitic diseases	2.4	3.4	0.7	0.8	0.3	0.1	7.7
Neoplasms	*	0.1	0.1	1.0	1.3	0.5	3.0
Metabolic, endocrine, and blood diseases	0.2	1.3	0.1	0.4	0.4	0.3	2.7
Diseases of the nervous system and sense organs	0.4	0.4	0.3	0.5	0.6	0.4	2.6
Diseases of the circulatory system	0.1	0.1	0.3	1.4	2.1	1.5	5.5
Pneumonia	3.9	3.3	0.5	0.2	0.3	0.3	8.5
Other diseases of the respiratory system	1.0	0.9	0.1	0.4	0.4	0.3	3.1
Gastro-enteritis (incl. diarrhea of the newborn)	7.0	4.1	0.2	0.1	0.1	0.1	11.6
Other diseases of the digestive system	0.3	0.3	0.2	1.2	1.0	0.4	3.4
Diseases of the genito-urinary system	*	0.2	0.1	0.4	0.5	0.3	1.5
Congenital anomalies & certain diseases of early infancy	12.9	0.1	*	*	*	*	13.0
Complications of pregnancy, childbirth, & puerperium	*	*	*	0.9	*	*	0.9
Other diseases	3.4	2.7	0.3	0.9	1.1	1.2	9.6
Senility	*	*	*	*	0.4	6.1	6.5
Accidents and violence	0.2	0.5	0.7	2.2	0.7	0.4	4.7
Ill-defined or unknown causes	2.1	2.5	0.5	1.0	1.1	0.7	7.9
Total	34.2	20.8	4.6	15.0	12.0	13.1	100.0

*Less than 0.05 per cent.

[1]Including cases where age was not ascertained.

Source: Ministry of Public Health, Bulletin de l'Institut d'Hygiène: La Statistique des décès et de leurs causes en milieu urbain au Maroc, 1960 à 1962 (special edition, 1965).

Among older persons, the infective and parasitic diseases, particularly tuberculosis, were also significant as a cause of death.

Data on morbidity are, as usual, even harder to come by than those on mortality, and a variety of indirect or partial sources must be resorted to. Some clues about the prevalence of certain diseases are provided by the causes-of-death data shown in Table 1. Next, some fourteen communicable diseases are subject to compulsory registration, and Table 2 shows the numbers of cases reported for these diseases in 1971. According to the official records, only two of the diseases (measles and conjunctivitis) had a significant impact in the sense of affecting more than one-half of one per cent of the total population (which numbered about 16 millions in 1971). There are reasons for believing, however, that many communicable cases went unreported.[1]

Other indications about morbidity are provided by diagnostic records of hospital patients. A sampling from these records, conducted by the present author and reported in detail in an appendix below, points to the importance of the diagnostic categories "infective and parasitic diseases" and "accidents, poisonings, and violence." These two categories accounted for 45 per cent of all the nonmaternity cases sampled. Finally, a picture of morbidity in Morocco can be pieced together from qualitative impressions recorded here and there--in conversations with informed physicians, in newspaper stories, government publications, and so forth. These sources tend to stress the wide prevalence of tuberculosis, but also indicate some causes of ill-health or debility which for one reason or another are not reflected in the statistical material mentioned above. Included here would

---

[1]For an analysis of this problem, see Stanislas Wellisz, "Observations sur les Problèmes de la Planification du Secteur de la Santé Publique au Maroc" (unpublished document, Plan and Economic Studies Division), pp. 11-14.

Table 2

Diseases Subject to Compulsory Reporting in Morocco

Number of Cases reported, 1971

Typhoid and paratyphoid	3,421
Measles	90,305
Conjunctivitis	194,663
Trachoma	42,614
Leprosy	103
Tetanus	202
Malaria	10,314
Bilharzia	1,787
Scarlet fever	251
Diphtheria	250
Dysentery	37,531
Polio	265
Meningitis	475
Recurrent fever	19

Source: Ministry of Public Health, Bulletin Annuel d'Information Sanitaire, 1971.

be certain eye diseases, venereal diseases, kif and hashish dependency, various forms of malnutrition, and the ravages of intestinal parasites like hookworm. It might be noted, however, that some parasitic diseases like malaria and bilharzia which are major problems in many low-income countries do not now seem to be of great significance in Morocco.

PRIVATE HEALTH CARE

Most of the resources used in providing health care in Morocco--hospital beds, physicians, nurses, and so forth--are to be found in the public sector, but private activities in the medical field are nonetheless significant. The system of private health care is markedly dualistic. A small minority of the population--the urban high-income élite--is served by high-quality medical facilities and personnel, while the great mass of the population, to the extent that they do not use the public system, must resort to a very primitive level of service.

The private medical services which the élite can affort to pay for

are provided by a well-trained corps of physicians and nurses supported by well-equipped clinics, laboratories, and pharmacy stores. About 45 per cent of the 1,100 doctors presently practicing in Morocco are in the private sector. Most of them are French. Over half of the private doctors reside in the two metropolitan areas of Casablanca and Rabat-Salé, for that is where both wealthy patients and cultural attractions are to be found.

Schemes of private health insurance are not well developed in Morocco, and the bulk of the population cannot afford to pay the high fees charged by trained physicians. Most of the population lives in any case in rural areas, where private doctors are almost never to be found. At the same time, many low-income persons seeking medical care are not able to find it in the public system, because facilities there are chronically overcrowded. Hence they resort to untrained practitioners, who for a pittance dispense folk remedies that may well do more harm than good. Figure 1 illustrates the practice of this kind of medicine. Magical powers are relied upon, and superstition plays a large role.

PUBLIC HEALTH CARE

The system of public health care in Morocco, the planning of which is the main concern of this paper, has as its main function the provision of free medical treatment to self-referred cases. Other activities, notably the prevention and early detection of disease, play only a secondary role. The treatment is provided by health institutions organized in the well-known "pyramid" fashion. The Moroccan pyramid is depicted in Figure 2. A sick person seeking treatment reports first to his local clinic (*dispensaire*). Treatment is provided there, or, if the case is judged sufficiently serious by the health assistant on duty, the patient is referred to the next level in the system, the health center (*centre de santé*). This is the lowest

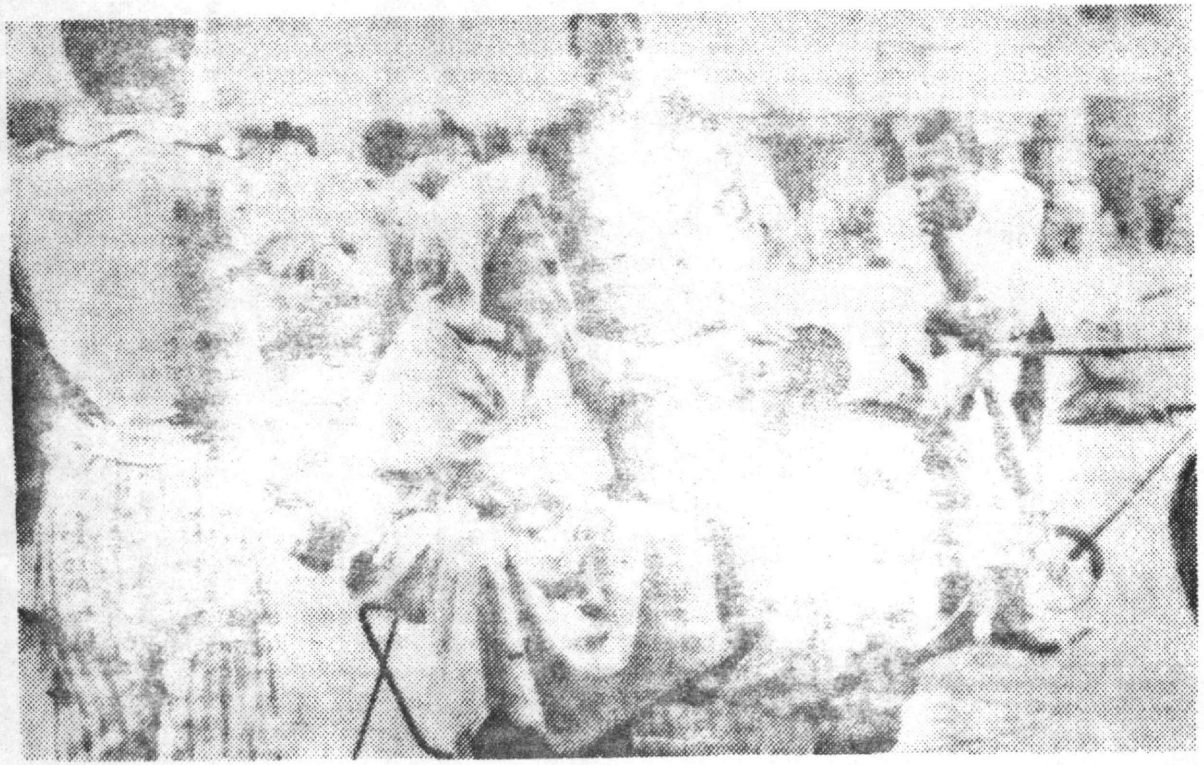
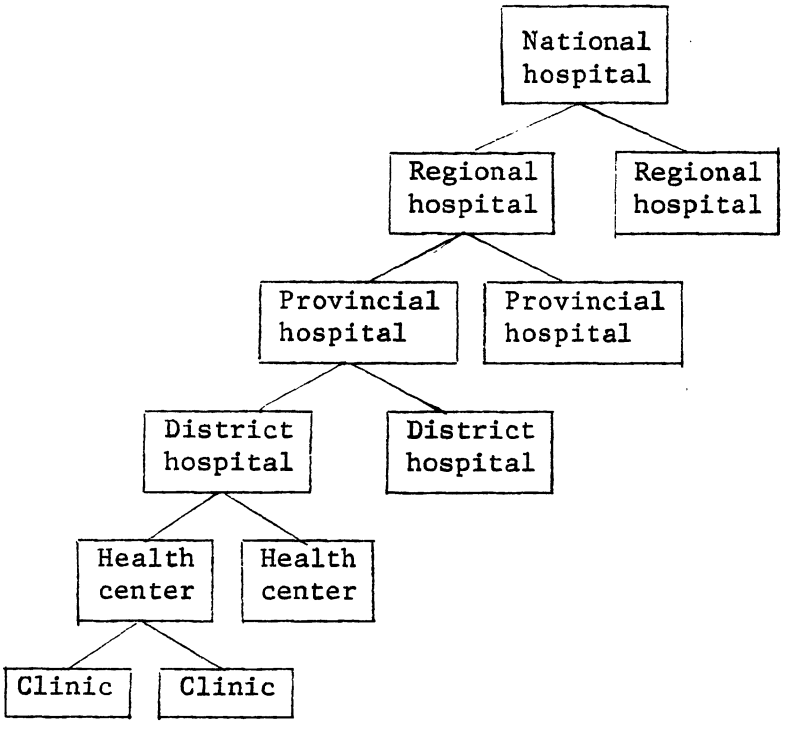


Figure 1

FOLK MEDICINE IN MOROCCO

Figure 2

The Organization of General Public Health Services In Morocco



Note: The above chart is considerably simplified for purposes of exposition. There are eighteen provinces in Morocco (plus two prefectures, a governmental unit equivalent in status to a province), and these are grouped into five regions. As indicated in the text, the average health center has three clinics under its jurisdiction.

level at which a physician will normally be found. The case is either treated at the health center (some of which have beds), or referred to the district hospital (hôpital de zone). Complex cases may subsequently be referred to larger hospitals at the provincial, regional, or national levels, which have successively more elaborate and specialized facilities.

In 1971 there were 598 public clinics in Morocco, 185 health centers, and 38 general hospitals. The average health center, in other words, received referrals from about three clinics. The population being about 16 millions, each clinic served an average of about 27,000 persons. There was substantial variation between different parts of the country in the numbers of persons per clinic.

Accompanying the general system shown in Figure 2 are some specialized facilities which deal with particular diseases or health campaigns. Maternal and child care units are attached to clinics in the urban areas and to health centers in the rural areas. They numbered 273 in 1971, and engage in a variety of nutritional and mass vaccination programs. The Moroccan family planning program operates through units attached to health centers. There are separate clinics for the treatment of tuberculosis (centres anti-tuberculeux). These clinics, twenty-two of which existed in 1971, refer cases to the tuberculosis hospitals. There were thirteen of these hospitals in 1971, and a like number of mental hospitals. The specialized hospitals, indeed, account for over 40 per cent of all the hospital beds in Morocco. The distribution of Moroccan hospitals by specialty and size is shown in Table 3.

The 138 hospitals described in Table 3 admitted a total of 364,000 patients in 1971, or one person out of every 44 in the whole population.[1]

---

[1]This latter statement neglects the fact that some persons were admitted more than once during the year. Data on hospital utilization are obtained from Ministry of Public Health, Bulletin Annuel d'Information Sanitaire, 1971.

Table 3

Types and Sizes of Public Hospitals in Morocco, 1971

Type of Hospital	Number of hospital beds						Total number of hospitals	Total number of beds
	Under 50	50-99	100-199	200-299	300-499	500 or more		
General	-	3	17	6	5	7	38	11,414
Tuberculosis	-	2	3	1	5	2	13	3,890
Mental	1	3	-	8	-	1	13	3,840
Eye	-	-	3	-	-	-	3	500
Eye and mental	-	1	-	-	1	-	2	478
Maternity	2	-	2	-	-	-	4	357
Leprosy	1	-	1	-	-	-	2	237
Dermatology	-	1	-	-	-	-	1	50
Urban health center	4	1	-	-	-	-	5	118
Rural health center	51	6	-	-	-	-	57	1,566
Total	59	17	26	15	11	10	138	22,450

Source: Ministry of Public Health, Code des Services et des Formations Sanitaires.

The mean length of stay was 17.3 days, a figure which reflects among other things the very long stays typical of the mental and tuberculosis hospitals. In the general hospitals, patients usually stayed for much shorter periods than this (see Table 14 in the appendix below). The hospital occupancy rate (the actual number of patient-days divided by the potential number thereof, given the availability of 22,450 beds) was 77 per cent. This figure seems unexpectedly low, in view of the strong unmet demand in Morocco for hospital treatment. The number of beds available would seem to permit an increase of perhaps one-fifth in the annual number of patient-days. The reasons for the relatively low occupancy rate are not immediately obvious, and this whole problem merits further study. It is possible that managerial inefficiencies caused the numerous bed vacancies, or that staffing bottle-

necks were responsible, or that many beds were unusable for one reason or another.[1]

Personnel

The personnel which run this system of health care are headed by a corps of some six hundred physicians. As in the private sector, only a minority of these--about one-fourth--are native-born Moroccans. The rest are mostly Frenchmen serving according to the terms of various technical assistance agreements concluded between the Moroccan and French governments. Their pay scales are much higher than those of their Moroccan counterparts in the public health service, and this disparity is a constant source of friction. The Moroccan government has also attempted to remedy the serious shortage of physicians by recruiting in Eastern Europe. Complaints about the foreign doctors are numerous. The East Europeans are handicapped by language barriers, and the Frenchmen are often held to be inexperienced. But it is also true that others of the French doctors in the public service have labored diligently in Morocco for two or three decades, and have amassed a wealth of expertise and understanding.

The Moroccan doctors serving in the public system suffer a large financial sacrifice by so doing, because they could all earn much higher incomes in full-time private practice. They remain in the public service out of a sense of duty or, in the majority of cases, because they are still bound by a contract which requires a certain period of public employment in return for their medical education. The obligation, however, is not complete. Physicians subject to the contract (médecins conventionnés) are

---

[1] One common reason for a low occupancy rate--a preponderance of small-sized hospitals--does not appear to have been of overriding importance. In the Casablanca prefecture, for example, where the bulk of capacity was provided by the 1,510-bed Averroes hospital and by five other hospitals each with 200 beds or more, the occupancy rate in 1971 was only 73 per cent.

allowed to operate a part-time private practice. This concession is reportedly much abused. Many conventionnés are said to spend a much smaller fraction of their time at the public hospital or health center than is required by their contract, or to show favoritism towards their own private patients in the assignment of public hospital beds, or to use the public facilities for obtaining new private patients.

The convention arrangement clearly means that the number of full-time physicians available to minister to the fifteen million or more clients of the public system is significantly less than the six hundred nominally so employed. And further erosion occurs because many of the six hundred--one-fourth of them, according to some estimates--are in predominantly administrative positions. This practice meets with much criticism. The public health officials who are specifically trained as administrators often resent the fact that virtually all of the top administrative positions in the public service are filled by persons who are trained as physicians but not as managers. These officials clearly have an axe to grind, but even disinterested observers would question a system which diverts so many expensively trained physicians from tasks where they have special expertise (principally diagnosis, prescription, and surgery) to others where they have little or none.

The paramedical personnel employed in the public service presently number about eight thousand. Almost all of them are men, since in Morocco as in most other Moslem countries there still exist strong prejudices against nursing as a career for women. There are three main categories of paramedical workers, distinguished from each other by the length of training involved. Those most highly trained are known as graduate health assistants (adjoints de santé diplômés d'Etat), some of whom are also certified specialists in such areas as radiology or sanitation. Next are the

licensed health assistants (adjoints de santé brevetés), and finally the health aides (aides sanitaires). These last are the products of a crash program adopted in the early years of independence to meet at short notice the urgent needs for paramedical personnel. The program provided only a minimal training and has since been discontinued. Its graduates, however, still account for about a third of the whole paramedical corps, which must therefore be regarded as very uneven in quality. Rounding out the personnel employed in the public health system are certain non-medical specialists like hospital administrators and statisticians, the clerical staff, and a large number of unskilled workers serving as hospital orderlies, janitors, messengers, etc.

Conceptually an integral part of the public health system (although in practice administered by the Ministry of Education rather than by the Ministry of Public Health) are the professional schools which train the various types of personnel required. These now suffice to produce the great majority of the new personnel hired each year in all categories--except for physicians. The physicians continue to arrive mostly from France, both Frenchmen hired for service overseas and Moroccans newly graduated from French medical schools. A medical school was established at Rabat some ten years ago in line with a policy of "Moroccanizing" the public health service, a policy which continues to receive official endorsement at the present time. But the contribution of the Rabat school to the nation's health manpower needs has been seriously weakened by a series of lengthy student strikes, which have delayed the certification of new graduates.

Financing

In principle the treatment services of the Moroccan public health

service are financed on an ability-to-pay basis. The bulk of the users are exempted from any direct charge on grounds of poverty, but wealthier clients are expected to pay fees in accordance with their financial status. In practice the wealthier patients are reportedly able to escape payment more often than not, through using their influence on impressionable officials to have themselves formally classified as "indigent" in the hospital or clinic records. Hence virtually all of the expenses of the health system have to be met from the government's tax revenues.

A zero price is effectively charged for the services of the public health system, and it is not surprising to find that at that price, the demand for the services much exceeds the limited supply. Nonprice methods of rationing must therefore be employed, and two of these appear to be important. The first is queuing, the service being provided to those who are prepared to wait the longest. The queues forming outside the public clinics in the early morning hours are a familiar part of the Moroccan scene. Second is personal influence. An individual with "pull," for example a government official or a member of a locally prominent family, will normally advance quickly to the head of the line.

Budgeting

Most of the expenses of the public health care system are included in the budget of the Ministry of Public Health. (The major exceptions are the personnel costs of the professional schools, which appear in the Ministry of Education's budget.) In 1971 the expenditures of the Ministry of Public Health were budgeted at 231 million dirhams (about $46 million). This sum represented 5.2 per cent of total national government expenditures in Morocco, and about 1.3 per cent of the gross national product. Six per cent of the Ministry's expenditures were included in the government's

investment budget. Most of these outlays were for the construction and equipping of new hospitals (or additions to old ones), with smaller amounts for the further development of health centers and clinics. The remainder of the Ministry's budget consisted of operating expenditures, and a breakdown of this part of the budget is reproduced in Table 4.

This table presents a slightly abridged version of the most detailed information available in published form.[1] The information in question is obviously seriously deficient from the standpoint of rational planning. To anticipate slightly our later discussion of planning principles, we can say that at least these should involve the costing of the main functions which the Ministry attempts to carry out. But the main item of expenditure--personnel salaries--is presented essentially as a single aggregate instead of being subdivided according to function. As a minimum one would want to know the personnel costs of the separate layers in the organizational pyramid discussed above, and beyond that the costs of the different kinds of unit at each level--for example, the staffing costs of general hospitals versus tuberculosis hospitals, or of large general hospitals versus small ones, or of maternal and child care units versus family planning units. But no tabulations are maintained on the distribution of the available personnel between the different organizational units in the health system. To know this it is necessary to handcount the cards which are kept on file in the Ministry, one for each employee. Similar problems exist for other major expenditure items like drugs and hospital meals. Thus much statistical groundwork must be done before any quantitative analysis can proceed.

---

[1] To emphasize the general dearth of financial information, it can be pointed out that the Ministry's basic statistical periodical, the Bulletin Annuel d'Information Sanitaire, contains in the 95 pages of its 1971 version not a single monetary figure.

Table 4

Budgeted Operating Expenditures, Ministry of Public Health, 1971
(in millions of dirhams)

Personnel	120.7		
Salaries, wages, and allowances		87.1	
Wages and allowances of temporary personnel		28.7	
Lump-sum allowances		2.7	
Other personnel expenses		2.2	
Supplies and miscellaneous expenses	96.3		
Expenses common to all ministerial units		50.8	
Fixed plant and equipment			2.5
Water, heating, and lighting of buildings			6.4
Other expenses of operating buildings			3.2
Operation of motor vehicles			2.5
Travel expenses			0.8
Pharmaceutical and medical supplies			35.2
Other expenses			0.1
Division of Prevention		2.3	
Campaign against "social scourges"			0.8
Prevention of endemic and epidemic diseases			1.0
Health education			0.1
Maternal and child care			0.4
Division of Health		37.0	
Operation of professional schools			3.0
Blood transfusion service			0.5
Feeding of patients and staff			14.0
Payments to autonomous hospitals*			18.1
Grants to health-related organizations			1.4
Other expenses			0.1
Division of Social Assistance		6.1	
Payments to disabled and needy individuals			2.1
Grants to social service agencies			4.0
	217.0		

*Three of the public hospitals are "autonomous," chiefly in an accounting sense. The Ministry finances their expenditures, as with the other hospitals, but through grants rather than directly.

Source: Kingdom of Morocco, Loi de Finances pour l'Année 1971.

Chapter III

ALTERNATIVE APPROACHES TO HEALTH PLANNING

In the budget process, a Ministry of Public Health is assigned a certain sum of money, and the question naturally arises, what is the best way of spending the money? This is the question which health planning tries to answer. It would seem that there are two main approaches towards providing an answer, each with a certain appeal. The first of these can be called the method of input norms, according to which health inputs (e.g., hospital beds) are purchased in quantities sufficient to satisfy certain norms (e.g., a certain number of hospital beds per 1,000 population). The second approach is that of output maximization, which involves purchasing inputs in that combination which will maximize some measure of the health sector's ultimate output (e.g., reduction of death rates). The first approach is widely used in practice, and the second hardly at all.

INPUT NORMS

Most of the governments which claim to employ health planning use the method of input norms. The features of the method will be illustrated here by reference to two cases, first Morocco and second the Soviet Union. It is in the Soviet Union that the method has been refined perhaps more than in any other country.

Moroccan Norms

To investigate the principles which guide health planning in Morocco, it is reasonable to start with the formal statement of health sector goals contained in the government's long-term plan of economic and social development. In the Five-Year Plan which ended in 1972, the following goals for

the health sector are found as part of a section on "Social Objectives":

1) Maintenance and protection of the hospital system and rendering existing facilities more productive (rentable)
2) Training medical and para-medical personnel to meet present and future needs and to achieve Moroccanization
3) Extension of the preventive network (in both urban and rural areas)
4) Extension and integration of Family Planning, which constitutes one of the priorities of the Plan in the health field.

It is noteworthy that the focus in this statement of goals is almost entirely on inputs--hospitals, personnel, preventive facilities, family planning units. What these inputs are for is barely specified at all. There is mention of the political objective of Moroccanization, while output in a health sense or an economic sense is referred to only in the vague phrases about "rendering facilities more productive" and "meeting present and future needs."

Turning from this broad statement of goals to the criteria which seem to have some actual effect on budgetary decisions, we find first that certain norms exist for the various layers in the organizational pyramid discussed above. These are as follows:

One clinic for every 15,000 persons

One health center for every 45,000 persons

One district hospital of 200 beds for every 180,000 - 200,000 persons.

The norms are used by the Ministry of Public Health in attempting to defend some of the budgetary requests submitted to the Ministry of Finance. For example, accompanying a request for funds to build a new health center in a certain province will be the statement that the population of the province would according to the norms justify the existence of x centers,

whereas presently only some smaller number exist.

Along with the norms concerning the density of the various health units are others which dictate the numbers and categories of the personnel who should be found in each of these units when they are at full strength. A summary of the personnel norms currently in force is presented in Table 5. These norms appear to have some influence on the government's health manpower planning. Given the projections of the future numbers of health units, the "manpower needs" of those units are calculated from the norms, and certain conclusions are then reached about the necessary rate of enrollment expansion in the various professional schools.

The Moroccan norms partake of the character of the stone tablets which Moses brought down from the mountain. They are mysterious in origin, and their authority is not meant to be questioned. Ministerial sources will be searched in vain for any discussion of the reasonableness of the norms, or for any indication of where they came from.

Soviet Norms

A detailed presentation of the principles which guide health planning in the Soviet Union appears in a W.H.O. publication written by G. A. Popov, a senior planner in the Ministry of Health of the U.S.S.R.[1] From this account it is clear that planning decisions are based on the same two kinds of input norms which are found in Morocco: standards for the density of various kinds of health facilities in a given population, and staffing norms for those facilities. The Soviet techniques appear to be superior in one main respect. The input norms are derived, albeit loosely, from considerations about the ultimate objectives of the health sector. Popov

---

[1]G. A. Popov, Principles of Health Planning in the U.S.S.R. (Geneva: W.H.O. Public Health Papers, No. 43, 1971).

Table 5

Personnel Norms in the Moroccan Public Health System, 1971

	Hospital				Health center		Clinic	
	National	Regional	Provincial	District	Urban	Rural	Urban	Rural
Physicians:								
Generalist	3	1	1	1	3	1	-	-
Surgeon	15	6	2	2	-	-	-	-
Pediatrician	3	3	1	1	-	-	-	-
Ophthalmologist	3	2	2	-	-	-	-	-
ORL	3	2	2	-	-	-	-	-
Lung specialist	3	1	1	-	-	-	-	-
Psychiatrist	3	1	1	-	-	-	-	-
Radiologist	3	1	1	-	-	-	-	-
Dermatologist	3	1	1	-	-	-	-	-
Gynecologist-obstetrician	3	2	1	-	-	-	-	-
Other specialist	36	6	-	-	-	-	-	-
Paramedicals:								
Graduate health assistants	143	108	84	21	6	5	1	-
Licensed health assistants	255	150	84	28	7	7	6	4
Administrative & clerical personnel	36	18	18	8	1	1	-	-
Maintenance personnel	216	108	108	36	6	5	2	-

suggests that a knowledge of morbidity conditions will yield estimates of the number of voluntary outpatient visits which can be expected from a given population, as well as the number of hospitalizations required. From these estimates, norms for the scale of both outpatient and inpatient facilities can be derived. The implied objective of the health sector is the reduction of morbidity. But no analysis is attempted of the complex relationships between this measure of output on the one hand and the various inputs on the other. For the most part, Popov's monograph consists of a listing without critical comment of the health "standards" or norms employed in the

Soviet Union and in other countries of Eastern Europe.

A Critique of Input Norms

The method of input norms has several basic weaknesses as a guide to health planning decisions, and these can be enumerated as follows:

1) The method will often detract from the achievement of the real objectives of the health sector, if these are defined in such terms as the reduction of morbidity and mortality or the promotion of economic growth. A clear example of this failing is provided by density norms which are uniform in all geographical areas, for example the requirement in Morocco that all provinces should have one health center per 45,000 inhabitants. To achieve the greatest possible improvement in health with limited funds obviously requires that public health facilities be unequally distributed in a geographical sense. This is partly because some districts are relatively well endowed with alternative facilities in the private sector, and partly because morbidity patterns are not uniform from district to district. In general, a health center will make a bigger contribution to health if placed in a rural setting than in an urban setting, because the rural inhabitants have lesser access to private facilities and are in any case more afflicted with disease.

2) The norms are incomplete. They fail to apply to certain important activities in the public health sector. In particular, no norms exist for activities in the preventive area, such as mass vaccination programs, insecticidal campaigns, improvement of drinking water supplies, or nutritional programs. Hence the Ministry receives no guidance

as to how much of its limited budget should be spent in the treatment area, where some norms exist, and how much in the preventive area, where none exist.

3) Perhaps the principal intended use of the input norms is to prevent overspending, but this effect is rarely seen in practice. The norms imply that no more hospitals should be built after a certain density has been reached, or that no more physicians beyond a certain number should be trained. But the chosen norms, at least in Morocco, are so far above the existing levels of the various inputs that there is no chance of any norm in any area being exceeded in the foreseeable future. Even if all budget increases for the next twenty years were to be devoted to, say, hospital construction, with nothing applied to any other input, this would not according to the norms constitute overspending on hospitals. Hence the Ministry receives no guidance on how the annual budget increases should be allocated between the various inputs.

4) The personnel norms imply fixed ratios between the numbers of personnel in various categories who are employed in the various health units. In the urban health center in Morocco, for example, there are supposed to be two graduate health assistants for each physician. These rigid ratios discourage experimentation with different possible combinations of the various types of personnel. Thus the possible gains in output from substituting one input for another--for example, replacing one physician with an equivalent-cost group of paramedical personnel--are less likely to be realized.

5) With physical norms there is always the temptation to achieve

impressive advances in quantity by making indefensible cuts in quality. Progress towards a norm of x hospital beds per 1,000 population can be made more easily, for example, if new hospitals are built without the ancillary facilities--laboratories, X-ray units, surgical equipment--which make hospitalization effective. (This is not to say, of course, that the substitution of quantity for quality is always bad, but that beyond a certain point it will be.) The problem is analogous to that experienced with physical production targets in Soviet planning. The assignment of such targets has often resulted in the production of shoddy, low-grade merchandise, because factory managers have found that the quantity targets can only be met by sacrificing quality.

OUTPUT MAXIMIZATION

From the foregoing discussion it will be obvious that the planning method urged in this paper is one which focusses on outputs rather than inputs. Outputs are measurable magnitudes derivable from the basic objectives which the political process assigns to the health sector. The task of the health planner is then to show what combination of inputs purchasable with the Ministry's limited budget will maximize the output thus specified.

The process of maximization encounters a number of difficult problems, among which one of the most important is the fact that the health sector would seem to have not one but several different types of output. We start, then, by considering the main forms of output which appear to be relevant.

Types of Output

A review of the official and academic literature in the field of

health planning suggests that the following types of output are relevant for a Ministry of Public Health:

1) Reduction of mortality

2) Reduction of morbidity

3) Economic improvement

4) Palliative care.

Examining each of these in turn, we can note that output defined generally as a reduction in mortality can be more precisely defined in a number of different ways. Simplest would be the reduction in the total number of deaths occurring annually (currently about 300,000 in the case of Morocco). Next in order of complexity would perhaps be the reduction in the crude death rate (last measured as 19 per 1,000 in Morocco), and next the reduction in the overall death rate adjusted for changes in the age-sex distribution of the population. Or the death rates in specific age-groups can be treated as separate types of output. In a discussion of the conceptual difficulties facing health planners, Abel-Smith poses the question of whether saving the life of an 80-year-old should be counted the same as saving the life of a 20-year-old.[1] Clearly one way to begin answering that question is to treat the two events in question as being different types of output. The maximization problem is in principle no more difficult than in any other situation where there exist two or more maximands.

The reduction of morbidity would probably be held by most health officials to be a more important form of output than the reduction of mortality, but it is also much more difficult to measure. Perhaps the simplest

---

[1]Brian Abel-Smith, "Health Priorities in Developing Countries: The Economist's Contribution," International Journal of Health Services, II (February 1972), pp. 5-12.

definition of morbidity would be a state of ill-health sufficiently serious to prevent the victim from carrying out his normal duties, such as attendance at work or school. Thus defined, morbidity can be and is measured by means of sample surveys of households, and the fraction of the sampled individuals who are reported to be in a morbid state can be translated into an estimate of the total number of person-days which are "lost" annually because of ill-health. Reductions in this number can then be counted as one kind of output of the health sector.

It can be objected that counting each person as "ill" or "not ill" simplifies too much the problem of measuring improvements in health. It would seem desirable to recognize the great differences in degrees of disability brought on by particular diseases or injuries.[1] One approach towards a more refined measure of morbidity reductions has been developed by Culyer et al., and this approach, although difficult to implement in practice, would seem worthy of further research.[2] The authors suggest that the intensity of a person's disability or ill-health possesses two dimensions--pain and restriction of activity--and can be measured along a scale ranging from "no significant discomfort or restriction" at one extreme to "death" at the other. The following ten-point scale is proposed:

0 ... normal
1 ... able to carry out normal activities, but with some pain or discomfort

---

[1]This point makes it difficult to accept the measure of health output proposed by David W. Dunlop ("The Development of an Output Concept for Analysis of Curative Health Services," Social Science and Medicine, VI, June 1972, pp. 373-85). Dunlop proposes that output be measured as the number of cases successfully treated, but this means counting as equivalent achievements the curing of renal deficiency by a kidney transplant and the curing of a headache by aspirin.

[2]A. J. Culyer, R. J. Lavers, and Alan Williams, "Social Indicators: Health," Social Trends, II (1971), pp. 31-42. Similar suggestions were made earlier by A. H. Packer ("Applying Cost-Effectiveness Concepts to the Community Health System," Operations Research, XVI, March-April 1968, pp. 227-53).

2 ... restricted to light activities only, but with little pain or discomfort
3-7 ... various intermediate categories reflecting various degrees of pain and/or restriction of activity
8 ... conscious, but in great pain and activity severely restricted
9 ... unconscious
10 ... dead.

The measurement of the intensity of disability in the case of any particular individual would involve the collection of certain medical and personal information, supplemented with evaluations by medical personnel.[1]

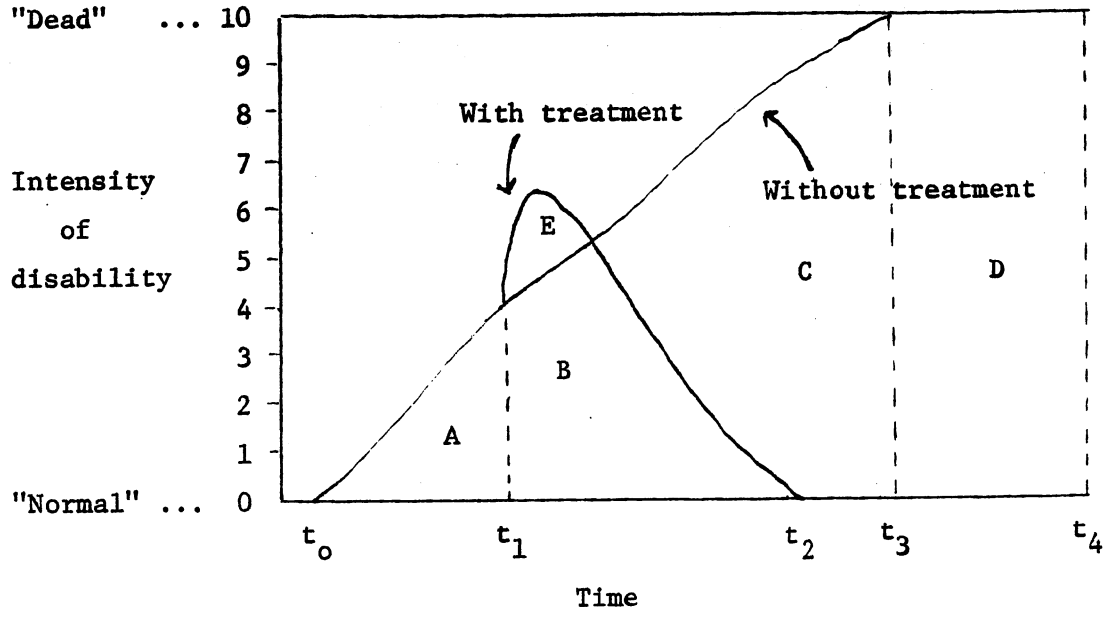
The use of the intensity scale in measuring one kind of output yielded by a health care system is illustrated in Figure 3. An individual contracts a disease at t_o and without the treatment provided by the system suffers increasing disability and dies at t_3. Given that his life expectancy is t_4, the total disability score in this eventuality (the product of the disability's intensity and its duration) is measured by the area A + B + C + D. If however he receives treatment at t_1, he suffers a temporary increase in disability (perhaps due to surgical procedures) but by t_2 is completely cured. His disability score in this case is A + B + E. The output of the system is the difference between the two scores, or C + D - E. It will be noted that the definition of output proposed by Culyer et al. combines the two objectives we have so far discussed, namely the reduction of mortality and the reduction of morbidity. Whether this is seen as a virtue or not depends on one's view of the relative weights implicit in the proposal: the relative weights attached to postponing death and reducing pain, as well as those attached to postponing the deaths of individuals at different stages in the life cycle.

---

[1] It should be pointed out that although such refined measures of morbidity may seem at first glance to be impractical, some experience with this kind of approach has in fact been accumulated. For example, the Veterans Administration in the United States has for long been measuring degrees of disability in connection with the administration of various pension programs.

Figure 3

The Measurement of Morbidity Reduction



Mortality-reduction and morbidity-reduction would normally be counted as "humanitarian" goals, and as such would be contrasted with the third goal or form of output to which we now turn, namely, economic improvement. The relevance of the economic goal for the health sector stems first from the fact that economic expansion is everywhere a major national concern, especially so in underdeveloped countries, and second from the fact that health programs have obvious effects on economic variables, through such mechanisms as improving the vitality of the labor force. The economic goal, like the others, can be variously defined. Simplest would be the expansion of GNP or some other measure of aggregate production. Economic goals, however, it should be remembered, are of interest not so much for their own sake as because they stand as proxies for other more basic concerns, such as average consumer welfare or the distribution thereof. Clearly superior

to GNP as a welfare proxy would be GNP per capita. A country which experienced an increase in GNP but a decrease in GNP per capita would not usually be described as "better off." The distinction between these two economic measures is important for the health sector, because sometimes a health program, by affecting both the size of GNP and the size of the population, will cause GNP per capita and GNP unadjusted to move in different directions. A malaria eradication program, for example, may increase GNP by raising labor productivity, but it may simultaneously cause a population explosion and lower GNP per capita. Some types of rather expensive birth control programs may lower GNP while raising GNP per capita.

In discussions of public health goals, there is often much confusion when economic considerations are introduced. Moreover, there is often an element of guilt, public health officials feeling that it is somehow callous to assess the merits of a program by looking at the economic savings which are realized. After all, it is said, the value of a human life is really immeasurable. But in fact, the value of a life, if defined in economic terms like "contribution to GNP," can be measured with considerable precision. What is often not clearly grasped in such discussions is that the health sector should not restrict itself to a single goal but must attempt to achieve several. One of these may legitimately be the economic goal, but others in the "humanitarian" area will also presumably be important.

Lastly, it may be reasonable to treat as yet another form of output the purely palliative care provided to certain individuals. We refer here to the care extended for humanitarian reasons in cases where it is known that no significant improvement in health will result. Included would be terminal illnesses, cases of mental retardation, cases where the disease must be allowed "to run its course" because no effective treatment exists,

and others. The provision of such care may legitimately be counted as an end in itself, not requiring justification by reference to some ulterior objective like the reduction of mortality. Output in this instance could be measured by the numbers of needful individuals thus served, with appropriate adjustment made for the quality of the care provided.

The Process of Maximization

Assuming for the moment that the health sector produces only one kind of output, the planner should be assigned the following problem:

Given (a) the total budget available
(b) input prices
(c) limitations, if any, on the total supply of inputs available
(d) the contributions of various combinations of inputs to output (e.g., combinations for "inpatient treatment," "outpatient treatment," or "mass vaccination"),

find that set of purchasable inputs which maximizes output.

The problem can obviously be expressed as a fairly straightforward one in the area of linear programming.

When several different types of output exist, the maximization process requires that these different types be combined into a single aggregate. This is done by assigning a relative weight to each type. In the case of health planning, the creation of the aggregate involves specifying a "social welfare function," according to which total welfare (W) would be seen as a function of the various relevant forms of output. One example of such a function, using the four types of output discussed above--mortality-reduction (D), morbidity-reduction (M), economic improvement (E), and palliative care (C)--might look as follows:

$$W = D^{a}M^{b}E^{c}C^{d}$$

The relative weights a, b, c, and d should in principle be assigned "through

the political process," although it can be freely admitted that political leaders do not find it easy to make such judgments. They are asked, for example, to assess the relative importance of saving lives and improving the economy, and are not accustomed to thinking in such terms. Before the maximization approach is rejected as unworkable, however, it should be recognized that some set of weights is necessarily implicit in the actual decisions that are made, and that these weights may be far removed from what the leadership really intends.[1] Decision-making would then be improved by efforts to discover the intended weights.

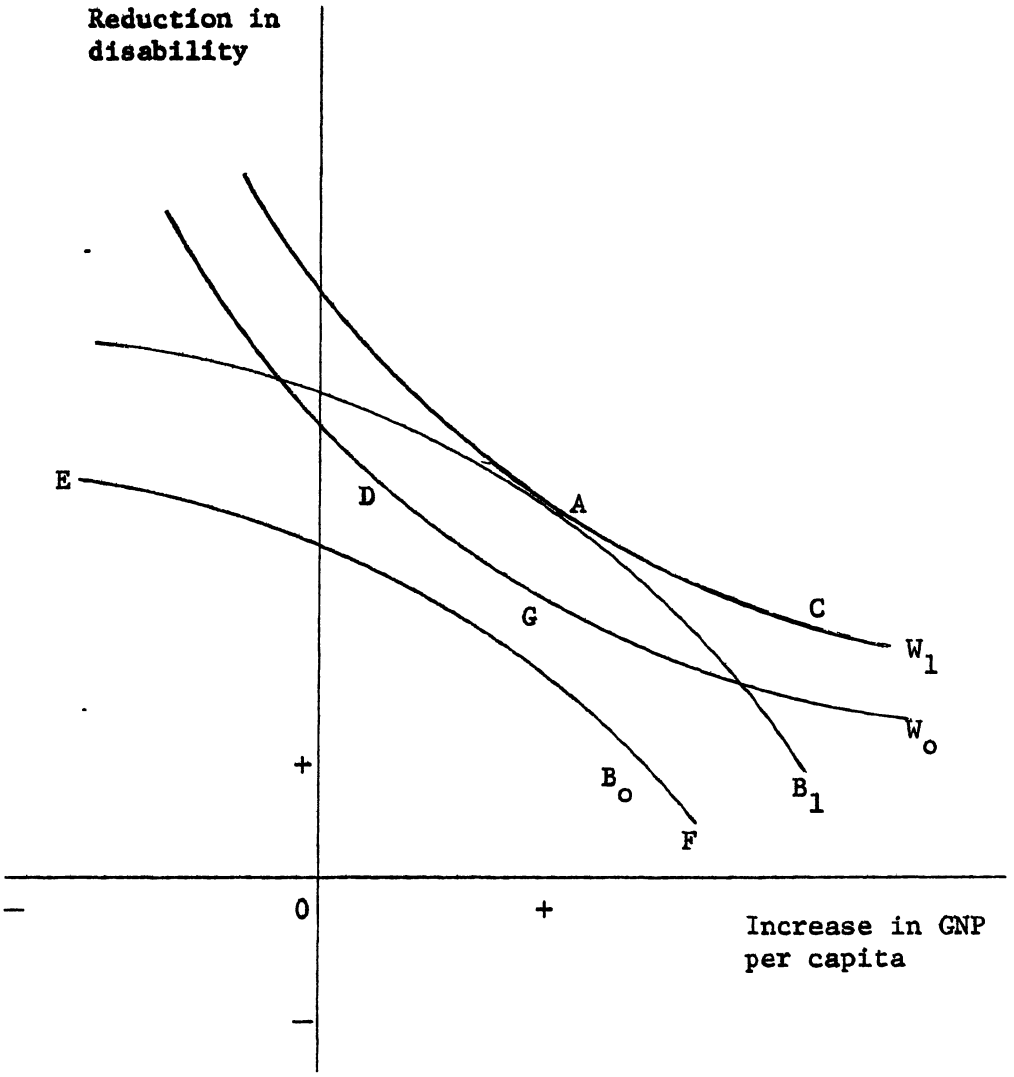
The process of maximization when more than one objective exists can be illustrated diagrammatically, as in Figure 4. Two objectives or forms of output are assumed: an economic one, expressed as increases in GNP per capita, and a humanitarian one in the form of reductions in disability (as defined, for example, by Culyer et al.). A social welfare function which assigns relative weights to these objectives can be depicted as a series of curves like W_o and W_1. Each one of such curves shows the combinations of increases in GNP per capita and reductions in disability between which the political leadership (or society in general) is indifferent. The combination at A, for instance, is regarded as being just as good as that at C, while both of these are regarded as superior to D, which lies on a lower "social indifference curve," W_o. A given budget renders possible a set of combinations like those shown by the "opportunity curve" B_o. The position of this curve is determined by asking, for each alternative level of disability-reduction, what is the greatest possible increase in GNP per capita

---

[1] It is possible to discover the implicit weights by reversing the mathematical procedure outlined above. Given the input and output decisions, the problem is then to solve for the set of output weights implied. For an example of this kind of analysis in the health area, see William B. Neenan, "Distribution and Efficiency in Benefit-Cost Analysis," Canadian Journal of Economics, 1971.

Figure 4

Optimization with Multiple Objectives



attainable with the given budgetary resources. There will normally be a wide range of feasible outcomes. At one extreme, the concentration of resources on campaigns against those infective and parasitic diseases which cause high levels of infant mortality and adult debility may yield the output combination at E, where disability is markedly reduced but where the resultant population explosion causes an economic decline. At the other extreme, diverting large amounts of resources to birth control programs may result in the combination at F.

An increase in the health budget makes possible an outward shift in the opportunity curve, such as to B_1. Whatever the budget level, the best combination of outputs to choose will be that where the relevant opportunity curve is tangent to a social indifference curve. No other feasible combination will yield so high a level of social welfare. With the budget associated with B_1, for example, the combination at A should be chosen.

It should be stressed that although a given budget will give rise to a single opportunity curve, there is no guarantee that the spending policies actually adopted will produce a combination of outputs located on the curve. Some inferior combination might well result. To take some examples from current controversies in the field of public health, if it is true that an emphasis on the prevention of disease will produce more results than an emphasis on the cure thereof, then with the budget associated with B_1 a "curative strategy" may produce an inferior outcome <u>inside</u> the opportunity curve, such as G, whereas a "prevention strategy" would permit the attainment of A. Or if it is true that a group of paramedical personnel can achieve more than an equivalent-cost and therefore smaller group of physicians, then a "physician strategy" may yield G, while a "paramedical strategy" would yield A.

The task of the health planner may therefore be seen, in geometrical

terms, as twofold. First, he must show what reallocations of budgetary resources will move the system northeastwards towards the opportunity curve. These reallocations will be unambiguously desirable since they entail a greater production of all kinds of output. Second, he must indicate what movements along the opportunity curve are in the social interest. This requires knowledge of the social welfare function.

Practical applications of the method of output maximization in the field of health planning are rare, but they do exist. Perhaps the most advanced work of this type is to be found in a study by Feldstein, who uses linear programming techniques to show what set of policies would be optimal in the area of tuberculosis control.[1] Seven different forms of output are assumed, representing both humanitarian and economic objectives. This kind of approach is potentially very fruitful, and merits further development. It is in this spirit that an attempt is made in the next two chapters to explore further the various relationships between inputs and outputs in the context of the Moroccan public health care system.

---

[1]Martin S. Feldstein, "Health Sector Planning in Developing Countries," Economica (May 1970), pp. 139-63. For a further example of the approach, showing how budgetary resources should be allocated between selected programs in order to maximize reductions in mortality, see Robert N. Grosse, "Cost-Benefit Analysis of Health Service," Annals of the American Academy of Political and Social Science, January 1972, pp. 89-99.

Chapter IV

A PROPOSED MODEL OF HEALTH PLANNING

The purpose of this chapter is to develop a verbal model of a public health care system like that in Morocco, which recognizes some of the main institutional complexities of such a system and which is designed to permit the application of the techniques of output maximization described earlier. In order to demonstrate the model's practical usefulness, the chapter following presents estimates, based on Moroccan data, of some of the relationships identified in the model.

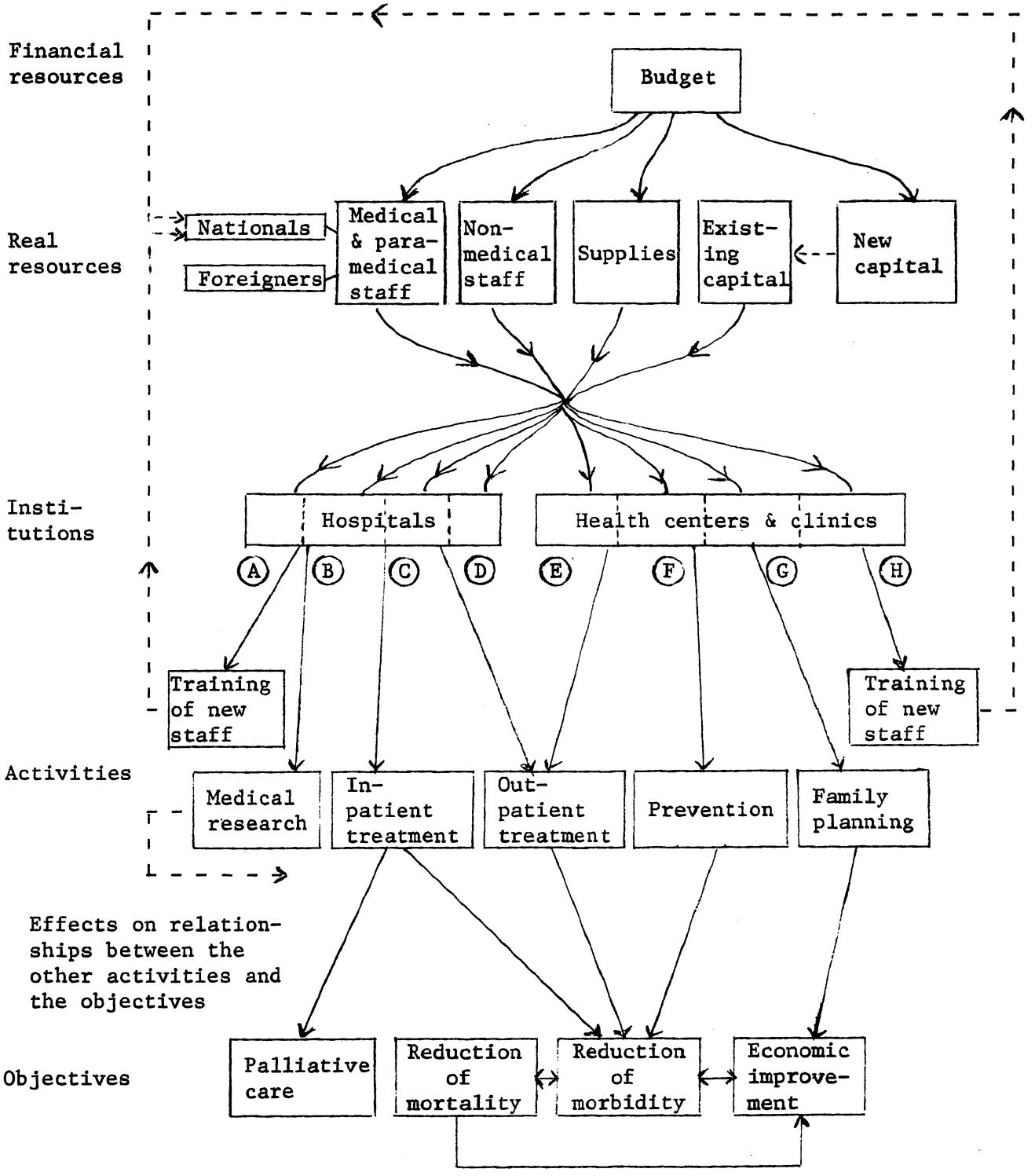
The proposed model is depicted in Figure 5. The health planner is presented with a budget, shown at the top of the chart, and his task is to spend this budget in a way which maximizes attainment of the system's objectives, which are shown at the bottom. In performing this task, he uses the budget to buy real resources (shown in the second row of the chart). The real resources are then deployed in various types of institutions, and these institutions engage in certain activities which promote in varying degrees the ultimate objectives. The different parts of this optimization process will now be discussed in more detail.

REAL RESOURCES

The real resources purchasable with the financial resources of the budget include first the physicians and paramedical personnel. These are either nationals or foreigners. In the short run the trained nationals will usually be in limited supply, and many of them will be unavailable to the public sector without a large increase in government salaries to bid them away from their lucrative private practice. In the long run the supply

Figure 5

A Model of Health Planning



- - - - = effect in a future year

will be greater if some resources are currently devoted to personnel training programs. The number of trained foreigners available for hire will normally be quite large, but the number actually hired will often be limited by political considerations.

Nonmedical staff, at least those who are unskilled, will also be available in large numbers in the typical labor-surplus setting of an underdeveloped country. For material supplies, the next category of real resources, tight restrictions on the amount purchasable are likely to exist in the case of imported materials (e.g., pharmaceuticals, gasoline) but not in the case of materials domestically produced (e.g., foodstuffs for hospital meals). Most underdeveloped countries face balance-of-payments difficulties, and the Ministry of Public Health, like the other ministries, will not normally be allowed to spend more than a limited amount of foreign exchange.

Similar restrictions will apply to some types of physical capital, the last category of real resources. This category includes all types of long-lasting plant and equipment, some of which will only be obtainable from overseas (e.g., X-ray equipment, motor vehicles). It should be noted that, in contrast to the other real resources, the great bulk of the physical capital utilized in any one period yields its services even in the absence of any current budgetary appropriations. These resources, in other words, result from past budgetary expenditures and not from present ones. Indeed, spending some part of the budget for capital resources will often have no effect on the quantity of capital available for short-run use. The facilities in question may well take months or even years to construct.

Thus a major point which emerges from this discussion of real resources is that for most categories, there are definite limitations on the quantities that can be purchased for immediate use, even when the total budget is fairly large.

INSTITUTIONS

The real resources are employed in different types of health institution. Two of these are identified in Figure 5, hospitals on the one hand and health centers and clinics on the other. Hospitals are defined in this context as institutions whose main function is the provision of inpatient care.

ACTIVITIES

The institutions are seen as containing eight departments or divisions, labeled A-H, which are distinguished by the kind of "activity" conducted. Hospitals engage in the activity of inpatient care, while all institutions--hospitals, health centers, and clinics--provide some outpatient care. The health centers and clinics engage in prevention activities like mass vaccination programs and nutrition supplementation, and also operate the family planning program.[1] Any individual health center or clinic could engage simultaneously in all of the activities identified, like the large multipurpose urban health centers in Morocco, or they could be smaller units specializing in only one activity. An example of the latter type in Morocco are the small airport clinics which insure that incoming passengers are adequately vaccinated against contagious diseases, an activity in the realm of prevention.

Then there are the research and training activities. These have the characteristic of producing results not in the current period but in the future. Medical research contributes towards the future attainment of the objectives by potentially altering the relationships between various of the other activites on the one hand and the objectives on the other. The discovery, for example, of a more effective hospital treatment for tuberculosis

---

[1]The scheme is obviously somewhat oversimplified, since some hospitals may be involved in preventive and family planning activities.

would make it possible to change the relationship between "Inpatient treatment" and "Reduction of morbidity."

Devoting resources to the training of new staff also makes no immediate contribution towards the health sector's objectives. The effect is to increase the stock of skilled personnel available for hiring in some future period. One important aspect of such increases is that they will tend to lower the salary which the government will need to pay in order to hire a given number of personnel away from the private sector. The increased supply of specialized personnel can be expected to lower their equilibrium wage in both private and public employment. A fully developed model of the health sector should allow for such linkages between health activities and input prices.[1]

In some instances both research and training are difficult to separate from other health activities. In large hospitals the treatment of patients often provides data for medical research projects as well as cases for study and practice in training programs for physicians and nurses. It is not easy in such circumstances to identify the separate costs of "inpatient treatment," "research," and "training." But such problems should not obscure the fact that there are definite trade-offs in a health care system between activities producing immediate results and those producing results in the future. A senior physician who is assigned to give lectures to a class of medical students obviously has less time available to spend with his patients.

OBJECTIVES

Four objectives are identified for the health sector, the same as those discussed in the previous chapter, and these are promoted in various ways by

---

[1]For a model of the American health care system which does recognize these relationships, see Paul J. Feldstein and Sander Kelman, An Econometric Model of the Medical Care Sector (Ann Arbor: Bureau of Hospital Administration, 1972).

four of the activities which the health institutions engage in. The objective of palliative care is promoted most clearly by inpatient services (though outpatient services may also play a role in this area). The reduction of morbidity is achieved by curative activities, both inpatient and outpatient, and by preventive activities. (One may also envisage these activities as having a direct impact on mortality, although for the purposes of the model here we have regarded all mortality as involving a prior state of morbidity--hence the reduction of mortality is achieved only through a prior reduction in morbidity. But the point is not essential.) The objective of economic improvement is directly served by family planning.

The total effects of activities on objectives are not limited, however, to those just mentioned. Various indirect effects also occur because of the fact that the objectives themselves are not independent of each other. A change in one objective or form of output will often necessarily induce a change in some other objective. We have already noted that reductions in mortality imply prior reductions in morbidity, in a largely definitional sense. But the relationship between the two objectives is more complex than that. Reductions in mortality can result in increases in morbidity. This effect is seen when new methods of treatment prevent the victims of certain diseases from dying prematurely but do not cure the underlying condition, so that the individual lives on for many years in a partially disabled state. Cases of diabetes are sometimes held to fit this pattern.[1] The two-way arrow in Figure 5 between the two objectives in question reflects these complex interconnections.

The objectives of morbidity reduction and economic improvement are likewise interdependent. An increase in per capita income is likely to

---

[1]For a further discussion of negative relationships between mortality and morbidity, see Herman M. Somers and Ann R. Somers, Doctors, Patients, and Health Insurance (Washington, D.C.: Brookings Institution, 1961).

cause reductions in morbidity through such means as raising nutritional levels, improving the quality of housing, and facilitating private expenditures on medical care.[1] At the same time, reductions in morbidity can lead to economic improvement by reducing the time taken off from work because of sickness, by extending working lives or postponing retirement, by raising the levels of vigor and alertness in the labor force, by rendering unnecessary the diversion of so many resources to the treatment of disease, and by other means.

The economic situation may also be affected by reductions in mortality, either favorably or unfavorably. Saving the lives of productive members of the labor force is likely to raise per capita income. But the opposite effect may be produced by a decline in infant mortality, since this will increase the proportion of the population that is in a dependent, unproductive status.

The measurement of the economic effects of health activities has aroused much interest among public health officials.[2] The basic technique of measurement employed has been to aggregate the additional future wage earnings which are realized by the postponement of death and the reduction in disability.[3] Sometimes savings in treatment costs are recognized as a

---

[1]This at least would be the expected relationship in low-income countries. A recent multivariate analysis of health conditions in the United States, however, suggests a negative relationship between income and health. It may be that in a generally affluent setting, higher income is associated with overrich diets, lack of exercise, and stress. See Richard Auster et al., "The Production of Health, an Exploratory Study," Journal of Human Resources, IV (Fall 1969), pp. 411-36.

[2]For an early review of the literature in this area, see C.-E.A. Winslow, The Cost of Sickness and the Price of Health (W.H.O. Monograph Series, No. 7: Geneva, 1951).

[3]For one of the more comprehensive studies of this genre, see Dorothy P. Rice, Estimating the Cost of Illness, Public Health Service Publication 947-6, Washington, D. C., May 1966.

further economic benefit. A major weakness of this technique has been to focus on output rather than output per capita as the measure of economic performance, and as indicated above, these two measures do not by any means always yield the same verdict with respect to a particular health program. Furthermore the technique ignores various important complexities of an economic system, like the dependence of wage-rates on variables like the capital stock which are themselves affected by the process of economic growth. A preferable method of measuring the economic consequences of health programs is to specify a general model of the entire economy in sufficient detail to permit recognition of all relevant relationships, and then employ simulation techniques to chart the response of per capita output to changes in public health policies. Some work of this kind has already been done, and its further evolution would seem to be quite feasible.[1]

A model designed to measure the effects of disease control on the future growth of per capita output would also, of course, be found suitable for making economic evaluations of birth control programs. Exercises with such models suggest indeed that birth control produces bigger economic gains per dollar of cost than almost any other public health program. Also suggested is that some of these other programs may even on balance produce economic setbacks. Malaria eradication, for example, may do this by causing a population explosion. This does not mean, to stress an earlier point, that malaria eradiction should be abandoned, but that it should only be adopted if the political weights attached to the reduction of mortality and morbidity

---

[1]The present author has developed three models of this type. In order of increasing complexity, they can be found in the following places: "Guidelines for Preliminary Project Appraisal: Public Health" (report prepared for Agency for International Development by Robert R. Nathan Associates, 1970); Robin Barlow, The Economic Effects of Malaria Eradication (Ann Arbor: Bureau of Public Health Economics, 1968); and Robin Barlow and Gordon W. Davies, "Project Evaluation with a Detailed Macroeconomic Model" (unpublished).

sufficiently exceed those attached to economic improvement.

HEALTH PLANNING OUTSIDE THE HEALTH SECTOR

We have assumed in this model of health planning that the Ministry of Public Health is assigned a given budget by higher authority, and that the task of the health planner is therefore to optimize the spending of this budget. The assumption of a fixed health budget is politically realistic, but it seems important nonetheless to point out that in a system without such constraints on the size of ministerial budgets, the health planner may decide to spend nothing at all on the Ministry of Public Health. This decision would be rational if the goals relevant to the health area, including the humanitarian ones, could be met more effectively by programs outside the health area as traditionally conceived. The point will not be pursued very far here, since a utopian system of social planning is implied. In most countries the strength of the medical establishment is sufficient to ensure that the Ministry of Public Health will survive.

The importance of nonhealth programs in promoting health goals has been suggested by the Auster study previously cited, among others. A cross-sectional analysis of death rates in the fifty American states revealed that medical inputs like the number of physicians or of paramedical personnel per capita were significantly less important as determinants of mortality than were certain socioeconomic variables like educational attainment and family income. Education, indeed, was the most influential of all the variables included in the multi-variate analysis. The provisional policy conclusion would be that the objective of mortality-reduction could be best served by transferring budget funds from the Ministry of Public Health to the Ministry of Education.

Some other programs outside the health area which may have a favorable

impact on mortality and morbidity might be briefly mentioned as follows:

- Changes in the design of highways and automobiles, leading to fewer traffic accidents. (Highway deaths and injuries are a problem of major proportions in Morocco.)
- Improved policing, which may deter crimes of violence to some extent.
- Housing construction, which may lower the incidence of tuberculosis and other diseases associated with overcrowded living conditions.
- The replacement of draught animals by machines in agriculture, leading to a decrease in animal-borne diseases and in diseases borne by flies and other insects associated with animal manure.

At the same time it should be recognized that health conditions might be worsened by some development projects. Irrigation schemes, for example, might spread bilharzia, or industrialization schemes might give rise to air pollution and an increase in bronchial disorders. Even if for jurisdictional reasons the health planner has no say over many government projects which possess important health aspects, it is at least to be hoped that the planners in the ministries that do have jurisdiction will incorporate health-related goals like the reduction of mortality into their planning processes.

Chapter V

MODEL IMPLEMENTATION

The implementation of the planning model described in the previous chapter clearly requires the amassing of a great deal of information on the numerous relationships involved. As indicated earlier, some work of this kind has already been done. Relationships between some tuberculosis-control activities and certain humanitarian and economic objectives have been investigated by Feldstein. Relationships between nutrition-supplementation activities and the mortality-reduction objective have been estimated from experiments conducted in Guatemala.[1] The studies reported by Grosse attempt to measure the mortality effects of a wide selection of government programs, ranging from syphilis control to colon-rectum cancer control. Relationships between mortality, morbidity, and economic output have been estimated in the work cited in the previous chapter. Other examples might readily be given. It is the intention of this chapter to add something to the body of quantitative knowledge required for health planning, or at least to indicate some methodologies that may prove fruitful. Specifically, the relationship between the activities of "inpatient care" and "prevention through mass vaccination" on the one hand and the objective of "mortality-reduction" on the other are explored with data provided by the Moroccan experience. The input costs of these activities are also examined, so that comparisons can be made--among an admittedly limited set of options--with a view to discovering what would be the cheapest way of saving lives.

---

[1] Werner Ascoli et al., "Nutrition and Infection Field Study in Guatemalan Villages, 1959-64: IV. Deaths of Infants and Preschool Children," Archives of Environmental Health, XV (October 1967), pp. 439-49.

LIFE-SAVING EFFECTS OF HOSPITALIZATION

Virtually all of the studies which have examined the mortality effects of public health activities have focussed on activities which aim to control a single disease or a restricted set of diseases. Thus there are analyses of tuberculosis control, of malaria eradication, or of anti-smoking campaigns. Few attempts have been made to measure the number of lives saved by a system of general hospitals, like those in Morocco, which stand ready to treat any patient who is referred there and which must therefore cope with a very wide range of different diseases.

How can the number of lives saved annually by a general hospital be measured? There are at least two approaches which would seem to hold some promise. The first of these, which might be called the "statistical" approach, would involve a statistical comparison between districts endowed in varying degrees with general hospital facilities. Death rates in each district would be examined, to see if districts with many such facilities experienced less mortality than did those with fewer, all other relevant factors being held constant. Involved here would be an extension of the cross-sectional multivariate analysis reported by Auster *et al*. The degree of correlation would be measured between district death rates on the one hand and each of the potentially important determinants of mortality on the other, among which might appear the following:

a) hospital beds per capita, standardized in some way for the quality and quantity of the staff and ancillary services associated with those beds;

b) some measure of the quantity and quality of outpatient services, which clearly act as a substitute for hospitalization in many instances;

c) an indicator of the local disease-prevention activities;

d) average family income, educational attainment, and other socioeconomic and environmental variables.

The degree of correlation between the death rates and variable (a) could then be used to estimate the number of lives saved by hospitalization.

This kind of analysis presents certain problems, and will not be attempted here. It is not easy to obtain the requisite data in the setting of a low-income country, and the high degree of correlation which may be presumed to exist between the hospital variable and some of the other explanatory variables suggested would make it difficult to isolate the effects of hospitalization on mortality.

The second approach would be on a "case-by-case" basis, and would involve a panel of medical experts examining the medical and personal records of a sample of hospital patients with a view to estimating the likelihood in each case that hospitalization had been life-saving. A fair trial of this approach cannot be attempted here, through lack of the necessary resources. But it has been possible to design a primitive version thereof, which may prove useful as establishing rough orders of magnitude.

A sample of patient records was drawn from three general hospitals of varying sizes located in different towns of Morocco. The records contained diagnostic information, which was later coded according to the three-digit categories of the International Classification of Diseases. The distribution of patients between the most frequently used categories is shown in Table 6. The period covered is from June through September, 1971, that being the only period for which records from all three hospitals were available at the time of sampling.

For each diagnostic category an estimate was then made of the likelihood that hospitalization had been life-saving. More precisely, the measure

Table 6

Patient Diagnoses in Three Moroccan General Hospitals, June-Sept. 1971

Diagnoses[1]	Percentage distribution of sampled patients			Assumed negative effect of hospitalization on probability of dying within one year
	Large-sized hospital	Medium-sized hospital	Small-sized hospital	
Delivery without mention of complication	20.4	22.2	32.4	.01
Diarrheal disease	27.9	3.1	31.2	.02
Spontaneous abortion	3.5	4.3	5.2	.01
Ill-defined heart disease	2.0	3.7	1.2	.05
Typhoid fever	2.0	1.9	1.7	.10
"Other" diseases of respiratory system	0.5	4.9	0.6	.05
Diabetes mellitus	2.0	2.5	-	.05
"Other" ill-defined and unknown causes of morbidity and mortality	0.5	4.3	-	.02
Enteritis due to "other" specified organism	3.5	-	-	.02
Appendicitis, unqualified	1.0	1.9	1.2	.50
Abortion not specified as induced or spontaneous	1.0	0.6	1.7	.01
"Other" general symptoms	-	-	2.9	.02
Injury, "other" and unspecified	-	2.5	0.6	.10
Inguinal hernia without mention of obstruction	0.5	1.2	0.6	.00
"Other" diseases of liver	0.5	-	1.7	.02
"Other" cellulitis and abscess	1.5	0.6	-	.05
Fracture of "other" and unspecified parts of femur	0.5	1.2	0.6	.00
Toxic effect of "other" substances chiefly non-medicinal as to source	-	1.2	1.2	.10
Other diagnoses	32.7	43.9	17.2	.02
Total	100.0	100.0	100.0	
Number of cases	201	162	173	
Number of lives saved per 100 patients[2]	2.55	3.39	2.49	

[1]Diagnoses follow the terminology of the International Classification of Diseases and are listed in order of the frequency with which they appeared among the patients of the three hospitals combined.

[2]Calculated as the sum of the products of (a) the entries in the column in question and (b) the entries in the right-hand column.

sought was the effect of hospitalization on the probability of dying within one year. In the case of a person with acute appendicitis, for example, the probability that he will die within one year is reduced if he is admitted to a hospital and there receives whatever treatment is available. This reduction in the probability of dying, if applied to all appendicitis patients admitted during the year, provides an estimate of the number of such patients whose lives were saved by hospitalization.

The estimates of probability changes shown in Table 6 are based on information obtained from medical reference works and other sources, but no great scientific validity is claimed for them, and they are intended to be primarily illustrative or hypothetical. They could obviously be improved upon by collecting more detailed diagnostic information and by arranging for consultations with medical experts.

Such as they are, the estimates indicate that the three hospitals respectively saved 2.55, 3.39, and 2.49 lives for each 100 patients admitted. According to the Ministry of Public Health's Bulletin Annuel d'Information Sanitaire, the total numbers of patients admitted by the three hospitals in 1971 were 16,392, 6,936, and 2,306 respectively. Hence we can estimate that the hospitals saved 418, 235, and 57 lives respectively during the year.

COSTS OF HOSPITALIZATION

As explained in Chapter 2, record-keeping procedures in the Moroccan public health system do not permit an easy identification of the costs of specific activities, but some rough estimates can nonetheless be made. In measuring the costs incurred by the three hospitals described above, we can first identify three categories of such costs: personnel salaries, other operating expenses (pharmaceuticals, etc.), and depreciation on plant

and equipment. The salaries can be estimated with some precision, since it is possible to find out the numbers of personnel of different grades employed in each hospital (not at given times in the past, but at the time of inquiry), and salary levels typical for each grade are also known. This information on the three hospitals is presented in Table 7. Total salaries for 1971 can be estimated as 2.96, 1.80, and 0.36 million dirhams respectively.

Estimates of other operating expenses and depreciation can be derived from ministerial documents relating to hospital investment projects proposed for the 1968-72 Plan. These documents provide data on the expected construction and equipment costs of the new hospitals (or hospital additions) proposed, as well as projections of salaries and other operating costs. The estimates were apparently based on some informal studies done by ministerial staff on the costs of existing hospitals. The planning documents indicate that for general hospitals, operating expenses other than salaries approximated 80 per cent of salaries, while the total cost of plant and equipment was about 25,000 dirhams per bed. A replacement-cost figure for 1971, which can serve as the basis for depreciation estimates, would be perhaps 20 per cent higher than 25,000 dirhams. The latter figure applies to the situation in 1967, since when there has been some inflation of costs.

Grouping these various estimates together, the annual costs of the three hospitals in 1971 would be as follows (in millions of dirhams):

	Large-sized hospital (548 beds)	Medium-sized hospital (297 beds)	Small-sized hospital (60 beds)
Salaries	2.96	1.80	0.36
Other operating expenses	2.37	1.44	0.29
Straight-line replacement-cost depreciation on plant and equipment with assumed average life of 20 years	0.82	0.45	0.09
Total annual costs	6.15	3.69	0.74

Table 7

Personnel Employed in Three Moroccan General Hospitals, March 1972

	Large-sized hospital	Medium-sized hospital	Small-sized hospital	Approximate mean annual salary (dirhams)
Full-time physicians:				
Moroccans	4	2	1	30,000
Foreigners	7	8	1	50,000
Half-time physicians*	3	2	-	15,000
Interns	7	3	-	7,500
Pharmacists:				
Moroccans	1	1	-	30,000
Foreigners	-	-	-	50,000
Specialist health assistants	1	-	-	10,625
Graduate health assistants	30	15	2	8,750
Licensed health assistants	92	50	12	8,750
Health aides	63	14	7	6,250
Administrators	1	1	-	12,500
Under-administrators	2	1	1	10,000
Clerical personnel	4	5	1	6,250
Maintenance personnel	134	88	15	6,250
Total employed	349	190	40	

*The nationality of the half-time physicians (médecins conventionnés) was not ascertained. For salary estimation purposes, they are assumed here to be Moroccan.

Since we are interested not so much in the total costs of running the hospitals as in the costs of the inpatient treatment services, a final necessary adjustment is to subtract from the above totals the costs of other activities, principally outpatient care. In the case of the three Moroccan hospitals, the actual scope of these activities could not be determined, and so the assumption is made that the costs of the inpatient services accounted for 90 per cent of total hospital costs. This figure is based on the median value found in a recently published international comparison of hospital expenditures.[1]

[1]Brian Abel-Smith, An International Study of Health Expenditures (Geneva: W.H.O. Public Health Papers, 1967), pp. 58-59.

LIFE-SAVING EFFECTS OF VACCINATION

The maternal and child care units of the Moroccan public health system carry out mass programs of vaccinating infants and young children against certain diseases. The number of injections given in 1971 was as follows:

Anti-tuberculosis (BCG)	755,000
Anti-smallpox	2,605,000
Anti-diphtheria, tetanus, and whooping cough:	
First dose	319,518
Second dose	266,870
Third dose	238,992
Booster	143,709
Anti-polio:	
First dose	335,104
Second dose	259,043
Third dose	229,464
Booster	175,924

For measuring the number of lives saved by these injections, at least two approaches would seem to be possible, analogous to those discussed above in connection with hospitalization. A "statistical" approach would examine whether the course of death rates over time was in any way correlated with the expansion of the vaccination programs; or, in a cross-sectional version, would see whether death rates fell more in heavily vaccinated districts than in those less well covered. In Morocco the mortality data are inadequate for this kind of analysis.

An alternative approach is to estimate the number of lives saved on the basis of information about the disease-specific death rates prevailing before the establishment of the programs, supplemented by expert judgments about the effects of vaccination of the probabilities of contracting and dying from the diseases in question. This is the approach attempted here.

To develop an estimating formula, we can posit that if I_i injections are given to persons in age-sex group $\underline{i}$ at the beginning of Year 1, then L_1,

the number of lives saved in that year (more precisely, as in the case of the hospital analysis, the number of deaths postponed by more than one year) will be:

$$L_i = \sum_i I_i d_i s'_i f \qquad (1)$$

where d_i is the appropriate pre-vaccination disease-specific death rate applying to age-sex group i, s'_i is the survival rate for that age-sex group (the prevailing survival rate adjusted upwards for the mortality effects of vaccination), and f (ranging between zero and one, like the death and survival rates) is a measure of the effectiveness of the immunization.[1] If the immunization lasts for a second year, then the total number of lives saved by the injections given in Year 1 would become:

$$L_1 + L_2 = \sum_i (I_i d_i s'_i f + I_i d_{i+1} s'_i s'_{i+1} f) \ . \qquad (2)$$

If the injections given in Year 1 provided immunity for n years, the total number of lives saved by those injections would be:

$$\sum_{t=1}^{n} L_t = \sum_i (I_i d_i s'_i f + \ldots + I_i d_{i+n} s'_i \ldots s'_{i+n} f) \ . \qquad (3)$$

This reduces to the formula used for computation purposes:

$$\sum_{t=1}^{n} L_t = f \sum_i I_i (d_i s'_i + \ldots + d_{i+n} s'_i \ldots s'_{i+n}) \ . \qquad (4)$$

The best estimates available of the d_i, or the age-sex-disease specific death rates prevailing in a period before the vaccination programs were widely established, are shown in Table 8. The official statistics show no deaths as having been caused in that period by either smallpox or tetanus. The adjusted survival rates (s'_i) were obtained from the same sources used

---

[1] This formulation assumes that the persons actually vaccinated would have in the absence of vaccination the same mortality experience as the persons of the same age-sex group who were not vaccinated.

Table 8

Age-Sex-Disease-Specific Death Rates
in Morocco, 1960-62
Rates per 1,000 population

	Tuber-culosis	Diphtheria	Whooping cough	Polio	Pneumonia, bronchitis, etc.[1]	All causes
Males						
Aged under 1 yr.	1.28	0.56	1.64	0.08	24.28	172.84
1-4	1.14	0.62	0.41	0.08	5.53	27.01
5-14	0.34	0.03	0.01	0.01	0.41	3.46
15-24	0.87	0.00	0.00	0.00	0.17	3.85
25-44	2.61	0.00	0.00	0.00	0.41	10.55
45-64	4.30	0.00	0.00	0.00	1.70	27.90
65 and over	5.36	0.00	0.00	0.00	6.07	109.79
All males	1.65	0.13	0.13	0.02	2.38	20.72
Females						
Aged under 1 yr.	1.29	0.42	2.21	0.08	21.46	147.63
1-4	1.09	0.53	0.59	0.03	5.56	26.83
5-14	0.32	0.03	0.01	0.01	0.42	2.89
15-24	0.87	0.00	0.00	0.00	0.12	3.39
25-44	1.93	0.01	0.00	0.00	0.35	8.29
45-64	1.75	0.00	0.00	0.00	1.03	15.90
65 and over	2.69	0.00	0.00	0.00	4.44	94.94
All females	1.15	0.10	0.18	0.01	2.11	17.28
All Persons	1.40	0.12	0.15	0.01	2.24	19.00

[1]Also including "influenza, acute upper respiratory infections, and other diseases of the respiratory system."

Sources: for numbers of deaths by cause, age, and sex, Ministry of Public Health, Bulletin de l'Institut d'Hygiène: La Statistique des décès et de leurs causes en milieu urbain au Maroc, 1960 à 1962; for aggregate death rate (19 per 1,000), Plan and Statistics Division, Résultats de l'Enquête à objectifs multiples, 1961-63; for population by age and sex, United Nations, Demographic Yearbook.

for the death rates. The following assumptions were made about the effectiveness (f) and the duration in years (n) of the various immunizations:

	f	n
Anti-tuberculosis (BCG)	.50	12
Anti-smallpox	1.00	3
Anti-diphtheria, tetanus, and whooping cough:		
First dose	1.00	.083
Second dose	1.00	.083
Third dose	1.00	2
Booster	1.00	7
Anti-polio:		
First dose	1.00	.083
Second dose	1.00	.083
Third dose	1.00	2
Booster	1.00	7

Using these data and assumptions in Equation (4), we obtain the following estimates of the numbers of lives saved by the various injections given in 1971:

Anti-tuberculosis	2,220
Anti-smallpox	0
Anti-diphtheria, tetanus, and whooping cough	1,275
Anti-polio	65

One probable source of downward bias in these estimates might be briefly noted. The diseases in question may have caused many more deaths in the pre-vaccination period than is suggested by the official causes-of-death data used in Table 8. In particular, many deaths that were really due to tuberculosis or diphtheria may have been officially ascribed to pneumonia, bronchitis, influenza, acute upper respiratory infections, or other diseases of the respiratory system. As indicated in Table 8, this latter set of diseases appeared very frequently as an official cause of death. Hence the anti-tuberculosis vaccinations, for example, would reduce not only the number of deaths ascribed to tuberculosis, but also the number of those ascribed to pneumonia. The death rates used in Equation (4) should be adjusted upwards to reflect this phenomenon.

COSTS OF VACCINATION

The costs of the materials used in the vaccination programs, after allowance for spoilage, were reported in 1972 to be as follows:

Anti-tuberculosis	.21 dirhams per dose
Anti-smallpox	Provided free by the Pasteur Institute of France
Anti-diphtheria, tetanus, & whooping cough	.10 dirhams per dose
Anti-polio	.21 dirhams per dose

Account must also be taken of the labor costs of administering the doses. If it is assumed that (a) the average injection takes two minutes, (b) a working year averages 2,000 hours, and (c) the relevant annual salary is 9,000 dirhams (see Table 7), then the following estimates can be made of the total costs of the vaccination programs, including both material costs and labor costs:

Anti-tuberculosis	0.27 million dirhams
Anti-smallpox	0.39
Anti-diphtheria, tetanus, & whooping cough	0.24
Anti-polio	0.36

SOME COST-EFFECTIVENESS COMPARISONS

The estimates presented in this chapter of the lives saved by hospitalization and mass vaccination, along with the estimates of the costs of these activities, are brought together in Table 9. The cost per life saved can be computed, and these numbers suggest that hospitals are a much more expensive way of saving lives than are mass vaccination programs. The vaccination programs, however, do vary greatly from each other in their effectiveness per dirham of expenditure. The anti-tuberculosis and anti-diphtheria, tetanus, and whooping cough vaccinations save many lives at little cost, whereas that cannot be said of the anti-smallpox or anti-polio programs.

Before these results are taken as a vindication of preventive activities

Table 9

Lives Saved By and Costs of Selected Public Health Activities in Morocco, 1971

	Number of lives saved (deaths postponed by one year or more)	Cost (millions of dirhams)	Cost per life saved (dirhams)
Hospitals:			
Large-sized	418	5.53	13,200
Medium-sized	235	3.32	14,100
Small-sized	57	0.67	11,800
Mass vaccinations:			
Anti-tuberculosis	2,220	0.27	120
Anti-smallpox	0	0.39	...
Anti-diphtheria, tetanus, and whooping cough	1,275	0.24	190
Anti-polio	65	0.36	5,500

over curative ones, or as a justification for diverting budgetary resources from hospitals to mass vaccinations, attention should be paid to two matters which have been raised before but which deserve re-emphasis. First, the calculations leading to these results rest on many debatable assumptions and could be much improved through further research. Second, the existence of other objectives besides mortality-reduction should be recognized, and no policy recommendations should be made until the analyst has measured the contributions which the programs under review make towards these other objectives--morbidity reduction, economic improvement, and palliative care.

APPENDIX

PATIENT RECORDS IN SELECTED MOROCCAN HOSPITALS

Early in 1971 the collection of information about hospital patients in Morocco was placed on a uniform, centralized basis. All general hospitals were required to complete in triplicate a standard form (billet d'hospitalisation) for each patient. The form is reproduced in Figure 6. Two copies were to be retained by the hospital, and the third was to be sent to the General Service of Health Statistics in Rabat. A sample drawn from the Rabat copies provided the diagnostic information used in the previous chapter to estimate the number of lives saved by hospitalization. It seems desirable to include here some other tabulations derived from these records, both for their intrinsic interest and to bring to the attention of a wider audience the existence of a body of hospital records unusually comprehensive and detailed for an underdeveloped country. The billets present great opportunities for fruitful analysis.

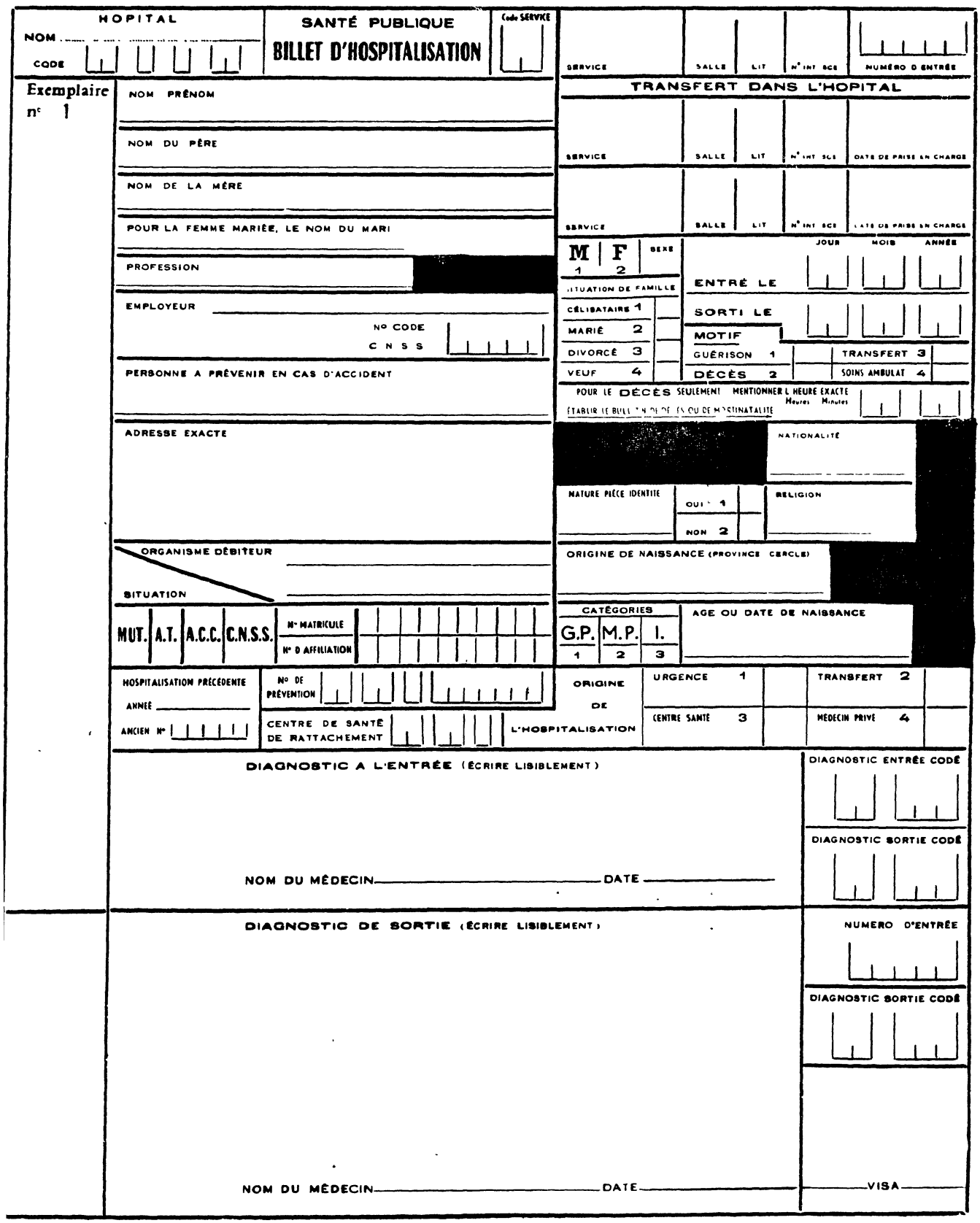
For the present project, three hospitals of varying sizes (548,297, and 60 beds), located in different towns of Morocco, were chosen for study. At the time of the study (March 1972), the total number of forms available for each hospital, arranged according to the month of discharge, was as follows:

	Large-sized hospital	Medium-sized hospital	Small-sized hospital
January 1971	0	0	0
February	0	277	0
March	0	506	1
April	2	560	157
May	17	529	5
June	824	535	9
July	1,606	689	331
August	1,596	544	218
September	1,101	581	183
October	0	642	146
November	0	599	145
December	0	641	144
Total	5,146	6,103	1,339

Figure 6

Patient Information Form

Used by Moroccan General Hospitals, 1971-1972



NOTE: The abbreviations at left center of the form refer to various health insurance schemes; those in the middle ("G.P.", "M.P.", "I") refer to the patient's payment category, which in principle varies according to his ability-to-pay ("Grand Payant", "Moyen Payant", and "Indigent").

It was clear that if a proper comparison between the activities of the three hospitals was to be made, the sampling should ensure that a sufficient number of cases be available from each hospital for the months of June-September. Those were the only months for which the records from all three hospitals appeared to be reasonably complete. Sampling ratios were accordingly chosen to yield approximately equal numbers of cases from each hospital for this four-month period, as well as a total sample of manageable size (about one thousand). Hence a sampling ratio of 1 in 25 was chosen for the large-sized hospital, 1 in 15 for the medium-sized hospital, and 1 in 4 for the small-sized hospital. From the stack of forms from the large-sized hospital, which were ordered by date of discharge, every twenty-fifth form was selected, and similarly for the other two hospitals. A total of 956 forms was thus obtained. Sixteen of these cases were not bona fide patients, but had entered the hospitals as companions of relatives or friends who were patients. The final sample therefore included 940 cases.

Not all of the information requested on the forms was regularly available for these cases. Some sections were habitually left blank by the hospital personnel responsible for their completion. The patient's financial liability--as "grand payant," "moyen payant," or "indigent"--normally went unrecorded. The circumstances of discharge (cure, death, transfer, or ambulatory care), information on which would have been useful for the analysis of lives saved, were rarely noted. But other sections were faithfully completed, and thus fairly complete information was available on the following variables of interest:

Sex

Age

Address of patient, and hence the distance of his residence from the hospital

Dates of admission and discharge, and hence the length of stay

Diagnosis, both a provisional one at the time of admission and a more definite one arrived at later.

Various relationships between these variables are presented in Tables 10-15.

The tables more or less speak for themselves, but some particular points of interest which emerge from them might be briefly noted:

a) Over a third of the sample was in hospital for maternity reasons (Table 10). The great majority of these cases presented no apparent complications: "accouchement normal" was the standard notation. Questions might be raised about the efficiency of devoting this much space in general hospitals to cases which could in almost all instances have been satisfactorily handled in much simpler facilities--maternity clinics or private homes.

b) The high frequency of "infective and parasitic diseases" (Table 10) was due in large part to a cholera scare which in the summer of 1971 gripped the region where two of the selected hospitals were located. Some cases of cholera were identified in that area, and for several weeks the two hospitals were inundated with patients exhibiting one or more of the symptoms of cholera (e.g., diarrhea or vomiting). It is likely that many persons with ordinary digestive problems not normally leading to hospitalization were referred to the hospitals by the health authorities, who were naturally anxious to restrict the size of the cholera outbreak. There may well be a tendency for the infective and parasitic diseases to become more frequent relative to other diseases in the summer months (Table 11), but the events of 1971 in this particular region were surely atypical.

c) The significantly greater average length of stay in the medium-sized hospital (Table 14) was partly due to the fact that this hospital received only a small number of "pseudo-cholera" cases (Table 6 above). These cases normally involved only one or two days of hospitalization.

d) Over two-thirds of all patients resided in the town where the hospital was located (Table 15), and many of the remainder came from other towns, located both far and near. It seems reasonable to infer that the general hospitals of Morocco cater overwhelmingly to the urban population. The inhabitants of the rural areas, who account for perhaps two-thirds of the country's total population, seldom receive any hospital services.

Table 10

Diagnosis by Age and Sex

Percentage distributions of patients sampled from 3 general hospitals in Morocco[1]

Diagnosis	All patients[2]	Male patients					Female patients				
		Aged under 15	15-24	25-34	35-44	45 & over	Aged under 15	15-24	25-34	35-44	45 & over
Infective & parasitic diseases	19.3	33.7	21.2	31.7	32.3	27.7	35.3	11.9	4.3	9.4	32.1
Neoplasms	1.7	-	4.5	-	3.2	2.0	-	0.8	1.6	0.9	5.4
Endocrine, nutritional & metabolic diseases	1.6	1.2	3.0	-	4.8	1.0	5.9	1.7	0.5	0.9	1.8
Diseases of blood & blood-forming organs	0.7	2.4	1.5	-	1.6	1.0	-	-	1.1	-	-
Mental disorders	0.3	-	1.5	1.7	-	-	-	-	-	0.9	-
Diseases of nervous system & sense organs	2.0	2.4	6.1	-	-	4.0	2.0	-	-	2.8	7.1
Diseases of circulatory system	5.2	3.6	10.6	6.7	6.5	16.8	2.0	3.4	1.1	0.9	7.1
Diseases of respiratory system	6.1	16.9	3.0	3.3	6.5	11.9	13.7	1.7	2.2	5.7	5.4
Diseases of digestive system	9.3	6.0	13.6	20.0	17.7	20.8	3.9	5.9	3.8	4.7	8.9
Diseases of genito-urinary system	3.5	-	4.5	3.3	9.7	5.9	-	3.4	3.2	2.8	3.6
Complications of pregnancy, child-birth & the puerperium	34.2	-	-	-	-	-	2.0	61.0	76.8	68.9	17.9
Diseases of skin & subcutaneous tissue	1.3	1.2	1.5	1.7	3.2	-	2.0	2.5	0.5	-	1.8
Diseases of musculoskeletal system & connective tissue	0.6	3.6	1.5	-	1.6	-	-	0.8	-	-	-
Congenital anomalies	0.1	-	-	-	-	1.0	-	-	-	-	-
Certain causes of perinatal morbidity and mortality	-	-	-	-	-		-	-	-	-	-
Symptoms & ill-defined conditions	7.3	14.5	10.6	6.7	4.8	12.9	21.6	4.2	2.7	1.9	3.6
Accidents, poisonings, & violence	10.5	16.9	21.2	31.7	11.3	11.9	13.7	3.4	3.8	0.9	3.6
Diagnosis not ascertained	1.7	1.2	6.1	1.7	1.6	-	3.9	-	2.2	0.9	3.6
Total	105.4	103.6	110.6	108.3	104.8	116.8	105.9	100.9	103.8	101.9	101.8
Number of cases	940	83	66	60	62	101	51	118	185	106	56

[1]Columns add to more than 100 per cent because some patients were diagnosed as having two or more conditions.

[2]Including cases where age or sex was not ascertained.

Table 11

Diagnosis by Month of Hospital Admission

Percentage distributions of patients sampled from 3 general hospitals in Morocco[1]

Diagnosis	All patients	Month when patient admitted to hospital: Jan.-March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Infective & parasitic diseases	19.3	4.1	8.4	6.1	12.4	49.7	25.5	13.0	6.7	7.5	9.2
Neoplasms	1.7	2.7	4.2	4.1	-	1.1	-	3.5	2.2	1.5	-
Endocrine, nutritional, & metabolic diseases	1.6	2.7	-	-	2.2	0.6	2.5	1.7	3.4	1.5	-
Diseases of blood & blood-forming organs	0.7	-	-	-	1.1	0.6	0.6	0.9	-	1.5	3.7
Mental disorders	0.3	-	-	2.0	-	-	0.6	0.9	-	-	-
Diseases of the nervous system & sense organs	2.0	2.7	1.4	4.1	1.1	1.1	1.3	1.7	2.2	7.5	-
Diseases of circulatory system	5.2	10.8	9.9	8.2	6.7	1.1	5.7	7.0	1.1	3.0	3.7
Diseases of respiratory system	6.1	9.5	7.0	16.3	6.7	1.7	6.4	1.7	5.6	6.0	13.0
Diseases of digestive system	9.3	13.5	11.3	8.2	14.6	2.9	3.8	12.2	13.5	11.9	13.0
Diseases of genito-urinary system	3.5	1.4	4.2	6.1	6.7	1.1	1.9	2.6	7.9	4.5	3.7
Complications of pregnancy, child-birth & the puerperium	34.2	36.5	32.4	24.5	29.2	28.0	35.0	40.9	38.2	41.8	37.0
Diseases of skin & subcutaneous tissue	1.3	-	1.4	4.1	1.1	0.6	1.3	1.7	-	-	5.6
Diseases of musculoskeletal system & connective tissue	0.6	1.4	1.4	-	1.1	0.6	-	0.9	1.1	-	-
Congenital anomalies	0.1	-	-	-	-	0.6	-	-	-	-	-
Certain cases of perinatal morbidity and mortality	-	-	-	-	-	-	-	-	-	-	-
Symptoms & ill-defined conditions	7.3	4.1	8.4	14.3	7.9	5.1	8.2	3.5	11.2	9.0	7.4
Accidents, poisonings, & violence	10.5	12.2	14.1	16.3	6.7	6.3	11.5	10.4	15.7	10.4	7.
Diagnosis not ascertained	1.7	4.1	-	-	5.6	1.7	0.6	0.9	2.2	1.5	-
Total	105.4	105.4	104.2	114.3	103.4	102.3	105.1	103.5	111.2	107.5	103.7
Number of cases	940	74	71	49	89	175	157	115	89	67	54

[1]Columns add to more than 100 per cent because some patients were diagnosed as having two or more conditions.

Table 12

Length of Hospital Stay by Diagnosis

Percentage distributions of patients sampled from 3 general hospitals in Morocco

Diagnosis	Number of nights in hospital							Total	Number of cases[1]
	0 or 1	2 or 3	4-6	7-13	14-29	30 or more	Not ascertained		
Infective & parasitic diseases	28.2	24.9	16.6	15.5	12.7	1.7	0.6	100.0	181
Diseases of the circulatory system	6.2	6.2	4.2	33.3	41.7	8.3	-	100.0	49
Diseases of the respiratory system	8.9	5.4	17.9	37.5	21.1	8.9	-	100.0	57
Diseases of the digestive system	4.5	4.5	9.1	36.4	35.2	8.0	1.1	100.0	88
Diseases of the genito-urinary system	-	21.2	12.1	24.2	27.3	12.1	3.0	100.0	33
Complications of pregnancy, childbirth and the puerperium	52.3	33.0	6.2	5.6	0.9	0.6	1.2	100.0	321
Symptoms and ill-defined conditions	6.1	10.6	22.7	24.2	25.8	6.1	4.5	100.0	69
Accidents, poisonings, and violence	12.9	13.9	17.8	17.8	20.8	13.9	3.0	100.0	101
Other diagnoses[2]	6.3	10.1	12.7	27.9	32.9	7.6	2.5	100.0	79
All patients[3]	27.3	20.8	11.5	18.0	15.7	4.9	1.6	100.0	940

[1]Column adds to more than 940 because some patients were diagnosed as having two or more conditions.

[2]Neoplasms; endocrine, nutritional, and metabolic diseases; diseases of blood and blood-forming organs; mental disorders; diseases of the nervous system and sense organs; diseases of the skin and subcutaneous tissue; diseases of the musculoskeletal system and connective tissue; congenital anomalies; and certain causes of perinatal morbidity and mortality.

[3]Including cases where diagnosis was not ascertained.

Table 13

Length of Hospital Stay by Age and Sex

Percentage distributions of patients sampled from 3 general hospitals in Morocco

	Number of nights in hospital								
	0 or 1	2 or 3	4-6	7-13	14-29	30 or more	Not ascertained	Total	Number of cases
Male patients									
Aged under 15	16.9	7.2	19.3	21.7	27.7	6.0	1.2	100.0	83
15-24	12.1	9.1	13.6	19.7	31.8	12.1	1.5	100.0	66
25-34	15.0	16.7	15.0	16.7	26.7	8.3	1.7	100.0	60
35-44	6.5	17.7	16.1	29.0	19.4	9.7	1.6	100.0	62
45 and over	14.9	12.9	16.8	25.7	24.8	3.0	2.0	100.0	101
Female patients									
Aged under 15	25.5	21.6	9.8	21.6	15.7	3.9	2.0	100.0	51
15-24	39.0	28.0	7.6	14.4	5.1	3.4	2.5	100.0	118
25-34	42.2	28.6	8.6	10.3	7.0	2.2	1.1	100.0	185
35-44	39.6	29.2	5.7	16.0	6.6	1.9	0.9	100.0	106
45 and over	26.8	14.3	10.7	21.4	17.9	7.1	1.8	100.0	56
All patients[1]	27.3	20.8	11.5	18.0	15.7	4.9	1.6	100.0	940

[1]Including cases where age or sex was not ascertained.

Table 14

Length of Hospital Stay by Hospital Size

Percentage distributions of patients sampled from 3 general hospitals in Morocco

Number of nights in hospital	All patients	Large-sized hospital	Medium-sized hospital	Small-sized hospital
0 or 1	27.3	27.9	14.2	43.7
2 or 3	20.8	29.9	20.8	15.2
4 - 6	11.5	10.3	12.7	10.8
7 - 13	18.0	12.3	22.0	16.7
14 - 29	15.7	14.7	20.8	9.9
30 or more	4.9	2.9	8.3	1.9
Not ascertained	1.6	2.0	1.2	1.9
Total	100.0	100.0	100.0	100.0
Number of cases	940	205	413	322
Median no. of nights	4	3	7	2

Table 15

Residence of Patient by Hospital Size

Percentage distributions of patients sampled from 3 general hospitals in Morocco

Residence of patient	All patients	Large-sized hospital	Medium-sized hospital	Small-sized hospital
In same town where hospital located	67.5	75.6	67.5	62.1
Outside the town, but less than 25 km from hospital	10.0	2.0	6.3	19.9
More than 25 km from hospital	10.4	5.9	17.7	4.0
Location of residence not identified	6.6	9.7	2.9	9.3
Residence illegible or not stated	5.5	6.8	5.6	4.7
Total	100.0	100.0	100.0	100.0
Number of cases	940	205	413	322

Center for Research on Economic Development

CRED Discussion Papers

(A list of the titles of Discussion Papers 1-15 will be sent upon request.)

No. 16 C. Michael Aho, *"The Use of Export Projections in Allocating Foreign Aid among and Domestic Resources within Developing Countries,"* July 1971, 59 pp.

No. 17 Michael Kennedy, *"An Empirical Evaluation of the Two-Gap Model of Development,"* November 1971, 29 pp.

No. 18 John Naranjo and Richard C. Porter, *"The Impact of the Commonwealth Preference System on the Exports of Latin America to the United Kingdom,"* March 1972, 37 pp.

No. 19 Gary Fields, *"Private Returns to Investment in Higher Level of Education in Kenya,"* April 1972, 16 pp.

No. 20 Izevbuwa Osayimwese, *"An Application of Control Theory to Rural-Urban Migration and Urban Unemployment,"* May 1972, 19 pp.

No. 21 George Johnson, *"The Determination of Hourly Earnings in Urban Kenya,"* May 1972, 36 pp.

No. 22 Charles Staelin, *"The Cost and Composition of Indian Exports,"* May 1972, 41 pp.

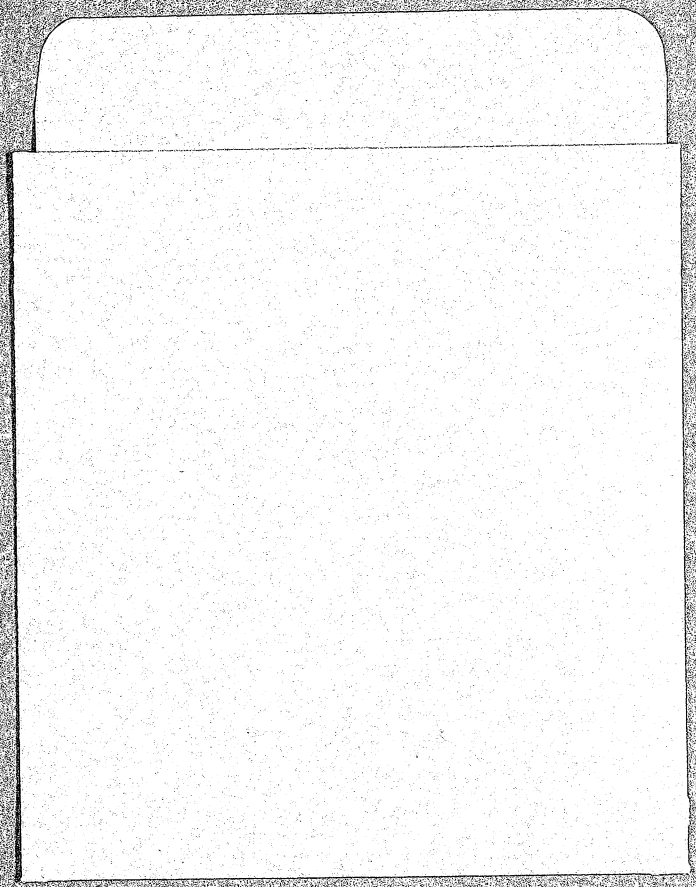
No. 23 Peter S. Heller, *"A Model of Public Sector Expenditure Dynamics in Less Developed Countries: The Kenyan Case,"* May 1972, 50 pp. Forthcoming in *Quarterly Journal of Economics.*

No. 24 Peter S. Heller, *"The Strategy of Health-Sector Planning in The People's Republic of China,"* July 1972, 62 pp. Forthcoming in a publication by the Josiah Macy Foundation.

No. 25 C.R. Winegarden, *"Determinants of International Differences in Educational Effort,"* September 1972, 31 pp.

No. 26 Charles Staelin, *"A General Equilibrium Model of Tariffs in a Non-Competitive Economy,"* March 1973, 29 pp.

No. 27 Robin Barlow, *"Planning Public Health Expenditures with Special Reference to Morocco,"* April 1973, 72 pp. (French 81 pp.) A part of task order No. 3, to A.I.D. Contract No. afr-675.



BRODART

MADE IN U.S.A.