Issues in the Allocation of Resources in the Medical Sector of Developing Countries: The Tunisian Case*

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In many parts of the developing world, resource allocation within the medical sector takes place in the context of a "medical referral" system. Studies of the health sector in such countries commonly conclude that there is considerable inefficiency and inequity in the allocation of medical resources. Focusing primarily on aggregative measures, a significant imbalance is invariably found in the level of expenditure and medical resources available per capita on an interregional and urban-rural basis. It is argued that an "excessive" level of expenditure is devoted to specialized urban hospitals rather than to primary health care facilities for the mass of the population.[1] The usual policy conclusion is that a more decentralized allocation of resources would be more equitable and efficient.

This paper contends that even the optimal allocation of medical resources in a less developed country (LDC) may exhibit, on the surface, many of these putative "imbalances" and yet be both efficient and equitable. Consequently, any meaningful policy analysis of a country's health system requires both a description of the pattern of resource allocation and an analysis of how the system in fact delivers medical care to the population. Is access to the more expensive medical facili-

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[1] For an example of this, see M. Sharpston, "Uneven Geographical Distribution of Medical Care: A Ghanaian Case Study," *Journal of Developing Studies*, vol. 8, no. 2 (January 1972). For a more sophisticated analysis of the health sector in developing countries, see Robin Barlow, "Application of a Health Planning Model in Morocco," *International Journal of Health Services* 6, no. 1 (Winter 1976): 102–22; and N. R. E. Fendall, "Primary Medical Care in Developing Countries," *International Journal of Health Services* 2, no. 2 (Spring 1972): 297–315.

ties a function of medical need, or is it determined by income and proximity to the hospital? Are there significant disparities in the quality of medical services available to different segments of the population? In other words, behind the mask of obvious surface imbalances, what is the actual operating efficiency of the medical system at a microlevel? These issues are examined through an analysis of Tunisia's medical system. In Section I, I briefly examine the theoretical rationale for reliance on a medical referral system and describe its institutional form in Tunisia. In Section II, I heuristically discuss the kinds of disequilibria that may arise in such a system and the conditions required for optimality. In Section III, I evaluate how well Tunisia's medical referral system satisfies these conditions.

I. The Role of Medical Referral Systems in Developing Countries

In organizational terms, a medical referral system may be likened to a pyramid of medical institutions. In its ideal form, at any level, i, of the pyramid, there are a set of $j(i)$ medical institutions, all of which are comparable in quality. A patient with a given disease could, in principle, go to any institution at a given level and receive the same quality of medical care. Yet across levels of the pyramid, these institutions are qualitatively different. At the base of the pyramid, there should be a network of accessible, low-cost medical institutions. These provide preventive health services and have a capacity to diagnose and treat most of their client community's recurrent medical problems on an ambulatory or outpatient basis. Moving up the pyramid, the number of institutions diminishes while the capacity for sophisticated treatment, as well as the attendant cost per case, increases.

Institutions at different levels are linked by a referral process. For example, a small fraction of the patients seen at the base-level institutions require further referral action, consisting of either primary inpatient care, specialty inpatient care, or more sophisticated diagnostic procedures. An implicit requirement of such a system is that institutions at each level must be able to screen out those medical problems that they cannot diagnose or treat at an acceptable standard of care and refer them upward to that institutional tier of the pyramid with such a capacity. Presumably, for the system to be efficient in an economic sense, no patient should be treated or referred to a higher level of the pyramid if an acceptable diagnosis or treatment is possible at an institution lower on the pyramid.

There is nothing inherently sacred about choosing a medical referral system for allocating resources in the medical sector of an LDC. Ideally, the organization of a country's health and medical system should reflect its solution to the problem of how to distribute limited financial and human resources to optimize the health status of its population. The

structure of this optimization problem and the policy issues that arise in its theoretical formulation can be reasonably well specified,[2] but, practically, empirical estimation and solution of the problem are extremely difficult due to its complexity and to an acute unavailability of data on many of the behavioral, epidemiological, medical, and economic relationships. Nevertheless, we can intuit the reasons why some form of medical referral system emerges as the implicit policy choice of most developing countries.[3]

There are five considerations which principally influence the choice of a particular medical resource allocation strategy. The first, and most important, is the magnitude and composition of a country's disease (or morbidity) burden. Each disease process is associated with particular consequences, in terms of pain and suffering, and with specific technologies that are required either to prevent the disease or to effect some change in its impact on the individual and society. In most countries, the most frequent health problems require, for diagnosis and treatment, only a small amount of human physical capital and intermediate inputs. For a wide range of diseases, it has been repeatedly demonstrated that a paramedic with minimal training can diagnose almost as accurately and treat almost as effectively as a physician.[4] At any point in time, only a small fraction of a country's population is afflicted with disease problems for which the diagnostic and treatment process requires sophisticated and expensive medical skills and equipment.

Second, the significant indivisibilities and complementaries associated with the more complex medical inputs necessitate that specialty medical care be delivered at a central hospital unit. Although in theory a surgeon's or a pediatrician's time could be distributed across many institutions or villages through the use of mobile medical teams, this is usually cost ineffective. A large fraction of the specialist's time is wasted in travel, and his effectiveness is diluted without the array of proper equipment.

These two factors alone bias policy toward a medical referral system. The overhead cost of the diagnostic and treatment process is high for many disease problems, while the percentage of the population in

[2] For a mathematical specification of the problem, see Peter S. Heller, "Issues in the Allocation of Resources in the Health Sector of Developing Countries," CRED Discussion Paper no. 67, University of Michigan, February 1977.

[3] It must be noted that for most LDCs the core of the medical system's capacity was shaped more by historical factors, such as the colonial experience, than by any theoretical design. Also, government policy memoranda often do not explicitly relate the organization of the medical care system to theoretical criteria. Yet whenever health officials are pressed concerning the rationale for a given pattern of resource allocation, the reasons given in the text are inevitably raised. In some countries, this policy rationale is made explicit (e.g., some of the East African countries, Malaysia, Tunisia).

[4] See Fendall.

need of such treatment is small. Economies of scale dictate against the proliferation of complex treatment facilities to many hospitals in order to minimize the underutilization of scarce medical resources. This suggests that the client population for any complex medical specialty service be drawn from a large population pool. Conversely, one may satisfy a large fraction of the demand for medical services through an abundant network of more limited, primary-care hospitals and/or clinics.

Third, the topographical conditions of the country and the pattern of population settlement influence the pattern of distribution of facilities across pyramid levels. In a country with several major population centers, a dispersed rural population scattered around smaller market towns, and a road network that connects these towns to the urban centers, a strong argument exists for locating the higher-level institutions in the larger cities. If the terrain or road conditions preclude referral between institutions at low cost, the rationale for limiting the number of specialty institutions breaks down. A more decentralized referral system may be necessary, with a greater dispersal of medical specialty care to the lower-level institutions.

Fourth, a country must implicitly choose the standard of medical care it desires for the treatment of disease problems. What is the minimally acceptable level of care that must be provided if an individual is ill? Conversely, the social decision maker may be forced by opportunity-cost considerations to limit the quality of care that can be provided to patients with certain highly complex illnesses.[5] Many countries shy away from such decisions, asserting that it is politically undesirable that any medical problems not be treatable within the country.

Inevitably, this raises the fifth factor—the nature of the country's objective function. A growth-oriented society may ascribe significant weight to achieving relatively optimal treatment of diseases afflicting high-productivity individuals or may provide different qualities of care to individuals with different productivity levels. Most LDCs claim to adhere to the egalitarian premise that income should not be a factor determining the degree of access or quality of care. The last three factors do not compellingly argue for abandonment of a medical referral system but are relevant in determining the allocation of resources across levels of the pyramid.

Tunisia relies on a medical referral system. The country is divided into health regions, which are further subdivided into health districts. Each district contains a regional or a district hospital. In each district, there is a network of primary-care outpatient clinics held in the rural and urban dispensaries or in the general medicine outpatient clinic of the district hospital. In addition, there is an emerging network of ma-

[5] E.g., the opportunity cost of a kidney dialysis machine is likely to be very high for many developing countries.

ternal-child health centers. At the next pyramid level, inpatient capacity in the primary medical services of general medicine and obstetrics (and often pediatrics) is provided at almost all the district and regional hospitals. Patients in need of more specialized services will be referred to the regional hospital, where a limited range of medical specialty services is available (usually surgery, gynecology, and ophthalmology).

At the top of the pyramid are six general hospitals and several specialty institutes located in four major urban centers. The general hospitals provide primary inpatient and outpatient services to their urban populations, as well as other medical specialty services for the entire region (e.g., dermatology, ophthalmology, orthopedics, otolaryngology, cardiology, and neurosurgery). In addition, each general hospital receives patients referred from a designated set of other regions. Usually these are patients that cannot be adequately treated within the regional hospital of their own region. For example, the general hospital in the region of Sousse also receives cases referred from the regions of Kasserine and Kairouan. Finally, the institutes serve as national referral centers for complex cases in specific specialty services.[6] Some of the general hospitals and institutes also are teaching institutions affiliated with the University of Tunis Medical School.

From table 1, it is apparent that the expenditure and capacity at the upper pyramid levels of Tunisia's referral system receive the dominant share of allocated resources.[7] Although institutions at the base levels of the pyramid are more numerous, the general hospital and institute levels alone have 60% of total bed capacity; the district hospitals have only 18%. Inpatient services at the upper two tiers account for 42% of total ministry expenditure, whereas expenditure on all outpatient services accounts for only 17.2%. Expenditures on primary outpatient care and maternal-child health account for an even smaller share of the budget. Approximately D 6.6 million was spent on 88,000 specialty inpatients, D 2.0 million was spent on 181,000 general medicine and gynecology-obstetrics inpatients, and D 2.5 million on 5,120,000 outpatients.

Does this represent an appropriate allocation of resources? Should more emphasis be accorded to improving the quality of the primary outpatient and inpatient services available at the pyramid base, at the expense of lowering quality at the upper pyramid levels? These equity issues are drawn into sharper perspective by their associated interre-

[6] There are specific institutes for pediatrics, psychiatry, tuberculosis, cancer, orthopedics, and ophthalmology.

[7] These estimates have been derived by econometric analysis and are discussed further in Peter S. Heller, "An Analysis of the Structure, Equity, and Effectiveness of Public Sector Health Systems in Developing Countries: The Tunisian Case, 1960–1972," CRED Discussion Paper no. 43, University of Michigan, June 1975.

TABLE 1

THE CAPACITY OF THE TUNISIAN REFERRAL SYSTEM: 1971

Type of Institution	No. of Units	Specialty Beds*	Primary Beds*	No. of Inpatient Admissions	Specialty Outpatient Visits (Thousands)†	Primary Outpatient Visits (Thousands)‡	Public Sector Expenditure (D Thousands)
Institutes	8	2,567	...	8,170	200.7	...	2,356.8
General hospitals: inpatient service	7	3,546	1,243	113,187	...	...	3,738.2
Regional hospitals: inpatient service	12	1,726	1,226	85,500	...	...	1,807.5
District hospitals: inpatient service	54	376	1,896	60,815	...	...	672.0
General hospitals: outpatient service§	7	...	...	...	648.8	149.9	366.8
Regional hospitals: outpatient service§	12	...	...	...	444.6	470.3	271.8
District hospitals: outpatient service§	54	...	...	...	77.1	978.2	194.2
Dispensaries:							
Urban‡	61	...	...	...	...	996.3	626.0
Rural‡	327	...	...	...	...	1,360.0	371.8
Maternal-child health centers	88	...	...	...	...	...	665.0
Total	...	8,215	4,365	267,672	1,371.2	3,954.7	14,531.03‖

SOURCES.—Heller, "An Analysis of the Structure, Equity, and Effectiveness of Public Sector Health Systems in Developing Countries: The Tunisian Case, 1960–1972," CRED Discussion Paper no. 43, University of Michigan, June 1975; Ministère de la Santé Publique, République Tunisienne, *Statistiques 1970* (Tunis, 1972), *Statistiques: Réseau et functionnement des services de santé, 1971*, vol. 2 (Tunis, 1973), *Profils demographiques, socioéconomique et sanitaire régionaux* (Tunis, 1973).

NOTE.—Percentage of population living in districts with a general hospital and/or institute is 25; with a regional hospital, 15; and with a district hospital, 60.

* Primary inpatient services include general medicine, gynecology, and obstetrics. Specialty inpatient services include all other specialties.

† Includes outpatient visits and consultations other than in general medicine.

‡ Includes outpatient visits and consultations in general medicine.

§ Includes both specialty and primary outpatient services.

‖ Estimated 1971 Ministry of Health expenditure (includes expenditures not itemized above).

gional and urban-rural differences. Since most of the general hospitals and institutes are located in the capitals of Tunisia's four most developed regions, there are large interregional differentials in the level of government medical expenditure per capita and in the supply of hospital beds, physicians, and paramedical workers per capita. For example, in 1971 the mean regional government medical expenditure per capita was D 1.59. In the urban regions of Sousse, Bizerte, and Tunis it reached D 2.39, D 2.21, and D 4.56, respectively.[8] Since each regional and general hospital is situated in the major metropolitan center of its region, there are potentially large urban-rural differentials in available medical resources per capita. If access to the upper levels of the pyramid was effectively limited to urban residents, the bulk of public sector resources would be spent on only 20%–30% of the population. In this case, the referral system's legitimacy becomes highly questionable on equity and efficiency grounds.

Yet I argued above that a comparable pattern of resource allocation across pyramid levels, and probably on a spatial basis, might characterize even the optimal referral system for Tunisia (if we knew it).[9] Consequently, to evaluate the real equity or efficiency of such a system, one must go beyond these surface indicators and address more fundamental questions. Can we empirically evaluate the sufficiency of the resources of different pyramid levels? Second, even if resources are optimally distributed across levels, does the system's referral mechanism operate effectively? If patients are not being referred, or if there are severe inequalities in access to higher-level units, then the rationale for concentration of high-quality resources in a small set of units breaks down. Are there obvious points of demand pressure or inefficiency which suggest ways in which the "medical" output of the medical system could be increased? What indicators measure the success or failure of a medical referral system to operate according to its own rationale and thus illuminate fundamental disequilibria?

II. Evaluation Criteria for a Referral System

What criteria would we expect an optimal referral structure to satisfy? Two requirements of an optimal referral system are that the number of

[8] Ibid.

[9] For example, from the little that is known concerning the much-acclaimed Chinese health system, the distribution of capacity and resources suggests structural characteristics similar to Tunisia, with a significant proportion of health-sector resources devoted to the higher pyramid levels. See P. S. Heller, "The Strategy of Health Sector Planning," in *Public Health in the People's Republic of China*, ed. M. Wegman, T. Lin, and E. Purcell (New York: Josiah Macy Foundation, 1973); T. W. Hu, "An Economic Analysis of the Cooperative Medical Services in the People's Republic of China," mimeographed (Pennsylvania State University, 1975); L. Orleans, *Health Policies and Services in China* (Washington, D.C.: Government Printing Office, 1974).

patients that should be referred to higher-level institutions equals (1) the number than can be referred, and (2) the number actually referred. Specifically, let β_{ij}^{i+q} equal the minimum fraction of patients seen at the j^{th} institution of level i that should be referred to some higher level, $i + q$, of the referral system in order to obtain the policy-determined standard of care, hereafter denoted as $\bar{s}$. For example, if the level $i = 1$ related to an outpatient clinic and $i = 3$ to a primary inpatient facility, then β_{1j}^{3} denotes the share of institution j's outpatients that should be referred for further diagnosis or for hospitalization. This could mean referral within the same institution (as within a general hospital) or across institutions.[10]

Presumably, an increase in inputs to an institution would permit a lower referral percentage, either by increasing the quality of medical care or by allowing a large case load with quality levels unchanged. Similarly, the particular case mix of its patients will determine the adequacy of its resources relative to the desired standard of care. Although possible, I assume institutions will not cram facilities with patients at the expense of lowering the standard of care below $\bar{s}$. Thus, an increase in patient demand will necessitate referring more patients to preclude dilution of $\bar{s}$. In a medical referral system, $\beta_{ij}^{i+q} > 0$ implies either that there are discrete jumps in the quality of medical care provided at higher pyramid levels or that there is inadequate capacity at a given level i.

Let α_{ij}^{i+q} equal the maximum percentage of patients of institution j at level i that can be referred to a higher level, $i + q$. In effect, α is determined by the absorptive capacity of the higher-level referral institutions. The greater their inputs, the higher α_{ij}^{i+q}.[11] *Ceteris paribus,* the greater the competition for this capacity, proxied by the pool of potential referrals, the lower the share of patients from any institution that can be referred. The greater the distance to the higher referral unit, the higher the cost of any referral. The higher the standard of care, $\bar{s}$, that must be provided at any unit in the system, the lower its own absorptive capacity for referrals, so that α_{ij}^{i+q} would fall. From our previous example, α_{1j}^{3} represents the maximum fraction of outpatients that any outpatient clinic, j, can refer for primary inpatient care. Finally, let γ_{ij}^{i+q} be the percentage of patients actually referred from institution j at level i to a referral unit at a higher level, $i + q$.

[10] One institution may embody several levels. A general hospital in an urban area services both the general urban population for common disease problems and a larger regional or national population for complex specialty problems. There may be a primary-care outpatient clinic and separate secondary specialist clinics.

[11] The absorptive capacity is not completely fixed. Any inpatient unit has some flexibility to increase the flow of admissions by lowering the average duration of stay and substituting ambulatory treatment. However, there is a limit to this flexibility in that the length of stay for any patient is largely medically determined.

Two necessary though not sufficient conditions of optimality for a medical referral system would be that $\beta_{ij}{}^{i+q} = \alpha_{ij}{}^{i+q}$ and that the actual standard of medical care, denoted s^*, provided to any patient not exceed the policy-prescribed standard $\bar{s}$ if at any other level $s^* < \bar{s}$. If the standard of care is higher than $\bar{s}$, it suggests that resources could be diverted to other levels of the referral system with net social gain. It would be inefficient to design a system to "medically" require hospitalization of $\beta_{ij}{}^{i+q}\%$ of patients, with only $\alpha_{ij}{}^{i+q}\% < \beta_{ij}{}^{i+q}\%$ of them able to be absorbed at the $(i+q)^{\text{th}}$ level. Even if this equality holds, the system is operating efficiently only if $\gamma_{ij}{}^{i+q} = \beta_{ij}{}^{i+q} = \alpha_{ij}{}^{i+q}$. Any inequality in these variables implies disequilibria and a lower operating efficiency for the system. What is the significance of a disequilibrium in these measures?

If $\beta_{ij}{}^{i+q} > \alpha_{ij}{}^{i+q}$, it may reflect two possible disequilibria in the referral structure. Both nominally suggest insufficient capacity at level $i+q$, but in only one case would increased capacity at the $(i+q)^{\text{th}}$ level be required.

(1) Qualitative inadequacy at level i. Specifically, the i-level institutions are deficient in the medical skills or equipment required to treat a large fraction of their cases. Ironically, this may lead to excess capacity in the i-level institutions. For example, in the district hospitals of Tunisia, physicians are willing to hospitalize only those patients that can be adequately treated (at an implicit standard of care $\bar{s}$) given the available budgetary resources of the hospital. Consequently, hospital bed capacity is only 50%–60% utilized. Institutions resolve this disequilibrium either by referring many patients to higher-level units or treating them on an ambulatory basis at a lower standard of care.

(2) Quantitative inadequacy at either level i or level $i+q$. The volume of patients requiring the standard of services, $\bar{s}$, provided at level i may exceed its delivery capacity, but referrals exceed the absorption capacity of the higher levels. This disequilibrium may lead to patients not being treated or having treatment deferred. In many Tunisian outpatient clinics, the physician will arbitrarily limit the number of outpatients to be seen during a clinic. Other patients are turned away for that day's clinic.

Alternatively, $\beta_{ij}{}^{i+q} < \alpha_{ij}{}^{i+q}$ implies excess capacity at higher-level units; the volume of patients that can be referred is greater than those in need of referral. As a result, capacity in referral institutions is either underutilized or is maintained by admitting patients with illnesses requiring less complicated treatment. Patients that could be treated at lower-cost inpatient institutions or on an ambulatory basis receive higher-quality treatment than necessary. This disequilibrium would be signaled by only narrow differences in the case mix of patients in the

higher- and lower-level units. A cutback in the higher-capacity units would be warranted.

A narrow case mix difference may arise even with $\beta_{ij}^{i+q} > \alpha_{ij}^{i+q}$, although it is unlikely in most LDCs. With bottlenecks to referral, the actual percentage of patients referred, γ_{ij}^{i+q}, may be less than both α_{ij}^{i+q} and β_{ij}^{i+q}. The low severity of the case mix at the $(i + q)^{\text{th}}$ level would not reflect an absence of complex cases at lower levels but, rather, obstacles to their referral. Such factors as inadequate communication facilities, high patient-borne referral costs, negligible public ambulance capacity, cultural resistance to hospitalization, etc., may impede the functioning of the referral process.

Alternatively, $\gamma_{ij}^{i+q} < \alpha_{ij}^{i+q}$ may arise from differences in the perceptions of sending and receiving institutions. If higher-level units perceive a different role for their institution, they may refuse referrals for residents of other regions or other units. If the lower-level units cannot adequately diagnose or treat their patients due to incompetence and refer them excessively, this may engender resistance at the receiving-level institutions.

Finally, $\beta_{ij}^{i+q} > \gamma_{ij}^{iq}$ may arise at the initial point of demand for services. Let β_{0j}^{1} serve as a morbidity index, where β_{0j}^{1} equals the fraction of the population of an area j that should appear at an outpatient clinic, given their health status. If γ_{0j}^{1} equals the percentage of people who actually go to the outpatient clinic, then $(\beta_{0j}^{1} - \gamma_{0j}^{1})$ equals the fraction of the population with illness which is not reached by the medical system. This group is determined by the medicocultural perceptions of the population, by the quality of medical care provided, and by the cost of obtaining care. The equality of $\beta_{0j}^{1} = \gamma_{0j}^{1} = \alpha_{0j}^{1}$ is obviously necessary for optimality, though it is less amenable to strictly technological intervention.[12]

III. The Referral Structure in Tunisia in Practice

Several referral options are realistically available in Tunisia. At a primary outpatient (POP) clinic, the physician may recommend further diagnostic tests, examination at a specialty outpatient (SOP) clinic or hospitalization. For example, the decision to hospitalize will be made at the POP clinic level only for obvious emergencies and for uncomplicated cases in general medicine and, perhaps, pediatrics and obstetrics. All Tunisian hospitals are presumably staffed to treat these medical problems, and most have ambulances to transport patients referred from nearby clinics. If further diagnostic tests cannot be performed at the

[12] For a further discussion of the factors influencing the demand for medical care, see Peter S. Heller, "A Model of the Demand for Medical and Health Services in Peninsular Malaysia," CRED Discussion Paper no. 62, University of Michigan, 1976.

POP clinic (e.g., at a rural dispensary), the patient must be referred to the nearest hospital. For all other problems, patients are usually referred to a specialist at one of the SOP clinics held in a regional or general hospital.[13] He will decide whether ambulatory care is possible or whether hospitalization in a specialty inpatient (SIP) service is necessary. Usually the referral process is sequential, with a patient referred initially to the regional hospital and then, if necessary, to a general hospital or institute. It should be noted that, since the POP clinic could range from the weekly clinic at a rural dispensary to the daily clinic of a general hospital, the same decision—to refer from one level of the system to another—is likely to involve quite different referral procedures.

Measures of Referral Capacity

One measure of α_i^{i+q} (hereafter α) is the ratio of the actual absorptive capacity at level $i+q$ to the number of patients at level i that could, in principle, be referred to the higher level. For example, if a referral system operates efficiently within a region, it should encompass all referrals within that region. If $i = 1$ and 4 represents care at POP and SOP clinics, respectively, then

$$\hat{\alpha}_{1,g}^{4} = \frac{\text{total specialty outpatients for all units in region } g}{\text{total primary outpatients for all units in region } g}.$$

This measures the probability that a random outpatient at any POP clinic in region g will be referred to an SOP clinic in the same region. One would expect that the probability of a patient with a given medical problem being referred from any level, i, to a higher-level institution should be the same, regardless of his region of residence (i.e., $\hat{\alpha}_{1,g}^{4}$ should be equal for all g).

In table 2, we provide estimates of $\hat{\alpha}$ for the following regional referral options: (1) an outpatient referred from a POP to an SOP clinic other than gynecology-obstetrics (col. 1); (2) an outpatient at a POP clinic hospitalized in the inpatient service of general medicine (GMIP) (col. 4); (3) an outpatient at a POP clinic hospitalized in an SIP service other than gynecology-obstetrics (col. 3); (4) an outpatient at an SOP clinic hospitalized in an SIP service other than gynecology-obstetrics (col. 2); (5) an outpatient at an gynecology-obstetrics outpatient clinic (GOOP) hospitalized in a gynecology-obstetrics inpatient service (GOIP) (col. 5). Our measures are imprecise since the data relate to outpatient visits rather than outpatients.[14] We have

[13] In cases where referral requires the patient to be sent outside of the region, each hospital unit has a limited budget to cover the patient's transport costs.

[14] If there is reasonable homogeneity in the case mixes among outpatients across regions, this will not prove too much of a distortion.

TABLE 2

MEASURES OF THE CAPACITY FOR REFERRAL (α): TUNISIA 1971

PROBABILITY OF ADMISSION FROM:	AT REGIONAL LEVEL (%)						FOR MULTIREGIONAL GROUPINGS (%)*		
	POP to SOP (1)	SOP to SIP (2)	POP to SIP (3)	POP to GMIP (4)	GOOP to GOIP (5)	POP to IP (6)	SOP to SIP (7)	POP to SOP (8)	POP to SIP (9)
Tunis	42.0	10.1	4.2	1.6	7.0	5.8	8.7	40.7	3.6
Tunis (including institutes)	74.8	9.6	7.2	1.6	7.0	8.8	8.8	64.8	5.6
Nabeul	36.9	4.0	1.5	3.8	7.3	5.3	...	...	...
Sousse	21.0	16.3	3.4	2.0	17.8	5.4	17.0	16.0	2.7
Kairouan	8.2	25.1	2.1	3.2	9.1	5.2	...	...	...
Kasserine	3.9	16.8	.6	1.7	3.3	2.3	...	...	...
Bizerte	37.9	11.5	4.3	2.6	8.6	6.9	11.4	23.9	2.7
Jendouba	11.2	30.3	3.4	3.2	10.2	6.8	...	...	...
Beja	8.0	22.0	1.8	3.0	15.7	4.8	...	...	...
Le Kef	29.1	5.5	1.6	1.8	7.9	3.3	...	...	...
Sfax	37.8	11.9	4.5	1.8	12.4	6.2	17.7	15.6	2.8
Gafsa	...	...	1.8	1.9	16.4	3.7	...	...	...
Gabes	11.7	19.2	2.2	2.0	6.1	4.2	...	...	...
Medenine	...	...	1.7	4.7	16.2	6.3	...	...	...

SOURCES.—Heller, "An Analysis of the Structure, Equity, and Effectiveness of Public Sector Health Systems in Developing Countries: The Case of Tunisia, 1960–1972" and Ministère de la Santé Publique, *Statistiques: Réseau et functionnement des services de santé, 1971* (see table 1 sources); also, unpublished data of the Ministère de la Santé Publique, République Tunisienne.

NOTE.—POP = outpatient consultation at a clinic of general medicine; SOP = outpatient consultation at a specialty clinic (excluding gynecology-obstetrics); GMIP = inpatient admission in a service of general medicine; SIP = inpatient admission in a specialty service (excluding gynecology-obstetrics); GOOP = outpatient consultation at a clinic of gynecology-obstetrics; GOIP = inpatient admission in a service of gynecology-obstetrics.

* Represents the sum of visits for all institutions of the region.

grouped the regions according to which general hospital they refer patients to.[15]

For each referral option involving specialty services, there appears considerable regional variance in α. The probability of hospitalization from an SOP clinic varies from 5.5% in Le Kef to 30.3% in Jendouba; from a POP clinic, from 1.7% in Tunis to 4.7% in Medenine. Even if one attempts to explain intragroup variation by referrals across regions within any group, the multigroup probabilities are still considerably different (cols. 7–9).[16] The probability of referral to an SOP clinic varies from 16% in Sousse and Sfax to 41% in the Tunis grouping. Similarly, the probability of hospitalization in an SIP service varies from 9% to 18%. Only the overall probability of hospitalization for a POP outpatient is fairly uniform across the regions, with a mean of 5.1%.

There is a clear pattern to these variations. For regions with a general hospital, the probability of referral to an inpatient service (whether from an SOP clinic to an SIP service or a POP clinic to a GMIP service) is clearly lower than for the other regions in its multiregional grouping. Conversely, the probability of referral to the SOP clinic from the POP clinic appears considerably higher.

One possible explanation is that the specific case mix of patients at general hospital outpatient clinics allows for a larger fraction that can receive ambulatory treatment. The major urban centers also have a higher ratio of skilled medical staff to bed capacity, and this may allow more frequent and accessible outpatient clinics for both specialty and primary care. Alternatively, these measures might indicate that general hospitals do receive a considerable flow of referred outpatients from the other regions within their grouping.

In calculating these measures, we assume that the probability of referral to any level $i + q$ is the same anywhere within a region and is independent of the choice of the lower-level (i) institution (i.e., the likelihood of referral to an inpatient service in the region is independent of the outpatient clinic to which a patient initially goes). In that case, only capacity differences explain regional differences in α. If one assumes that referral occurs with difficulty and that patients are referred only within the medical district (and not across districts of a region) (table 3), considerable variation exists in the probability of referral to a GMIP ward. It is also apparent that the initial quality of care differs

[15] E.g., patients in the southern regions of Sfax, Gafsa, Gabes, and Medenine will be referred to the Sfax general hosptial for complex illnesses which cannot be treated within their regions. Only rarely will patients from a multiregional grouping be referred outside this grouping, and then primarily to the institutes or general hospitals in the Tunis region.

[16] In cols. 7–9, we assume there is an equal probability of referral across levels for all regions within a multiregional grouping.

sharply across districts. The number of treatment tasks (injections, bandaging, etc.) per outpatient visit also varies widely.

How does the probability of referral differ across medical specialties? Table 3 provides a measure of the probability of a specialty outpatient's referral to the specialty ward of each institutional level of the pyramid, under the assumption of a fully efficient referral structure. As

TABLE 3

MEASURES OF REFERRAL POSSIBILITIES

A. FOR GENERAL MEDICAL CARE

District	Ratio of PARA-ACTS To POP*	Ratio of GMIP To POP (%)†	District	Ratio of PARA-ACTS To POP*	Ratio of GMIP To POP (%)†
Kairoun‡	...	...	Sousse‡	1.38	1.7
Haffouz	5.62	4.1	Enfida	.29	.3
Ouseltia	2.60	7.7	Mahdia‡	2.28	1.3
Sidi Amor	1.87	3.9	Souassi	1.68	4.4
Hadjeb	2.10	4.6	Le Kef‡	1.14	1.3
Beja‡	1.35	3.2	Makthar	1.36	3.1
Teboursouk	.97	2.8	Tadjerouine	1.53	.5
Medjez-El-Bab	1.39	3.9	Ebba Ksour	1.89	.9
Bou Arada	1.82	3.3	Habib Thameur‡	1.18	1.2
Kasserine‡	1.09	.5	Zaghouan	1.84	6.9
Sbeitla	.99	1.0	Pont du Fahs	1.29	1.0
Sbiba	1.27	1.5	Gafsa‡	2.25	1.5
Thala	1.19	.5	Gamouda	1.71	2.7
Feriana	1.11	1.2	Maknassy	.93	.9

B. FOR SPECIALTY MEDICAL CARE

	PROBABILITY (%) OF REFERRAL FROM SOP TO A SIP SERVICE BY INSTITUTIONAL LEVEL							
	Tuberculosis		Pediatrics		Ophthal-mology		Oto-laryn-gology	Sur-gery
HOSPITAL LEVEL	At Same Level	To a Higher Level§	At Same Level	To a Higher Level§	At Same Level	To a Higher Level§	At Same Level	At Same Level
Specialty institute	14.7	8.0	4.9	2.4 (.49)‖	4.2	1.0	...	...
General hospital	19.0	14.2	6.3	9.3 (1.07)‖	2.6	1.8	6.4	21
Regional hospital	20.7	16.5	18.9	11.2 (1.12)‖	6.2	4.8	1.7	20

SOURCES.—Ministère de la Santé Publique, République Tunisienne, *Statistiques: Réseau et fonctionnement des services de santé, 1971* and *Profils demographiques, socio-économiques et sanitaire régionaux* (see notes to table 1).

* The ratio of all "soins divers" (includes bandaging, injections, etc.) performed at outpatient clinics by paramedical personnel (PARA-ACTS) to total outpatient consultations at hospitals and dispensaries.

† The ratio of general medicine inpatients in 1970 to all POP consultations in hospitals in 1971 and dispensaries in 1972.

‡ Relates to the specific district named; this is not a summary statistic for the entire region.

§ The ratio of the number of specialty inpatients at level *i* to the number of specialty outpatients at the same or lower levels.

‖ Number in parentheses includes all pediatric outpatient visits at maternal-child health centers.

expected, the probability falls for referral to higher levels. If the referral only operates within institutions, the probability of hospitalization is highest at the general hospital level and lowest at the institute level (with the exception of ophthalmology).

Though not fully conclusive, these results suggest that the capacity of Tunisia's referral structure is not optimally distributed across regions and districts. They do not reveal the extent to which referrals actually occur. To answer this question, we classified a sample of inpatients of different hospital units according to their town or region of residence. This yields a rough picture of the population groups actually served by each hospital.[17] In table 4, we compare each area's share in the total "client" population to the share of inpatients actually drawn from each area. Implicitly, these results are the product of the probabilities that an ill person will seek outpatient care and the probability, γ, that an outpatient will be referred to a higher-level unit. A measure of γ may be calculated by relating the number of specialty inpatients from an area to the number of primary outpatient visits in this area. This may be compared with our measure of α for the relevant client population, as calculated above. The results may be summarized as follows.

(1) All of the institutes cited are located in Tunis and are national institutions, ostensibly handling the most complex cases associated with their particular specialty.[18] In all cases, but particularly for the pediatrics institute, the Tunis region's population is disproportionately represented. The value of γ for residents of Tunis far exceeds the national value for α.

(2) There are three regional and general hospitals in the gouvernorat of Sousse. Although each supplies specialty inpatient services, the Sousse general hospital is the largest, providing 80%, 100%, and 53% of capacity in ophthalmology, otolaryngology, and surgery and pediatrics, respectively. It is difficult to judge whether the residents of the city of Sousse consume a disproportionate share of the inpatient services of the Sousse general hospital. By comparing the α value for the gouvernorat of Sousse with the district-specific values of γ, the residents of the Sousse municipality do not appear to be differentially favored. On the other hand, since this gouvernorat is well endowed with hospital beds,

[17] One difficulty with these data is that they may overestimate the fraction of inpatients residing in the city of the hospital unit. Inpatients of a Tunis hospital may give as their address the home of a friend or relative in Tunis rather than their actual address. The magnitude or significance of the bias is unclear.

[18] One must assume that the institutes are intended to have a national focus. The Tunis region has more than twice as many pediatric beds per capita, for the under-14 population, as any other region. The ratio of the under-14 population to pediatric beds is 1,032 to 1 for the Tunis region, relative to a national average, exclusive of Tunis, of 5,547 to 1. Similarly, Tunis has more than half of all ophthalmological beds in the country. Similarly, there are only two psychiatric services in the country: Razi Manouba Hospital in Tunis (1,018 beds) and Sfax (117 beds).

TABLE 4

MEASURES OF THE EXTENT OF ACTUAL REFERRALS IN THE TUNISIAN MEDICAL SYSTEM: 1971

A. HOSPITALS

Client Areas	% of SIP from Area	ν	Client Areas	% of SIP from Area	ν
Sousse General Hospital (α=2.31%):*			Kairouan Regional Hospital (α=5.05%):†		
Sousse Municip. (16.4)..	34.1	2.1	Kairouan Municip. (30.6)	51.6	7.7
Enfida (5.1).....	3.3	1.2	Haffouz (15.2).....	8.3	2.5
Souassi (10.2).....	4.4	3.4	Hadjeb El-Aioun (6.4)...	2.7	1.0
Msaken (8.7).....	8.3	1.3	Sidi Amor (16.8).....	10.3	2.2
K. Kebind (8.1).....	16.6	4.6	Sidi Ali (10.5).....	1.1	.4
Mahdia H. Region (18.3)	5.5	.8	Outside region.....	5.5	...
Monastir H. Region (27.6).....	10.4	1.0	Kasserine Regional Hospital (α= .64%):‡		
Kairouan H. Region....	3.9	.3	Kasserine Municip. (18.5).....	47.6	.80
Kasserine H. Region....	1.7	...	Sbeitla (25.0).....	13.9	.50
			Thala (27.9).....	22.9	.80
			Rest of Kasserine (28.6).	16.0	.37

B. INSTITUTES

	OPHTHALMOLOGY (α=.05%)		PSYCHIATRIC§		PEDIATRIC (α=.12%)	
CLIENT AREA	% of SIP	ν	% of SIP	ν	% of SIP	ν
Tunis (22.3).....	46.5	.15	44.6	.34	84.3	.72
Nabeul (6.5).....	10.5	.12	7.1	.19	3.5	.10
Bizerte (6.3).....	1.7	.01	8.1	.16	1.8	.04
Sousse (11.6).....	9.7	.03	8.9	.10	1.3	.01
Beja (5.8).....	4.4	.05	8.9	.23	2.6	.07
Jendouba (5.5).....	.9	.01	7.1	.02	.5	.02
Le Kef (6.7).....	4.4	.03	4.5	.06	.5	.01
Kasserine (4.5).....	.9	.01	1.9	.06	2.1	.07
Kairouan (6.0).....	1.7	.03	8.9	.31	1.8	.06
Sfax (9.6).....	6.1	.03	0	0	1.8	.01
Medenine (5.3).....	3.5	.03	0	0	0	0
Gabes (4.4).....	1.7	.01	0	0	0	0
Gafsa (7.2).....	7.9	.05	0	0	0	0

NOTE.—ν = the ratio of specialty inpatients from an area to total primary outpatient visits in hospitals and dispensaries in that area, in percent; α = the ratio of total specialty inpatients to all primary outpatients visits in the region; numbers in parentheses are percentages of population.

* SIP includes services of general surgery, pediatrics, otolaryngology, and ophthalmology.

† SIP includes services of pediatrics, surgery, gynecology-obstetrics, ophthalmology, tuberculosis, dental surgery.

‡ SIP includes services of pediatrics, surgery, and maternity.

§ Dazi Manouba Hospital

one would expect this hospital to serve as a referral unit for other regions in central Tunisia in order to justify its higher recurrent and investment expenditure per bed. In all the services surveyed, less than 9.3% of inpatients were from outside the gouvernorat of Sousse.

(3) The purpose of Kairouan's regional hospital is to supply specialty inpatient and outpatient services to its own regional population. With the exception of the services of surgery, tuberculosis, and ophthalmology, the residents of the city of Kairouan occupy a disproportionate share of inpatient capacity and have a higher probability of actual usage than the rest of the regional population.

(4) Kasserine is Tunisia's least developed region. The city of Kasserine is new (ca. 1954) and contains no more than 20% of the region's population. Although municipality residents disproportionately use the hospital's inpatient facilities, this reveals less about the referral structure's inadequacy in the region and more about its small bed capacity, that is, the services of pediatrics and gynecology have only nine and eight beds, respectively. It is not surprising that these are overwhelmingly used by Kasserine residents. Surgery is the largest service (22 beds) and is more equitably utilized within the region.

Case Mix Differences at Different Levels of the Referral Pyramid

Another test of the referral system's performance is whether one observes an increase in the medical complexity of inpatient cases at the upper levels of the system. If there is no difference between the case mix of patients in institutions at different levels of the system, this would suggest, at best, a malfunctioning referral system, and at worst inefficiency in the distribution of resources. Such comparisons are fraught with hazard. If a district hospital's only inpatient service is general medicine, its case load will obviously differ from a regional hospital with additional services in gynecology-obstetrics, pediatrics, and surgery. This applies a fortiori for general hospitals. By definition, the existence of a specialty service suggests cases that are substantively different from hospitals without such a service. One can only compare the case mixes of medical services found at more than one level of the referral system.[19]

Table 5 categorizes the disease problems encountered in a sample of cases drawn from a small number of hospitals. In the service of general medicine, clear differences emerge in case mix. In the district hospitals, respiratory, intestinal, and digestive illnesses account for 58% of all cases, as opposed to only 39% and 27% at the regional and

[19] The alternative task of determining whether the hospital has more (or less) than the inputs necessary for adequate diagnosis or treatment is empirically difficult.

TABLE 5

CASE MIX OF A SAMPLE OF INPATIENTS IN THE GENERAL AND SPECIALTY MEDICAL SERVICES IN A SAMPLE OF TUNISIAN HOSPITALS

DISEASE PROBLEM	PERCENTAGE AT INSTITUTIONAL LEVEL		
	General Hospitals*	Regional Hospitals†	District Hospitals‡
Service of general medicine:			
Intestinal infections	3.97	5.50	7.62
Tuberculosis	2.27	4.83	.80
Viruses	1.63	.94	1.04
Endocrine illnesses (including diabetes)	5.03	.85	0
Illnesses of the blood (anemia)	4.04	2.01	1.79
Rheumatism	3.35	9.26	4.57
Heart disease	14.52	7.63	3.30
Hypertension	3.67	4.08	.51
Respiratory illnesses	11.84	25.63	43.52
Digestive illnesses	11.63	8.59	6.35
Stomach ulcers	6.59	0	.75
Illnesses of annexes of digestive tube	7.76	2.15	2.65
Urinary illnesses	6.71	9.17	4.55
Complications associated with pregnancy	0	1.31	5.38
Service of maternity care:			
Deliveries with no complications	65.28	53.51	79.13
Abortion or delivery with complications	13.90	22.00	1.08
Service of surgery:			
Respiratory illnesses	3.25	3.23	...
Appendicitis	8.38	2.07	...
Hernias	6.94	9.30	...
Urinary diseases	6.29	3.60	...
Skin diseases	20.26	8.07	...
Fractures	16.80	14.00	...
Trauma internal	3.35	4.94	...
Trauma superficial	6.10	11.50	...
Bone diseases	1.70	1.74	...
Service of pediatrics:			
Intestinal infections	43.90	14.00	...
Malnutrition and metabolic troubles	5.25	18.00	...
Maladies of nervous system	11.25	3.73	...
Respiratory illnesses	18.70	31.80	...
Bronchial pneumonia	7.94	5.50	...
Urinary infections	5.05	6.06	...
Service of ophthalmology:			
Cataracts	33.00	60.81	...

SOURCE.—Records of *fiches medicales* kept by Ministère de la Santé Publique, République Tunisienne.

NOTE.—Numbers are percentages of cases within a particular specialty service.

* Habib Thameur, Sousse.

† Kairouan, Kasserine.

‡ Enfida, Haffouz, Hadjeb El Aioun, Sidi Amor, Ousseltia, Sbiba, Thala, Feriana, Sbeitla.

general hospitals, respectively.[20] The shares of patients with tuberculosis, rheumatism, and urinary illnesses are largest at the regional hospital level. This suggests they receive many cases on referral from the district hospitals. The smaller shares of the latter illnesses at the general hospitals would indicate that their cases are primarily drawn from their urban populations. There is also an increase in the share of patients with endocrine illnesses, blood diseases, heart disease, stomach ulcers, illnesses of the digestive tube, hypertension, and digestive diseases at the general and regional hospitals. In the service of gynecology-obstetrics, district hospitals clearly have a smaller share of complicated deliveries or abortions.

The remaining specialty services are only in regional and general hospitals. In surgery, general hospitals have a higher fraction of appendicitis and urinary and skin diseases. In pediatrics, they dominate in the treatment of intestinal infections and nervous system diseases. Regional hospitals dominate in the treatment of respiratory illnesses, malnutrition, and metabolic deficiencies. In ophthalmology, cataracts are a larger share of the regional hospital's ophthalmological case load.

A more complete analysis of the significance of these differences in the absence of morbidity data for different areas of the country is impossible. The case mix differences in general medicine may simply reflect differences in morbidity in the client populations of the respective areas of the country. The higher socioeconomic status of urban groups may lead to less respiratory and intestinal illness. Alternatively, urban groups may receive treatment for many such common problems on an ambulatory basis from private physicians. The rural population lacks access to private-sector physicians, and the environmental conditions in the rural areas may preclude adequate ambulatory care for the more common disease problems, thus necessitating a higher hospitalization rate.

Summarizing tables 4 and 5, the data suggest that inpatients in the higher-level units of the referral system are disproportionately from the same urban area as the hospital. Population groups from more distant areas are underrepresented. Nevertheless, the case mixes in these higher-level hospitals do suggest a more complex set of disease problems. One cannot conclusively determine whether the referral structure is adequately working without knowledge of (1) the number of cases that ought to have been referred and were not, and (2) the number of cases at the higher levels receiving too costly a level of care.

For example, if there are major differences in the morbidity char-

[20] Complications associated with pregnancy are also common (5.38% of total cases), but the small percentage of cases at the other levels reflects their treatment in a service of gynecology-obstetrics.

acteristics of the urban and rural populations, the rural groups may be accurately represented in the higher-level referral units in terms of their share of particular types of disease problems. If morbidity differences are not significant, one can conclude that the referral system is working badly for patients distant from hospital units. In this case, the case mix for the higher-level referral units is not complex enough. Referrals are more likely from the primary outpatient clinic of a general hospital than from a rural dispensary 30 miles away. A disequilibrium between the β_{ij}^{i+q} and γ_{ij}^{i+q} is implied for rural patients with complex disease problems.

The latter explanation appears more reasonable. The incidence of many complex illnesses either does not appear related to socioeconomic status (for example, anemia, stomach ulcers, urinary illnesses, deliveries with complication, appendicitis, hernias, fractures, pediatric intestinal infections, or cataracts) or is inversely related to income. Since I have shown elsewhere that the poor are not underrepresented in the urban hospitals, relative to their share in the population,[21] these are not disease problems only manifested by the affluent. Thus, the weak access of the rural poor primarily reflects a breakdown in the referral system.

This suggests one factor that must be considered in designing an LDC referral system. The cost of a referral option will differ according to the level and location of the referring institution. The cash outlay and time cost to a rural resident of further referral for specialty outpatient care is likely to be greater than for an urban resident of comparable socioeconomic status. In addition, the time lag between the initiation of a referred diagnostic decision and the response from the laboratory may be as long as 2 weeks. In the interim, further medical action is temporarily stalled and is contingent on the return of the patient to the clinic.[22] Particularly when the patient is a child or is very ill, the latter may simply not occur. Moreover, for cultural reasons,

[21] From a survey of inpatient records, we classified patients according to their payment class. This allowed us to identify the proportion of hospital users in the "indigent" class, which encompasses the bottom 42% of the population in the income distribution. We found that the indigent class (1) was adequately represented in the pediatrics institute and overrepresented in the ophthalmological and psychiatric institutes; (2) dominates in the use of the district hospitals (constituting 82%–97% of inpatients; and (3) substantially utilizes the facilities of the regional and general hospitals (ranging from 50% to 70% of all inpatients). See Heller, "An Analysis of the Structure, Equity, and Effectiveness of Public Sector Health Systems in Developing Countries: The Tunisian Case, 1960–1972" (n. 7 above).

[22] If a patient cannot be expected to return within a period of time to obtain the results of a laboratory test, etc., then any significant time lag in obtaining such results—as may occur if a lab test must be referred to another more distant hospital unit—may render the test irrelevant. Similarly, if the cost to a low-income patient of transporting himself to another unit, either for further tests or for hospitalization, is prohibitive, then the existence of a referral capacity is irrelevant.

patients may resist going far from home for diagnostic tests and, particularly, for hospitalization. Particularly where the health system does not internalize these referral costs, either through direct transport or through transportation subsidies, the system's actual operations will inevitably break down.

Such costs arise in any referral system, but their importance is primarily a function of the society's degree of modernization. In a society with a large rural population, it is crucial that the referral linkages be designed with the pattern of rural demand in perspective. This suggests a need for more base-level services, either through mobile specialist clinics or laboratories, or a logistically easier referral process (e.g., increased frequency of regular ambulance runs between different levels of the referral system).

Other Issues Underlying a Possible Breakdown of the Referral System

In Tunisia, two additional measures of disequilibrium in the allocation of resources within the medical referral system are readily apparent: the excessive congestion at primary outpatient clinics, and the severe capacity underutilization at the district hospital level. Since these issues are discussed in more depth elsewhere, I shall only briefly allude to them.[23]

Two obvious measures of an inefficient referral structure are a lack of outreach to the client population and an insufficiency of primary-care capacity. Most medical systems operate on a self-referral basis. In LDCs with traditionally oriented segments of the population, an individual's decision to seek modern medical services depends on whether the illness is perceived as unusual or dangerous, on the accepted means of treatment for given symptoms within the society, and on the relative prices of alternative sources of care. Use of modern medical services may be initially deferred when traditional medicine is valued highly and a traditional practitioner is at hand. The importance of this "choice" as a public policy issue does not derive wholly from the public good and externality value of improving the health status of those consciously choosing traditional sources of medical care. In many cases the groups who fail to reach the system may be the elderly, the dependent child population, or other sociological groups unable to act for themselves. The development of a mechanism (e.g., the village health worker) for rooting out these groups in the population would appear necessary.

Insufficiency of primary-care capacity is equally serious. If the cost of access to a minimal level of primary diagnostic and treatment services is relatively expensive for many individuals, they may choose

[23] Heller, "An Analysis of the Structure, Equity, and Effectiveness of Public Sector Health Systems in Developing Countries: The Tunisian Case, 1960–1972."

to forgo them. This effectively precludes access to the higher levels of the referral system. In Tunisia, significant congestion and excess demand are manifest at the primary outpatient clinics, particularly in the rural areas. This is a complex phenomenon, often involving sociological factors (e.g., hypochondria, the status of women in the traditional Islamic society of rural Tunisia, etc.) as well as actual morbidity. The current technology of providing outpatient services exacerbates the problem. Tunisia's requirement that all outpatients be seen by a physician guarantees that any diagnosis or medical guidance will be cursory, under present manpower supply constraints. With the obvious exception of emergency cases, for which diagnosis is easily made and critically urgent, the quality and adequacy of the diagnostic and treatment process at the primary level is highly questionable, particularly in the rural areas. Many of the rural outpatient clinics are staffed only by a foreign (usually East European) physician barely fluent in French, let alone Arabic. A clinic volume of 100–150 patients per morning is typical. Severe medical problems are likely to be detected only after subsequent patient visits trigger reexamination.

Opposed to the congestion bottleneck is the disequilibrium implied by extreme underutilization of a pyramid level. For example, there is a strikingly low inpatient-capacity utilization rate in the district hospitals, averaging 59%, and to a lesser extent in the regional hospitals, averaging 74%.[24] This may be compared to a norm rate of 85% and the 79% utilization rate in the general hospitals. Several causes are possible. Clearly, cultural or economic factors may limit the direct demand for inpatient services. Bottlenecks in the referral mechanism from lower-level units may preclude an adequate flow of inpatients. The underutilization may also reflect a conscious response by the managers of public sector medical units to underfinancing of their recurrent operations. Rather than lower quality standards below a minimal level $\bar{s}$, the activity level of the units is correspondingly reduced, particularly in the district hospital units.

In the supply induced case, the pattern of capacity underutilization at the lower-level inpatient units implies that the nominal number of hospital beds shown in table 1 overestimates their effective treatment capacity. This effectively places greater pressure on physicians to adequately discriminate among potential users of the higher-referral-level units. It may also imply disequilibrium between the marginal quality of care at the different pyramid levels, relative to the marginal severity of the case load (inadequate quality at the lower-level units, excessive quality at the upper-level units).

[24] Within the regional hospitals, underutilization is particularly high in the services of ophthalmology (49%) and otolaryngology (19%).

IV. Conclusion

Our analysis suggests that Tunisia's medical system only partially justifies its current pattern of resource allocation. The referral of complex cases to the higher levels of the system clearly occurs and is perceived as an available option by the physicians at the primary-clinic level. Although not fully representative, patients from outside the cities of the major hospitals do have access to them. Moreover, the complexity of cases treated also appears to rise as one moves up the pyramid. There are two principal structural deficiencies.

First, rural patients distant from the upper-level referral units do appear at a disadvantage in terms of their probability of referral, compared with their urban counterparts (of whatever economic status). This primarily reflects bottlenecks in the linkage mechanism between the referral units, with excessive costs to the patient of exercising the referral option. Second, congestion at the primary-clinic level and inadequate capacity utilization of the district hospitals suggests the need for an expansion in the resources allocated to the base-level institutions.

What is the cost to the Tunisian government of providing the higher-level referral capacity? Suppose that the difference in the average cost per inpatient day or outpatient visit between the higher-level and lower-level units approximates the marginal recurrent cost associated with providing specialty care. Given the volume of hospital admissions and outpatient visits, we may estimate the marginal recurrent cost of higher-quality treatment in the regional and general hospitals and institutes as in table 6. The table shows that a reduction in the quality and range of inpatient services provided in the regional hos-

TABLE 6

THE MARGINAL RECURRENT COST OF HIGHER-QUALITY MEDICAL CARE IN TUNISIA

	Cost (D)
Inpatient care:	
Marginal cost of inpatient treatment above the quality of district hospitals	3,794,416
Marginal cost of inpatient treatment above the quality of regional hospitals	1,775,229
Marginal cost of inpatient treatment above the quality of general hospitals	69,340
Total inpatient expenditure	8,343,659
Outpatient care:	
Marginal cost of outpatient treatment above the quality of district hospitals	1,078,395
Marginal cost of outpatient treatment above the quality of regional hospitals	589,181
Total outpatient expenditure	2,638,976

pitals could save approximately 21% of the inpatient budget and 15% of the total institutional health budget. These funds could be used to upgrade the quality of services at the primary outpatient and inpatient levels and still allow for a further increase in expenditure per unit of output at all levels of the system.