TOWARD A RESOURCE PLANNING MODEL FOR COMMUNITY HOSPITALS: A CONCEPTUAL MODEL OF THE PATIENT TREATMENT SYSTEM

By

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The need for a resource planning model for community hospitals was recognized at the outset of the research. Community hospitals conduct several programs, namely preventive and promotive health services, patient care services, education in health professions and occupations, health science and health care research, other public services, and general administration.

One program—patient care services—was selected for investigation. Patient treatment is a production process having inputs, outputs, and processes which transform inputs into outputs. Consequently, the problem of this research is defined as:

1. Definition of the community hospital's treatment system.
2. Identification of the inputs, outputs, and the important variables and relationships which constitute the treatment process of the treatment system.

3. Application of the general model to the production of a specific output—a patient treated for uncomplicated inguinal hernia.

The research has an underlying hypothesis that a limited number of production processes are applied to the treatment of the spectrum of health problems presented to community hospitals.

The analysis starts with a statistical profile of the community hospital, followed by a comprehensive listing of hospital programs. The basic objectives for each of these programs are also stated. Subsequently, the outputs of one program, patient care, are analyzed. Output concepts advanced by other researchers are presented, after which an output concept is proposed that has the following characteristics:

1. The basic output unit of patient care is a fully or partially processed patient.
2. Output units are placed in equivalence classes according to:
   a. Discharge diagnosis of the patient's health problem.
   b. Stage of illness at hospital admission.
   c. Proportion of the total treatment process completed.
   d. Objective state of the patient's health at dismissal.

The treatment process is then defined, being viewed as having two subprocesses: provision of essential medical services and provision of supplemental care. Essential medical services has the elemental activities: application of high professional skills and management of the treatment system. Provision of supplemental care consists of primary supportive care, provision of essential nursing

and paramedical services, and secondary supportive care, provision of optional services by care team members. Primary supportive care includes:

1. Application of diagnostic and therapeutic procedures.
2. Preparation, dispensing, and administering medications.
3. Accomplishment of preparatory procedures.
4. Monitoring and assessment of patient condition.
5. Communication with patient and care team.
6. Recording of patient care data.

Secondary supportive care includes:

1. Admission and discharge processing.
2. Assistance in patient hygiene and nutrition.
3. Promotion of patient comfort.
4. Provision of emotional support to the patient.
5. Transportation of patient and patient-related items.

The patient as a subprocess of the treatment system is also considered. The patient provides the major interties between the two subprocesses, provision of essential medical services and of supplemental care.

Inputs to patient treatment seem to be constrained markedly by the output goals of patient care and by the production processes utilized to treat patients. Various types of input resources are discussed and classified. A special input, feedback, is also considered. Feedback information, resulting from comparison of care

outputs with established criteria, affects the treatment system by modifying:

1. Inputs.

2. The treatment process or its subprocesses.

3. Output criteria through changes in objectives or removal or diminution of constraints.

Finally, the treatment process model is applied to a specific output, the treatment of uncomplicated inguinal hernia.

CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Introduction

Health care services in the United States are delivered to the public via a fragmented collection of institutions and individuals, many pursuing narrowly defined objectives with a seeming disinterest in coordinated effort. This vital industry's disorganization has resulted from poorly planned, rapid growth that has occurred in response to increasing demand for health services (Rutstein, 1967, pp. 9-50; Knowles, 1965, pp. 195-200; Garfield, 1970, pp. 3-11). Planning, and other measures which would contribute to rationalization of the provision of health services, has been emphasized increasingly in this country as evidenced by passage and implementation of the Regional Medical Program and Comprehensive Health Care Planning Acts (see Gherig, 1968, pp. 466-468).

Central in any present or future health care delivery system is the community hospital—the short-term general hospital. Originally a refuge for the indigent sick and injured, the community hospital has become a complex institution playing a crucial role in medical care. Klarman states (1965, p. 102):

> However measured—whether in terms of capital investment, operating expenditures, the number of employees, the seriousness of the illness cared for, the effect on the pattern of medical care organization, or the contribution to medical education medical research—the hospital is the major facility in the health and medical care industry.

The hospital can have three important interrelated roles to play in health care—patient care, education in the health professions and occupations, and research in health science and health care. The fulfillment of these related roles requires coordination of efforts of the many agencies which provide health care services. Coordinated efforts, up to the present time, have more or less taken the inappropriate organization and inflexible role structure of present health care delivery as constraints to which adjustments had to be made. It appears that sound planning decisions, however, can promote needed changes and lay the groundwork for improved coordination in the future delivery of health care services.

Research designed to promote understanding of the delivery of health services in hospitals, and at improving resource allocation to and within hospitals serves the public interest. In the United States, basic health care is coming to be regarded as a fundamental human right of all citizens. The current health care delivery arrangement provides care distributed unevenly between the rich and poor, between the various age groups of the population, and between the rural and urban located populations (Jeffers and Bognanno, 1970, p. 7; Fein, 1967, pp. 31-50, 71-79).

The resources that are allocated for provision of health care services are sizable, and have been for a number of years. Some basic health care expenditure data are enlightening. In 1966, citizens of the United States spent $42.3 billion on health care with 34 percent or $14.2 billion being outlay for hospital care. By 1968, total health

care outlays had risen to $53.1 billion with $19.1 billion of the total going for hospital care. Expenditures for hospital care are the largest single class of expenditures of total health care outlays, and if expenditures for other medical services received in hospitals, but allocated to other expenditure categories (e.g., professional fees), and for construction and research were added, hospital outlays would account for more than half of all health care expenditures (National Advisory Commission on Health Facilities, 1968).

The growth of hospital facilities has been especially noteworthy during the past two decades. In 1968, community hospitals accounted for 92 percent of all admissions, 74 percent of employees in hospitals, and 74 percent of total hospital expenditures (*Hospitals*, Guide Issue: August, 1969).

During the past twenty years assets, costs, and utilization of short-term hospitals have undergone some marked changes, as chronicled by the American Hospital Association's journal, *Hospitals*, Guide Issues for 1951 and 1969. Assets have risen dramatically in dollar value, increasing a little more than 400 percent from 1950 through 1968. This increase reflects an increased use of capital goods in the provision of hospital services and significant inflation in the costs of medical plant and equipment.

The widely used measures of short-term hospital utilization, admissions, average daily inpatient census, and average length of stay, had rather dissimilar patterns of change over the 1950-1968 period. Admissions increased throughout the period but at a steadily declining

rate of increase; the most recent years found admissions remaining virtually constant. Average daily inpatient census grew at an increasing rate during the full twenty-year period, growing faster than did the number of beds, yielding nearly a 5 percent gain in occupancy rate during that time. The explanation for this rise in utilization in the face of slowed admissions lies in the behavior of patient stay in short-term hospitals.

Average length of stay in short-term hospitals declined steadily from 1950 through the mid-sixties, continuing a long-term trend. However, the trend ended abruptly in 1965-66, and average length of stay began to increase from 7.8 days in 1965 to 8.4 days in 1968.

Recognition of these fundamental changes in short-term hospital utilization and costs provides some insight into the changes that are occurring in these hospitals. Changes in hospital outputs and in the nature and combination of input resources utilized in producing these outputs could represent partial reason for the apparent changes in usage and costs.

Hospital Planning

Planning is defined by Dror as "the process of preparing a set of decisions for action in the future directed at achieving goals by optimal means" (Dror, 1963, pp. 44-58). The planning process when applied to resource allocation culminates in a multiyear budget. In past years, in many instances, budgeting became the responsibility of the administrative accountant, whose orientation was one of controlling

expenditure by organization units rather than one of seeking to fund optimally programs of the organization. Planning, programming, budgeting was created to resurrect the economist's budget, seeking to provide fiscal interpretation of economic decisions as to ends and means. The PPB process generally includes:

1. A clear statement of program objectives.
2. The identification of alternative ways of attaining those objectives.
3. Systematic analysis of these alternatives so as to approach optimal means of attaining desired goals, given limited resources to do so.
4. Explicit recognition of the time dimension of these goal-seeking activities.

PPB is the general planning framework which is used to encompass the particular problem to be explored in this study. No judgments are made or are implied as to the value of PPB in organizational planning and resource allocation; PPB is merely used as a convenient framework within which to develop the proposed analysis.

Statement of the Research Problem

PPB, according to Fisher, involves certain essential features, namely, "structural (or format) aspects, analytical considerations, and data or information system considerations to support the first two items" (Novick, ed., 1965, p. 61). The structural aspect of PPB deals with the categorization of organizational activities aimed at identifying programs having mission-oriented outputs. The budgeteer is faced with the problem of selecting a program structure from recognized

alternatives which provides an optimum balance between (1) the effectiveness of the analytical process facilitated by the structure and (2) implementation cost. The analytical usefulness of a structure rests on the utility of the program outputs and associated benefits and costs it makes explicit. The cost of program structure implementation relates to the costs that would be incurred in measuring the outputs identified in the program structure.

Analytical process considerations relate to analysis designed to "systematically examine alternative courses of action in terms of utility and cost, with a view to clarifying the relevant choices (and their implications) open to decision makers in a certain problem area" (Novick, ed., 1965, p. 61). The analytical process of PPB is systems analysis. A definition of systems analysis based on the work of Churchman (1968) and Quade (1966b) is:

> Systems analysis is an approach to complex problems of choice under uncertainty in which the relevant system is defined so that the truly meaningful choices can be formulated and examined.

For example, the inclusion of public education as a component of a health care system leads to different choice problems than are encountered when education is excluded.

Information systems support both structure and analysis by providing the type, quantity, and quality of information needed by the decision makers in the system. Analysis, in turn, redefines continuously the data file that must be maintained in the information system.

The Problem

This analysis spans the three aspects of PPB—the structure, analytical process, and information system, and will be addressed to the problem of developing a conceptual model of the patient treatment system in short-term, general hospitals.

This study is exploratory, seeking to perform basic definition of the community hospital patient treatment system: its resource inputs, treatment process, and outputs. The study also seeks to identify important variables and relationships which constitute the treatment process. The model of patient treatment was derived from a detailed analysis of the production of a prototype output—a patient treated for inguinal hernia without complication or accompanying health problems.

Plan of the Research

The plan that will be followed in completing this study is:

1. Define the goals of the community hospital including those for patient care programs.

2. Describe the basic patient treatment system model and identify and describe system outputs and output constraints.

3. Describe the input-to-output transformation process of the patient treatment system, identifying the major sybsystems.

4. Identify and describe patient treatment system inputs and describe the systems feedback mechanism.

5. Apply the general patient treatment system model to a particular diagnosis (program element)—inguinal hernia without complication or accompanying health problem.

Related Research and Literature

Research results and other published literature which are related to this study can be described within the broad subject outline presented below:

A. Planning, Programming, Budgeting (PPB)

1. PPB principles
2. Rationality, politics, and PPB
3. Analysis in PPB

B. The Economics of Health, Diseases, and Hospital Treatment

1. Economics of health
2. Economics of diseases
3. Economics of hospital treatment

C. Hospitals

1. Hospital goals and programs
2. Hospital growth and utilization statistics

D. Patient Care in Hospitals

1. Elements of patient care in hospitals
2. Patterns of patient care

The individual subject entries will be discussed in turn in the paragraphs that follow:

A. Planning, Programming, Budgeting

1. PPB principles

A great deal has been written about PPB, so that the problem of the researcher is not finding material but locating the better

literature and sorting out the common thread that runs through the various writings. There is considerable divergence of opinion over basic definitions and concepts as they apply to PPB. The more informative literature can be found in relatively few sources.

Two symposia of articles dealing with PPB were published in the *Public Administration Review*, one in late 1966 and the other in early 1969. The articles in these symposia by Schick (1966), Hirsch (1966), Greenhouse (1966), Wildavsky (1966), Gross (1969a), Dror (1969), Mosher (1969), and Mushkin (1969) provide a range of definitions and concepts which in total describe what PPB is and what it can and cannot be expected to do for the process of allocating resources. Basically, PPB is a process for the development and preparation of a budget in a planning context. The process concentrates on outputs, purportedly avoiding a preoccupation with input resources. Activities are grouped into programs which yield outputs which are evaluated in light of the basic missions of the organization. Full resource costs of programs are developed and are compared to the utility or benefits of program outputs through systematic analyses. Resource allocation to programs is then aided by the comparison of the cost to benefit ratios for the respective programs.

Schultze (1968) emphasizes that PPB subjects policies and programs to analysis and integrates the decisions into the budgetary process, and he also draws attention to PPB's multiyear time dimension and to the benefits that accrue to the budgeting process from the planning orientation.

2. *Rationality, politics, and PPB*

As with any new process proposed as a reform, PPB is not without critics. The fundamental criticism deals with the role of analysis and rationality in a political process. Lindblom (1959; 1961) and Wildavsky (1964) argue that PPB and its problem solving approach are not compatible with political decision processes. Political decisioning, according to Lindblom, utilizes an incremental trial and error process that is appropriate for public programs where there is difficulty in specifying objectives or ends, and where ends and means can be difficult to separate. The Lindblom school also stresses the inherent difficulty in predicting the full range of consequences that accrue to a single programmatic means.

The political process relies on advocacy of points of view by those parties that might be affected by a policy decision to develop some understanding of the possible consequences of that decision. Lindblom (1961) argues that analysis could not replace advocacy in performing this role.

Wildavsky (1966) stresses another important point in his criticism of PPB. In gaining a consensus on important policy decisions, coalitions are formed which frequently include parties with conflicting values and goals. Part of their ability to coalesce is the result of minimal debate concerning values and goals. Action is possible because the particular policy decision offers something to each cooperating party, and the less said about the benefits to other parties the better. PPB with its requirement for clear statement of objectives could, according to Wildavsky, prevent the cooperation required for decisions.

Charles Schultze (1968), the former Director of the Bureau of the Budget under President Johnson, sees no damaging incompatibility between politics and reason. Incrementalism allows the politician to hedge against the uncertain future; the information brought to light during analysis will tend to reduce the level of uncertainty. An incremental approach is not replaced by analysis but is complemented by it.

An important analytic result is the understanding of the production functions associated with various programs, that is, the process whereby inputs are converted to outputs. Such understanding, rather than limiting advocacy, makes it meaningful by translating values to program specifications and consequently to desirable program outputs. Thus, analysis can be addressed to the problem of specifying ends, and to exploration of alternative means for achieving those ends (Schultze, 1968, pp. 55-56).

Finally, Schultze (1968, p. 66) argues that analysis need not constrain political tactics and strategy. He states:

> While it is often strategically and tactically important for participants in the bargaining process to conceal their objectives from their adversaries, it hardly behooves them to conceal them from themselves. Ends as well as means, need systematic examination and analysis.

The controversy between the "political realists" such as Wildavsky and Lindblom, and the "management science analysts," such as Novick and McKean has not been resolved. The likely outcome will be a somewhat more rational political process. One could use the nature of political debate pre- and post-Employment Act of 1946 to detect the

influence of analysis on public decisions. This experience strongly suggests that the political process is amenable to rationalization.

3. *Analysis in PPB*

Most PPB advocates see it as a system for bringing analysis to bear on policy decisions. As would be expected, a major segment of the literature deals with aspects of analysis within the PPB framework. The major areas covered by various writers relative to PPB analysis are general systems analysis, cost-effectiveness analysis, and cost analysis for PPB.

The definition of systems analysis that has been used in this dissertation was given above (see page 6). Systems analysis is an approach to the solution of complex problems which has the unique feature of explicitly delineating the total entity that will affect and be affected by the solution that is proposed. Systems analysis consciously seeks to avoid an excessively narrow problem definition where such delimitation leads to distinctly inferior solutions. The works of Quade (1964; 1966a; 1966b), Churchman (1968), Optner (1965; 1968), Hitch (1955), Kahn and Mann (1957), and Fisher (1966a) provide a comprehensive, understandable, and theoretically sound development of systems analysis as the term is used in this study.

Cost-utility analysis is the basic methodology used for determining the relative values of program outputs in PPB analyses. Cost-benefit analysis is one form of cost-utility analysis that has been widely used in evaluating water resource development projects; a notable discussion of this technique is offered by Eckstein (1967).

Cost-benefit analysis attempts to quantify the time-distributed stream of all returns or benefits from a project for comparison with the costs that are incurred in creating and operating the proposed development.

As Klarman and his coauthors state (Klarman, Francis, and Rosenthal, 1968, pp. 48-49):

> Cost-effectiveness analysis is a special narrower form of the cost-benefit approach that economists have evolved in the past generation. Much of the original work was done in the field of water resources.
>
> The cost-benefit approach represents an attempt to apply systematic measurement to projects or programs in the public sector where market prices are lacking and external effects in production or consumption loom important (so that individual decisions do not reflect true economic values). The cost-benefit approach is characterized by (1) the objective of enumerating as completely as possible all costs and benefits expected, and (2) the recognition that costs and benefits tend to accrue over time.
>
> In principle cost-effectiveness partakes of both of these characteristics: a complete listing of inputs and outputs and recognition of time. Under cost-effectiveness analysis the enumeration of benefits need not be so complete as under the cost-benefit approach. Rather, certain results are specified and all other results are regarded as held constant or perhaps of secondary importance.
>
> Cost-effectiveness, rather than cost-benefit, is employed when benefits are difficult to measure or when the several benefits that are measured cannot be rendered commensurate. Under cost-effectiveness analysis costs are calculated and compared for alternative ways of achieving a specific set of results.

Prest and Turvey (1965) present an excellent survey of cost-effectiveness analysis. Their discussion is comprised of three parts: (1) development and scope of the subject, (2) general principles, and (3) applications of cost-effectiveness analysis to various resource allocation problems. Their discussion of costs and benefits, of how they are valued, of the appropriate discount rate to be applied to the

streams of costs and gains, and of the constraints on the use of the technique constitutes a discussion of the general principles of cost-utility analysis.

Since cost-effectiveness deals with both cost and utility of alternative courses of action, assessment of resource costs is an important element of the technique. The costing of programs can be a major obstacle to the adoption of an output or mission-oriented program approach since many cost gathering and reporting systems relate to organizational units.

Fisher (1968) provides a discussion of the development and understanding of cost functions and their relation to budgeting. McCullough (1965; 1966), in two RAND reports, discusses cost analysis for cost-benefit analyses; these reports explain the role of cost analysis in systems analyses, detail the features of this type of cost analysis, and, finally, provide a listing of recommended steps for sound cost analysis.

The other half of cost-benefit analysis, the measurement of expected benefits, has received extensive coverage in the literature . An excellent collection of papers dealing with the measurement of the benefits of government projects was edited by Dorfman (1965). Some of the analyses dealing with program benefits are concerned with the value of a human life; Becker (1965), Hayzelden (1964), and D. Rice and Cooper (1967) provide typical works dealing with this subject. An informative series of papers dealing with measuring the effectiveness of

child health services was presented at a special seminar by Fein (1967), Haggerty (1967), Stewart (1967), and White (1967a).

B. The Economics of Health, Diseases, and Hospital Treatment

1. The economics of health

An important segment of the related literature deals with the topic of economics of health and diseases. Klarman (1965) and Harris (1964) provide important works dealing with the general topic, health economics. Klarman, in an overview section, discusses the content of health economics, the nature of the health and medical care industry, and the distinctive economic characteristics of health care delivery. He then considers various topics under the headings of supply of and demand for services and personnel in health care. Klarman also presents an excellent discussion of cost-benefit analysis in health applications. He also discusses some topics relating to the organization, coordination, and regulation of the health and medical care industry. The primary focus of this section is the physician, the organization of his practice and his relationship with the community hospital. An important section of Klarman's book deals with the supply of hospital services. In addition to stating briefly his view of the hospital's role, Klarman presents a general discussion of the shape and level of hospital service supply curves for the individual hospital and the industry in both the short and long run. Another part of the section deals with the rise in hospital costs; the major explanation for the increases is given as the closing of a wage gap in the health industry, the

increasing complexity and costliness of hospital care, and, finally, a lag in hospital productivity behind the rest of the economy.

Harris discusses several aspects of health economics, dealing with identified problem areas in the broad field. He provides analyses of cost and pricing in the markets for medical services, for drugs, and for hospital services. He also considers the supply of physicians, their distribution, and their income and productivity. The rises in hospital costs and some of the causes of their dramatic inflation are treated in several chapters. Harris devotes the final sections of his book to compulsory health programs, voluntary health insurance, and the education of the physician in the American medical school.

2. *Economics of diseases*

The economics of diseases, with special attention devoted to the economic costs of specific diseases, is covered by D. Rice (1965; 1966), Fein (1958), and Conley et al. (Conley, Cromwell, and Arrill, 1967). The basic approach to measuring the costs of diseases is to calculate both direct and indirect costs:

a. Direct costs including expenditures for prevention, detection, treatment, rehabilitation, research, training, and capital investment in facilities (as these items relate to the specific disease).

b. Indirect costs including loss of output to the economy due to death, illness or disability (attributable to the particular disease).

D. Rice discusses costs of all diseases and cardiovascular diseases and cancer, respectively, in the works cited. Fein presents a discussion of the costs of mental illness; Chapter 2 of the cited work provides an informative discussion of cost concepts and of cost

estimation methodolgy. Conley and his coauthors expand on the works of Fein by estimating the output loss attributable to the employed mentally ill, and by accounting for a wider range of direct costs of mental illness.

Certain authors have dealt with the application of cost-benefit analysis to health problems, which is a generalized discussion of many of the aspects covered in the analyses of costs of specific diseases. Klarman (1967) discusses the nature of costs and benefits in health applications of cost-benefit analysis. Costs, according to Klarman, are merely expenditures as might be itemized in a budget. Benefits are comprised of three elements: (1) savings in the use of health resources, (2) gains in economic output, and (3) satisfaction from better health. He points to the difficulties in the measurement of all three elements, especially the last item. Analysts, Klarman asserts, are frequently guilty of measuring what can be measured rather than what really should be measured. Klarman still sees the use of cost-benefit analysis as a forward step in rational resource allocation in spite of its limitations.

Levin (1968) also comments on data and measurement problems in the use of cost-benefit analysis. He draws particular attention to nonquantifiable aspects of programs with special reference to maternal and child health programs. Marshall (1965) discusses the relationship of cost-benefit analysis to planning, programming, budgeting of Federal health programs.

3. *Economics of hospital treatment*

An important segment of health economics for the purpose of this research is concerned with the economics of hospital treatment. Klarman (1951), P. Feldstein (1968), R. Rice (1966), Deeble (1965), Slesinger and Smalley (1958; 1963), and M. Brown, Jr. (1970) provide works which were especially useful. Klarman and P. Feldstein provide general discussions of the economics of hospitals. Klarman addresses his comments to four sets of problems that he feels have "serious implications for hospital management." These problem areas are: (1) hospital costs and income, (2) hospital utilization, new construction, and capital financing, (3) the need to coordinate hospital resources to promote efficiency and improve quality of service, and (4) the relations of the hospital to its owners, employees, and patients.

P. Feldstein (1968) discusses the importance of specifying output in health care and then specifying the factors that determine the level of output. He discusses in a general way long-and short-range hospital planning, the hospital maximization problem, cost-benefit analysis in the allocation of hospital resources, hospital functional relationships, supply and demand functions for hospital services, the hospital production function, and restrictions on production.

R. Rice (1966) discusses the economic relationships between the physician and the community hospital, arguing that the physician acts as a contractor for the patient, utilizing the hospital output in his own production function which yields total health care to the patient.

Deeble (1965) and Slesinger and Smalley (1958; 1963) present conceptual discussions of patient care outputs, distinguishing two components of those outputs. Each discusses the medically essential care required by the patient as quite distinct from the amenities or accommodations of hospital stay that are jointly produced and consumed.

M. Brown, Jr. (1970) discusses the need for economic analysis of hospital operations and the lack of such analysis in the past. He then presents a general discussion of hospital production and outputs. He comments further on nursing and physician services and their place in hospital production. Other sections of Brown's article deal with capital and other labor inputs and the potential for economies of scale in short-term, general hospitals.

C. Hospitals

1. Hospital goals and programs

Most authors recognize three major programs as constituting component categories of the total effort of the community hospital—patient care, teaching, and research. Knowles (1965) discusses the "balanced biology" of the hospital, referring to the balance that must be struck between these three primary functions. A fourth program is now recognized by many students of the community hospital, that being concerned with the provision of preventive health services. This program reflects the rapidly changing role of the community hospital noted by Somers and Somers (1967b), Brown (1966), Querido (1962), and others.

Sheps and his coauthors propose still another program that also envisions a broadened role for the community hospital (Sheps, Clark, and Gerdes, 1965). The program they suggest is service to the community, a willingness by the hospital to assume a central role in providing the whole range of health services needed by the community.

Literature can be found which relates to each of the five main hospital programs. The patient care program literature is discussed below. Sheps and his coauthors, discuss the hospital teaching role at some length, reporting on findings of a study of medical school-teaching hospital affiliations. Wiggins (1960) analyzes the objectives of hospital medical education programs, relating intern and resident education to the quality of patient care.

Research seems to be concentrated in relatively few of the community hospitals in this country, research being associated mainly with medical education programs. Prioleau (1966) outlines a research role for the community hospital not deeply involved in medical education, pointing to the unique clinical research opportunities that may exist in the smaller hospitals.

Pendall (1965) discusses preventive health services as the forgotten function of community hospitals, with similar comments also offered by Crichton (1970) and Brown (1966). The current community hospital specializes, with rare exceptions, in curative medicine for the acutely ill. The major causes for this neglect of preventive health services stem from tradition and from a failure to define the hospital's total role in the community.

2. *Hospital growth and utilization statistics*

Several of the important quantitative dimensions of the hospital system in the United States are displayed in the periodic hospital statistics releases of the American Hospital Association (AHA). The vehicle for these releases is the annual Guide Issue of *Hospitals*, the journal of the AHA. The statistics are based on an annual survey of AHA registered hospitals supplemented with statistical adjustments for nonreporting. The statistics are extensive, and each few years have witnessed increasingly intensive coverage of individual hospital services. The quality of the series has been improved slightly through the application of more stringent statistical standards but the series offered are still inadequate for certain research. The statistical portrayal of community hospitals presented in Chapter II rests primarily on AHA data. These are the only data available for this type of description.

D. *Patient Care in Hospitals*

1. *Elements of patient care in hospitals*

A discussion of the elements of hospital patient care must include its two important aspects, physician supplied medical services and patient services supplied by nurses and allied health professionals. Physician services have traditionally been supplied on a one-to-one basis between doctor and patient, in the hospital as well as in the physician's office. The trend in the doctor-patient relationship appears to be changing, with increasing specialization of physicians providing the important impetus (Fein, 1967, pp. 69-71).

The literature dealing with medical care standards and audits has been developed by a number of authors; the works of Evans (1966), Williams (1966), Donabedian (1968), Weed (1970), and Howland and McDowell (1964) are typical. The standards for hospital accreditation developed and applied by the Joint Commission on Accreditation of Hospitals (JCAH) set minimum care standards, and spell out certain procedures and mechanisms for the continuing audit of medical care by physicians.

The provision and control of the patient services accompanying the delivery of essential medical services are provided, for the most part, by the nursing and ancillary medical staffs. Many articles and books have dealt with the provision of nursing services (Clausen, 1955; Smith and Gips, 1963; Matheny et al., 1968). Some of the more relevant current literature treats this topic under the heading of progressive patient care (PPC). PPC is a concept of hospital care in which the patient's medical needs determine the pattern of care. The books by Griffith, Weeks, and Sullivan (1967) and by Weeks and Griffith (eds., 1964) and the Public Health Service monograph by Haldeman (1962) provide a comprehensive view of PPC.

The provision of services by allied health professionals has also been reported in the literature. Robbins (1970) provides a broad discussion of the roles played and to be filled by allied health professionals and the role of the economist in analysis of present and future job structures in the health industry.

Magraw (1968), Silver (1966), Millis (1967), and Garfield (1970) discuss services provided by various allied health professionals in current and proposed health care delivery systems.

2. *Patterns of patient care*

Patterns of patient care refer to the recognizable regularity in the incidence of particular elements of care in aggregate statistics relating to the treatment of specific diseases. McNerney et al. (1962) and Riedel and Fitzpatrick (1964) have used care pattern analysis for purposes of gauging appropriateness of hospital use for specific diagnoses. Clinical abstracts of medical records were studied to discern patterns of care with one aim being the comparison of observed care with pre-established criteria of appropriate hospital use. Trends in patterns of care were also scrutinized in the McNerney study by reviewing records from the years 1938, 1948, and 1958, and noting the changes in the respective care processes.

A previous study of hospital use was made by Lerner (1961) in which Indiana Blue Cross claimants' records were tabulated and analyzed. The purposes of this study were to analyze the hospital experiences of a large population having a uniform health insurance benefit structure, and to establish standards for comparison of that population with its own later experience.

The Commission on Professional and Hospital Activities (CPHA) has assembled an extensive collection of abstracts of medical records from hospitals participating in their Professional Activity Study (PAS) and Medical Audit Program (MAP). These data can be used to compare an individual patient's or an individual hospital's treatment of particular diagnosed conditions with the appropriate regional or national patterns of care.

Organization of Chapters

The remaining chapters of this dissertation are designed to lead logically through the development of a model of the patient treatment system in the short-term, general hospital. Chapter II presents some basic community hospital utilization and financial data. In addition, the chapter provides a discussion of the major hospital programs, objectives for each of these programs, and some general information as to the status of these various programs in community hospitals in the United States.

Chapter III discusses outputs of patient care programs in community hospitals. Some notions of hospital outputs from the literature are presented, followed by a proposed output structure for patient treatment in the community hospital.

Chapters IV and V are devoted to the development of the model of the patient treatment process, that set of activities in the treatment system which transforms input resources into the identified spectrum of patient care outputs. Chapter VI deals with the final parameter of the treatment system, the resources that are the inputs to the system.

Chapter VII presents an application of the treatment process model of Chapters IV and V to hospital treatment for uncomplicated inguinal hernia. This case study represents a structuring of the

basic data that were gathered for the purpose of constructing the treatment process model. Chapter VIII presents a discussion of research findings and further research that was suggested in the course of this study.

CHAPTER II

THE COMMUNITY HOSPITAL

The short-term general hospital, or community hospital, has evolved over five centuries from a house of despair to the present-day health center. Students of health care delivery in the United States are in broad agreement that the community hospital or health center, the hub of current health care delivery, will experience an increase in scope and importance of its role in the years ahead. Somers and Somers comment (1967b, p. 43):

> [The hospital's] role in modern health services can hardly be exaggerated. Physical and intellectual center of the medical world, it is the doctors' indispensable workshop, where three essential elements of scientific medicine—patient care, research, and teaching—are increasingly focused. The hospital is also gradually becoming a community health center, the one institution with the potential for encompassing and integrating the wide range of comprehensive medical services—prevention, treatment, rehabilitation, and after care.

Knowles, in a prefacing chapter to a collection of Lowell Lectures at the Massachusetts General Hospital, makes a similar observation (Knowles, 1965, p. 21). He asserts:

> Health has now become a birthright and the benefits of medical science must be made available to all. The public looks with rising expectations to the medical profession and its political representation, and the hospital finds itself squarely in the middle, providing the center stage where all the forces meet.

Some basic data on the expansion of the nation's community hospitals, and on utilization of and costs in these hospitals provide a quantitative notion of the growing importance of community hospitals.

The average community hospital in 1968 had approximately 138 beds, admitted nearly 4,700 patients during the year, had an average daily inpatient census of about 108, and utilized the services of 295 persons along with plant and equipment valued at nearly $3.75 million. Table 1 compares these 1968 statistics with comparable data for the years 1955 and 1960 (*Hospitals*, Guide Issue: August, 1969). Beds in the average short-term hospital increased nearly 28 percent from 1955 through 1968, admissions and average daily census increased 28.5 and 39.4 percent respectively. The dramatic gains during the 1955-1968 period occurred in personnel, expenses, and assets. Full-time personnel increased 87.1 percent, expenses 271 percent, payroll 259 percent, and total assets 181 percent. Modern care in the community hospital requires more employees per bed who are paid more per person, and who utilize increasingly expensive plant and equipment than for care in prior years.

Looking at an "average hospital" can be misleading. Table 2 depicts the distribution of short-term hospitals among eight size groups, measured by number of beds. The median-sized hospital has changed from 65 beds in 1955 to 73 beds in 1960, to 86 beds in 1965, and, finally, to 91 beds in 1968. The most common hospital size in 1955 was 25 to 49 beds, and was 50 to 99 beds in 1968. The smaller hospitals are decreasing in relative importance, but at a very slow rate. More than half of the hospitals have fewer than 100 beds in all four years depicted in Table 2.

TABLE 1

Profile of the Average AHA-Registered Short-Term Hospital, 1955, 1960, and 1968

	Hospital Characteristics						
Year	Beds (No.)	Admissions (No.)	Average Daily Census (No.)	Total Expenses ($)	Full-Time Personnel (No.)	Payroll ($)	Total Assets ($)
1955	108.5	3647.1	77.7	$ 655,719	157.7	$ 404,239	$1,333,779
1960	118.2	4248.2	88.2	1,038,839	199.7	647,124	2,008,138
1968	138.5	4686.6	108.3	2,433,333	295.0	1,451,031	3,741,924

Source: Derived from data in *Hospitals,* Guide Issues: August, 1956; 1961; 1969.

TABLE 2

Community Hospitals Distributed by Number of Beds for Selected Years, 1955-1968

		Beds—Percent of Hospitals Having:							
Year	Number of Hosps.	Less than 25	25-49	50-99	100-199	200-299	300-399	400-499	500 and over
1955	5237	17.3	25.8	23.1	18.8	8.1	5.0		1.9
1960	5407	12.5	26.1	24.9	18.7	9.1	6.3		2.4
1965	5158	7.9	23.6	25.7	21.0	10.3	5.9	2.5	3.2
1968	5444	6.5	22.8	25.4	22.1	10.3	6.1	3.1	3.7

Source: Hospitals, Guide Issues: August, 1956; 1961; 1966; 1969.

Table 3, on page 30, provides some basic utilization and cost data for community hospitals for selected years from 1950 through 1968, which expand on the summary data of Table 1. Plant and equipment in community hospitals, reflected in total assets, has grown in value over the entire 1950-1969 period. The rate of growth has fluctuated during the period, however, declining sharply in the early sixties from the pace of growth in the preceding decade. A slight increase in rate of advance in total asset value was registered during the 1965-1968 years. Total assets grew from $4.35 billion at the close of 1950, to $10.86 billion at the close of 1960, to $21.78 billion at 1968 year-end. The investment in plant and equipment per bed was $8,612 in 1950, $16,992 in 1960, and $27,020 in 1968. Increases in per bed assets reflect rising costs of plant and equipment, the increased use of capital goods in patient care, the needless duplication of assets within the system

TABLE 3

Changes in Community Hospital Utilization, Expenses, Personnel and Assets, and in Civilian Resident Population in the United States for Selected Years, 1950-1968

						Annual Avg. % Change		
	1950	1955	1960	1965	1968	50-60	60-65	65-68
U.S. Civilian Resident Population (000)	150,790	162,967	178,153	191,894	197,560	1.81	1.54	0.98
Number of Hospitals	5,031	5,237	5,407	5,736	5,820	0.75	1.22	0.49
Number of Beds (000)	505	568	639	741	806	2.65	3.19	2.92
Beds per 1,000 Population	3.35	3.49	3.59	3.86	4.08	0.72	1.50	1.90
Admissions (000)	16,663	19,100	22,970	26,463	27,276	3.78	3.04	1.02
Admissions per 1,000 Population	110.5	117.20	128.9	137.9	138.1	1.67	1.40	0.05
Average Daily Census (000)	372	407	477	563	630	2.82	3.61	3.97
Patient Days per 1,000 Population	900	912	977	1,071	1,164	0.86	1.92	2.89
Occupancy (Percent)	73.7	71.5	74.7	76.0	78.2	0.10	0.35	0.96
Average Length of Stay (Days)	8.1	7.8	7.6	7.8	8.4	0.62	0.53	2.56
Total Expenses (Millions)	$2,120	$3,434	$5,617	$9,147	$14,162	16.50	12.57	18.28
Total Expenses per Patient Day	$15.62	$23.12	$32.23	$44.48	$61.38	10.63	7.60	12.66
Full-Time Personnel (000)	662	826	1,080	1,386	1,717	6.31	5.67	7.96
Payroll Expenses (Millions)	$1,203	$2,117	$3,499	$5,664	$8,445	19.09	12.26	16.54
Payroll Expenses per Patient Day	$8.86	$14.26	$20.08	$27.44	$36.61	12.66	7.33	11.14
Total Assets (Millions)	$4,349	$6,985	$10,858	$16,364	$21,778	14.97	10.14	11.03

Source: Derived from American Hospital Association, *Hospitals*, Guide Issues: August, 1951; 1956; 1961; 1966; 1969. U. S. Bureau of the Census, *Current Population Reports*, Series P-25.

of hospitals due to poor planning and organization in the delivery of hospital care, and the accelerated growth of outpatient facilities (see Somers and Somers, 1967b, pp. 47, 233-239).

Trends in the remaining data in Table 3 have been analyzed for three time periods—for the decade of the fifties, for the first half of the sixties, and for the last four years for which data are available, 1965 through 1968. The rate of growth in numbers of hospitals and hospital beds peaked in the mid-sixties and then declined. However, beds per 1,000 population accelerated from period to period during the entire eighteen years since civilian resident population increased at a steadily decelerating rate during the same years.

Admissions, in absolute terms, increased at a decelerating rate; per capita admissions showed a similar decline in rate of advance from 1950 through 1965, and practically no advance during the past three years for which data are shown in Table 3. In spite of the decline in rate of admissions, the inpatient population in short-term hospitals, as reflected in average daily census, has risen at an accelerating rate from period to period. The missing element in this analysis of admissions rate and inpatient census is the nature of the trend in average length of stay which took a sharp change of direction from decline to advance during the fifties, rose moderately during the first half of the decade of the sixties, then climbed sharply from 1965 through 1968. Per capita use of inpatient facilities increased at an accelerating rate, in spite of the decelerating rate of per capita admissions, reflecting the increase in average length of stay. The rise in the rate of

occupancy in short-term hospitals results from the relatively more rapid rate of growth in per capita use of facilities than in the rate of growth of beds per capita.

What has caused these changes in the basic indicators of short-term hospital utilization—admissions and length of stay? The rise in average length of stay coincides roughly with Medicare's inception and quite probably reflects a subsequent higher utilization of short-term hospitals by the aged with a consequent extension of confinement period (Somers and Somers, 1967b, p. 71). Admissions exhibited a retarded rate of increase because of greater use of outpatient facilities, because of a shortage of beds in localized geographic areas, because of expanded utilization of other types of inpatient facilities, and because of a combination of these and less significant other factors (Somers and Somers, 1967b, pp. 45-48).

Finally, Table 3 shows the trend in hospital expenses during the nineteen-year period. Total expenses and total expenses per patient day increased rapidly during the fifties, slowed somewhat in rate of advance during the first half of the sixties, and then accelerated in rate of increase during the 1965-1968 period. Total payroll expense and payroll expense per patient day grew as a proportion of total expense during the fifties, but then decreased in proportionate share as the remaining components of total expenses grew at a faster rate than did payrolls.

A distinctive characteristic of the growth of community hospitals has been the diversification and expansion of facilities

and services offered to patients. The percentage of hospitals offering selected services and facilities for selected years from 1963 through 1968 is displayed in Table 4. Clearly, all services reported are being offered in an increasingly large proportion of community hospitals.

TABLE 4

Percentage of Community Hospitals Reporting Selected Services and Facilities, Selected Years, 1963-1969

Services and Facilities	Year 1963 (%)	1965 (%)	1967 (%)	1968 (%)	1963-1968 (%) Change
Inpatient:					
Postoperative recovery room	63	69	72	73	15.9
Intensive care unit	18	27	. .	42	133.3
Premature nursery	59	59	55	51	-13.6
Psychiatric care	12	13	13	. .	. .
Inpatient or Outpatient:					
Pathology lab	52	57	62	. .	. .
Pharmacy	53	59	64	72	35.8
Physical therapy	46	52	55	. .	. .
Occupational therapy	10	11	12	30	200.0
Dental services	30	33	32	. .	. .
Radioisotope therapy	26	30	. .	. .	. .
Family planning	3	5	. .	. .	. .
Outpatient:					
Emergency department	92	93	92	90	- 2.2
Outpatient department	40	40	49	46	15.0
Social Service program	15	17	21	. .	. .
Home care services	5	5	. .	5	0

Source: Hospitals, Guide Issues: August, 1964; 1966; 1968; 1969.

A better perspective of the offering of specialized services and facilities can be obtained from Table 5. It is readily apparent that only the larger hospitals offer the full range of services that can be provided. Obviously, certain highly specialized services should be offered in a relatively limited number of hospitals (e.g., renal dialysis and organ banks), but these data, coupled with the analysis of hospital size, indicate a dearth of facilities and services in the hospitals which constitute more than a majority of all community hospitals. The median-sized hospital in 1968 of 91 beds would very likely have a postoperative recovery room, an emergency room, and a hospital pharmacy, but would be much less likely to have an intensive care unit, inhalation therapy, outpatient clinics, or home care services. The chances would be less than even of finding a premature nursery in the median-sized hospital. The general area of intensive care, the area of service which has grown most rapidly in recent years, is relatively neglected in the 55 percent of the reporting hospitals that have less than 100 beds. The quality of patient care, at least as measured by the range of services which bear directly on patient mortality in the hospital, is clearly lower in the smaller hospital.

Another important category of service neglected by the smaller hospital deals with community outreach. Outpatient services and home care services are virtually ignored in hospitals with fewer than 100 beds.

The information that has been presented on hospital size, utilization, costs, and services should assist the interpretation of

TABLE 5

Percentage of Community Hospitals Offering Selected Services and Facilities, by Hospital Size, 1968

Services and Facilities	Beds								
	6-24	25-49	50-99	100-199	200-299	300-399	400-499	500 and over	Total
	(percent)								
Inpatient:									
Postoperative recovery room	15	40	76	96	99	99	99	100	73
Intensive care unit	5	11	24	54	85	94	96	99	42
Premature nursery	18	27	44	60	77	85	93	91	51
Renal dialysis	7	6	6	10	14	29	45	60	12
Organ bank	1	1	1	1	3	5	7	18	2
Self-care	1	0	1	4	8	17	26	22	5
Inpatient or Outpatient:									
Pharmacy	25	40	67	95	99	100	99	100	72
Dental services	9	11	22	36	50	60	67	77	30
Inhalation therapy	14	22	33	60	82	88	93	93	48
Family planning	1	0	1	2	8	17	22	36	5
Outpatient:									
Emergency department	73	85	90	94	97	98	97	100	90
Outpatient department	46	39	36	38	55	74	86	94	46
Clinical facilities	29	18	13	13	12	21	25	35	17
Home care services	2	2	3	7	15	17	21	30	7
Renal dialysis	6	5	5	6	10	16	28	44	9
Number of hospitals reporting	354	1243	1384	1202	561	333	167	200	5444

Source: *Hospitals*, Guide Issue: August, 1969.

the discussion of community hospital objectives and patient care programs which follows.

Goals of Community Hospitals

The mean community hospital had 138.5 beds in 1968, while the median-sized hospital had approximately 91 beds, as is indicated in Table 5. The wide range in hospital sizes and the relatively small size of the typical community hospital, coupled with the rather narrow distribution of services and of educational programs offered, suggests that not all hospitals are pursuing goals* in all of the recognized hospital program areas. The goals that are presented in this chapter are belived to be exhaustive, in that goals are developed for all major hospital programs. These are much more encompassing than the goals of a typical community hospital. The full range of goals might be found in the average or median-sized hospitals, but most likely would be best stated and pursued in teaching hospitals and in the larger hospitals, especially those closely affiliated with medical schools.

The major hospital program categories, each representing sets of activities yielding outputs consistent with the basic community hospital goals are:

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*Goals and objectives will be differentiated in this study. Goals will refer to the broad purposes to be accomplished within the major hospital program areas. Objectives (discussed in Chapter III) refer to specific output aims of element-level activities.

1. Preventive and Promotive Health Services
2. Patient Care Services
3. Education in the Health Professions and Occupations
4. Research in Health Science and Health Care
5. Other Community Health Services
6. Hospital Administration and General Support

A general statement of goals for each of these program categories, based on the literature and on the writer's experience in implementing PPB in a 400-bed teaching hospital and affiliated medical, dental, nursing, pharmacy, and allied health professions colleges, are presented in the remaining paragraphs of this chapter.

Preventive and Promotive Health Services

Goals: To use the professional skills, the facilities and equipment, and other services of the hospital:

1. To convey pertinent information to community members on health and health related issues.
2. To devise, implement, and otherwise support environmental standards and controls which promote positive health.
3. To participate in diagnostic and care programs in the community designed to cope with health problems.

The preventive and promotive health mission has been the most neglected mission of community hospitals. Pendall (1965, pp. 108-9) views the promotion of health as a "stepchild" function of the hospitals, and that the basic reason for this condition is a failure on the part of hospital administration to adequately perceive the hospital's role in the community. Historically, the vast array of talent and modern

equipment have only assisted the community if one of its members occupied a hospital bed. The present-day hospital emphasizes acute, curative medicine, and a community member has to be in a relatively advanced stage of illness or injury before hospital resources are expended on him.

Preventive and promotive health services are included as a community hospital program because of the role visualized for these hospitals in future years. Somers and Somers, cited on the first page of this chapter, see the community hospital integrating health services from prevention through rehabilitation and after care. Brown (1966, p. 128) states that community hospital resources "will have to be utilized for all levels of health care and at all points in the community." But, as the Somers indicate (1967b, p. 278-284), the projected change in orientation will not come without opposition, for the pressures for change pose a direct challenge to the physicians' powerful role in hospital operation.

Patient Care Services

Goals: To guide and participate in a continuum of up-to-date, effective patient care for the acutely and chronically ill:

1. By organizing and controlling the medical staff so as to provide essential medical services to the individual patient consistent with his medical needs.

2. By organizing and controlling the nursing, other health professional, and supporting staffs so as to provide supplemental care services to the individual patient consistent with prescribed essential medical services, and with other patient needs.

This goal expresses a concept of hospital patient care that is designed to meet the patient's needs. Basically, patient care is seen as having two main aspects:

1. The provision of essential medical services demanded by the disease or injury as perceived by the physician or physicians treating the patient.

2. The provision of supplemental care services as required by the physician prescribed and managed treatment and as required by the patient's support, comfort, and other care needs.

Each of these aspects will be discussed as separate entities, even though the two processes are interwoven in the actual treatment process.

Provision of essential medical services

The provision of essential medical services by the physician is also conceived as having several elements. The physician appears to do the following:

1. Assume the responsibility for the total hospital care process for his patients.

2. Apply the high skills of his profession to the treatment of the identified health problem or problems of the patient.

3. Assume the role as the top manager of the total care effort.

The separation of items (1) and (3) may be confusing. The first element, the assumption of patient responsibility, is oriented to the patient and his need to identify with one physician as "his doctor." This phenomenon has been termed "sponsorship," and it has come to take several forms from individual physician sponsorship to committee sponsorship. The study by Duff and Hollingshead (1968) and the article by Babcock (1965) indicate that sponsorship is extremely

important to some patients, and that committee sponsorship may leave an unsettling effect on the patient's morale.

The third item refers to the application of sound management principles to the planning, organizing, directing, controlling, etc. of the treatment process itself. Care process management seemingly should be a major physician function, and is clearly recognized as such in this research. However, because the physician has so often seemed as though he were subject to criticism only by his peers, and then reluctantly, the application of management theory to the hospital treatment of patients has lagged. A recent book by Weed (1970), a physician, dealing with the preparation of the patient record by the physician, reflects some of the major management functions in its recommendations.

Weed argues for a problem-oriented patient record in which the patient's problems are enumerated and the progress of care is recorded for each problem. Additional detail on the proposed patient record provides some insight into the physician's role in patient care.

The first task done by the physician, according to Weed (1970, p. 13), is the establishment of a data base for the patient. This generally consists of the chief complaint, patient profile and related social data, present illness, past history and body systems review, physical examination reports, and routine and special lab test results.

Next, the physician prepares a problem list, including every problem, past or present. New problems are added as they are discovered in the course of treating the patient. The development of the initial

plans for further diagnosis and for therapeutic efforts is then prepared. The plans may be for the collection of additional data in order to establish a diagnosis or to facilitate care management, for specific treatment procedures or drug therapy, or for the education of the patient about his problems and his role in the care process.

Weed (1970, p. 42) sees all classification schemes for diseases, and programs for the management of those diseases, as somewhat arbitrary. There are, however, certain variables "prominently associated with each disorder and its management." The physician's responsibility is to identify those variables and restore them to, or maintain them in, a normal state. These efforts are what the patient commonly associates with item (2) above, the application of high professional skills.

The final phase of patient record keeping is the periodic recording of notes on the progress experienced in dealing with the identified problems of the patient. These notes relate to medical and to nursing and paramedical services performed, and can be in narrative form, or in the form of flow charts showing the time distributed values of vital signs, lab tests, body input/output, medications, and so forth. The final progress note is the discharge summary which should include retrospective and prospective comment on each identified problem.

The care management process is both explicit and implicit in the discussion of the patient record. Data collection, organization, integration, and evaluation are evident. Planning of diagnostic and

therapeutic efforts is prescribed. Control and feedback are implicit in the periodic monitoring of patient progress. The major implicit function in this discussion, and one crucial to the quality of care, is the organization and leadership of the health care team. The conflicts inherent in the carrying out of this management function are well documented (see Duff and Hollingshead, 1968; Georgopoulos and Mann, 1962).

In summary, the physician assumes a sponsorship role for individual patients, treats the identified health problems, and manages the delivery of the hospital care he has prescribed. As Babcock (1965, p. 99) indicates, the doctor has become the central figure in a complex care team. There is considerable evidence that the second element of the triad of physician duties, treatment of identified health problems, has improved steadily through the years, backed by rapid advances in the health sciences. The sponsorship role has been diluted to some extent by the increasing specialization of physicians. The physican's care process management skills seem to have failed to keep pace; the extreme variation found in care patterns as reported by Riedel and Fitzpatrick and by Lerner gives some evidence of questionable hospital utilization by some physicians. Improper treatment and hospital utilization, says Weed, stem more from ineffective management of the care program than from errors in medical judgment (Weed, 1970, p. 15-16).

Provision of supplemental care services

The other aspect of patient care is the provision of supplemental care services related to requirements of the primary treatment regimen, and to patient and other care needs. Supplemental care has two main components—primary and secondary supportive care.

Primary supportive care services are services provided by nurses and allied health professionals that are essential to progress in dealing with recognized health problems. This care is dictated by the patient's physical and/or mental condition, regardless of his particular disease or stage of care, and can be categorized utilizing concepts from progressive patient care (see Haldeman, 1962, and Weeks and Griffith, 1964). Care classifications and the patient condition determining the need for that type of care are provided in the following definitions.

Intensive care—for critically and seriously ill patients (including surgical postoperative cases) who are unable to communicate their needs or who require extensive nursing care and observation. These patients are under close observation of nurses who have been selected because of their special skills, training, and experience. All necessary lifesaving emergency equipment, drugs, and supplies are immediately available.

Intermediate care—for patients requiring a moderate amount of nursing care. Some of these patients may be ambulatory for short periods of time. Emergency care and frequent observation are rarely needed. Included in this group are those patients who are beginning

to participate in caring for themselves. In addition, the terminally ill may be included here.

Self-care—for ambulatory and physically self-sufficient patients requiring therapeutic or diagnostic services, or who may be convalescing—provision is made for relaxation and recreation. The patient is instructed in self-care within the limits of his illness.

These three categories of care refer to acutely ill patients who can "progress" from a state of total dependency in intensive care to a state of relative independence in self-care. However, some additional care categories are required to cover the full range of community hospital patients. They are:

Long-term care—for patients requiring skilled prolonged medical and nursing care. Rehabilitation counseling, occupational therapy, and physical therapy services may be needed for these patients. In addition, emphasis is placed on instructing those patients who must learn to adjust to their illness and disability.

Home care—for patients who can be adequately cared for in the home through the extension of certain hospital services.

Outpatient care—for ambulatory patients requiring specific diagnostic, curative, preventive, and rehabilitative services provided by the hospital, but who live at home.

Day care—for ambulatory patients requiring specific diagnostic, curative, and rehabilitative services provided by the hospital on a day-long basis, but who live at home.

These additional care categories contemplate a broadened role for the community hospital; care is extended to the chronically ill and also across more of the continuum of care of the patient, reaching beyond hospital boundaries into the community.

Secondary supportive care is designed to provide for the physical and emotional needs of the patient, but it is not deemed essential to progress in dealing with identified health problems. This element of supplemental care is concerned with providing physical comfort and emotional support to the patient before, while, and after essential care is administered.

Patient care is the primary mission of the community hospital. It is the historical role of the institution and the program upon which educational and research programs are built. Even in the future hospital, with its expanded obligation in health care delivery, curative efforts for the acutely ill will undoubtedly remain a major function.

Education in the Health Professions and Occupations

Goals: To utilize the professional skills, facilities, and other services of the hospital to support educational programs for eligible individuals:

1. To obtain clinical and, in some cases, classroom instruction as part of their pursuit of professional and advanced degrees, and postgraduate education in medicine, nursing, and other health professions.

2. To receive clinical training that will enable the individual to perform in a health occupation.

The hospital is involved primarily in the clinical aspects of health education, whether it be part of medical or nursing education or

of a practicum or internship for occupational therapy, clinical psychology,or some other health-related professional program. Basically, the hospital is a convenient place to bring the developing professional in contact with patients so that he or she can practice and perfect skills required in patient care. The students provide services to patients under differing degrees of supervision while being educated in the processes of delivering care to patients.

Table 6 displays summary information on medical and nursing programs in community hospitals. Of the 5,189 short-term hospitals reporting data on approvals and affiliations for the year 1968, 364 or 7 percent reported having a medical school affiliation, 706 or 13.6 percent had professional nursing schools, 730 or 14 percent had internship programs, and 885 or 17 percent had residency programs. Medical school affiliations and professional nursing schools of community hospitals grew in number over the full nine-year period covered by Table 6. The percentage of community hospitals offering internship and residency programs declined from 1960 to 1965, but increased again by 1968. The data in Table 6, showing the distribution of educational programs by hospital size for 1968, provide additional proof of the importance of the larger community hospitals. Medical and nursing education are, in the main, centered in the larger hospitals. In 1968, a little over 87 percent of all medical education programs and 83 percent of all nursing education programs were located in hospitals with 200 or more beds—only 24 percent of the total number of community hospitals. Programs for the education of individuals in

TABLE 6

Percentage of Hospitals Offering Medical and Nursing Education Programs, for All AHA-Registered Hospitals, 1960, 1965, 1968 and for Community Hospitals, 1968

Educational Programs	All Hospitals 1960	All Hospitals 1965	All Hospitals 1968	Community Hospitals: Total Hospitals 1968	Community Hospitals, Beds: under 25	25-49	50-99	100-199	200-299	300-399	400-499	500 and over
	(in percent)											
Medical School Affiliation	5.6	6.6	8.6	7.0	0	0.1	0.7	3.6	10.4	24.2	34.9	59.7
Professional Nursing School	13.7	10.6	11.7	13.6	0	0.1	0.4	9.7	34.4	51.1	62.0	63.8
Residency Program	18.2	17.0	19.7	17.1	0	0.5	1.7	10.0	34.2	66.2	86.1	96.4
Internship	12.4	10.8	12.8	14.1	0	0	0.1	3.7	26.0	52.9	68.7	63.8

Source: Hospitals, Guide Issues: August, 1961; 1966; 1969.

the health-related professions would most likely be in the larger hospitals also for they are the hospitals providing the services needed to support such educational programs.

The initial formal education in a health professional area is recognized as a first step in a lifelong process of training that is required if the individual is to remain conversant with the advances in the theory and practice of his or her profession. Continuing education is an obligation that accompanies the practice of a health profession, and the community hospital can assist immeasurably in the discharge of that obligation by providing continuing education for practicing health professionals.

Nelson (Knowles, ed., 1965, pp. 247-253) views a network of community hospitals created to provide quality clinical education from preprofessional to postgraduate levels, with a medical school and teaching hospital at the center of the network. The special expertise of the medical school/teaching hospital staff would be addressed to the design of teaching programs, to the production of special teaching aids, and to the administration of the network educational activities. A regional plan such as this, according to Nelson, would tend to upgrade the overall health educational effort while utilizing an organizational arrangement that would promote efficient delivery of hospital services.

Educational effort in hospitals can be expected to increase in response to current shortages in the supply of all health professionals (Fein, 1967, pp. 80-85, 127-8; Robbins, 1970, pp. 59-60). When universal health insurance becomes effective (the legitimate

question now seems to be "when" rather than "if") still greater needs for the services of trained health personnel will be created. A regional cooperative program, such as discussed by Nelson, seems to be part of the answer to effective care delivery and to effective utilization of educational resources. Regionalization promises to bring some, if not all, of the special skills of the large community hospitals and medical education centers to the smaller hospitals, helping to eliminate the gap in services provided and quality of care evident in the statistics that have been presented.

Research in Health Science and Health Care

Goals: To use the facilities and other hospital resources to support research by health professionals which seeks:

1. To create new knowledge and broaden the understanding of existing knowledge of the basic sciences which underlie the practice of the respective health professions.

2. To improve the clinical application of findings in the basic sciences.

3. To assess the needs for health care, and to devise improved administrative and organizational arrangements for the delivery of health care.

4. To improve the understanding of the economics of disease and the delivery of health care.

5. To conduct investigations seeking to control the incidence of diseases by exploring the causes of, the detection of, and the cures for those diseases.

Research in the basic sciences related to the practice of the various health professions has received the greatest dollar support and has involved the greatest effort by health researchers. Research in the basic sciences has contributed significantly to the understanding

of disease and to its diagnosis and treatment, but, at the same time, has led to higher costs of hospital care. The advance of modern care has required greater specialization of personnel and increased utilization of costly equipment (Klarman, 1965, pp. 109-111; McNerney et al., 1962, pp. 621-622).

Research designed to improve the clinical application of scientific findings has not kept pace with research in the basic sciences. Clinical research gets neither dollar support nor approval from one's colleagues, and so tends to be neglected (Knowles, ed., 1965, p. 31). McKeown states (in Knowles, ed., 1965, p. 268):

> Some people consider that while the acquisition of knowledge about health and disease is a matter of profound interest and importance, its application is a humdrum affair which can be left to the administrator. This viewpoint is reflected in the contemporary organization of research which finds little place for concern with services. Thus, investigation of the biochemistry of schizophrenia is regarded as a proper subject for scientific inquiry; investigation of services for the schizophrenic is not. In reply it should be necessary only to stress that, on the contrary, the problems raised by the application of medical knowledge in a complex world are at least as formidable as those associated with its acquisition.

Leaf (1968, pp. 358-9) argues that the research in the application of medical science findings should receive added financial support, but not at the expense of basic science research. It is apparent that some very difficult resource allocation decisions must be made in the future by those funding health research in the basic and the applied sciences.

Still another area of health research that has been relatively neglected is the investigation of the administration and organization of health care delivery. As Weed states (1970, p. v):

> If communities were the size of cells and if hospitals, pharmacies, laboratories, patients, and physicians were the size of subcellular particles, no doubt they would be the subjects of a great deal of research, and much more would be known about their interrelationships and pathophysiology. But the apparent ease with which the organization of medicine itself can be observed has discouraged examination of it and has even made the idea of that examination seem somehow naive and unscientific.

Weed feels that much of the disorganization in the delivery of care stems directly from the physician's mode of practicing his skills. Too often what has been passed off as the "art" of the profession is in reality lack of a disciplined approach to a complex multivariate problem (Weed, 1970, pp. 127-129).

Prioleau (1966, p. 80) discusses participation in research by the community hospital, noting the financial and administrative constraints faced by smaller hospitals which are expected to provide patient care, and little else. He also mentions the important impact on educating the new and the experienced hospital physicians. Prioleau also sees a positive contribution extending beyond the immediate confines of the hospital undertaking clinical research. Some types of problems not encountered in larger hospitals or referral clinics may have to be dealt with in smaller hospitals, making the smaller institutions valuable sources of clinical information.

No data could be found that provided insight into the amounts of research conducted in the community hospitals. One is forced to draw conclusions on the basis of the evidence at hand, in the absence of these data. For instance, basic science and clinical research are probably undertaken to a miniscule degree, if at all, in the smaller hospitals. Further, since clinical research is relatively ignored,

little of this kind of research will likely be found in any hospital, and when undertaken it will probably be in the larger hospitals with the broader range of services and facilities. It seems logical to conclude that most health research conducted that in any way involves the hospital, is probably conducted in hospitals heavily involved in health education, especially hospitals with strong ties to medical schools. Research, after all, is more nearly related to teaching and its reward system than to patient care. This is especially true of the basic science research which is so heavily supported. Significant research effort is quite likely more narrowly distributed among the nation's community hospitals than are educational efforts or hospital services.

Other Community Service

Goal: To assume a role of leadership in the community health care delivery system, utilizing the personal skills of the hospital staff to guide programs offering comprehensive health services to community members.

This goal, suggested by Sheps and his coauthors (Sheps, Clark, and Gerdes, 1965, p. 29-30), based on their study of medical school-teaching hospital affiliations, is broader than the preceding goals. Rather than referring to specific "in-house" activities it more nearly reflects a basic philosophy of operation and a broadened perception of the role of the hospital in the community. The operating philosophy detected by Sheps was a "readiness to serve" which applied to activities

in all of the other program areas. Thus, this goal can be visualized as being served concurrently by properly designed activities that serve one or more of the remaining program goals.

Hospital Administration and General Support

Goal: To plan, organize, staff, implement and direct, evaluate and control, coordinate, report, and budget the total hospital program.

The previous sections of this chapter have identified the major programs of the community hospital and the goals that are pursued in each program. The final program category deals with the efforts, procedures, and mechanisms that are required to get the total job accomplished effectively. The goal that is presented incorporates the major functions of administration presented by Gulick and Urwick (1937) and recognized in similar form by Fayol (1949).

Little would be gained by treating each of these functions of administration in detail. Knowles (1965), McGibony (1969), Robinson (1962), and Georgopoulos and Mann (1962) discuss the role of administration in hospitals in depth, highlighting the very special organizational conflict that is more or less inherent in the modern hospital's administrative structure.

Hospital administration must provide the proper setting and guidance to achieve an optimal balance of effort among the major hospital programs, given a limited amount of resources with which to do the job. There can be conflicts among program goals as well as among individuals in the community hospital, and a major task of administration is the constructive management of that conflict.

CHAPTER III

THE PATIENT TREATMENT SYSTEM—PATIENT CARE OUTPUTS

The hospital planner would like to have a logical procedure for moving from definition of basic organizational goals to the budgeting of required input resources. In addition, he would want the procedure to facilitate analysis of alternative ways of attaining the basic goals. Such a procedure would permit a high degree of rationality in the allocation of scarce means to the pursuit of desired ends. The research problem, as expressed in Chapter I, is to develop a general model of patient treatment in the short-term hospital. Systems analysis is to provide the very basic concepts as well as the elementary framework upon which the model is built. This chapter, and the three chapters which follow it, are concerned with the development of a general systems model of patient treatment.

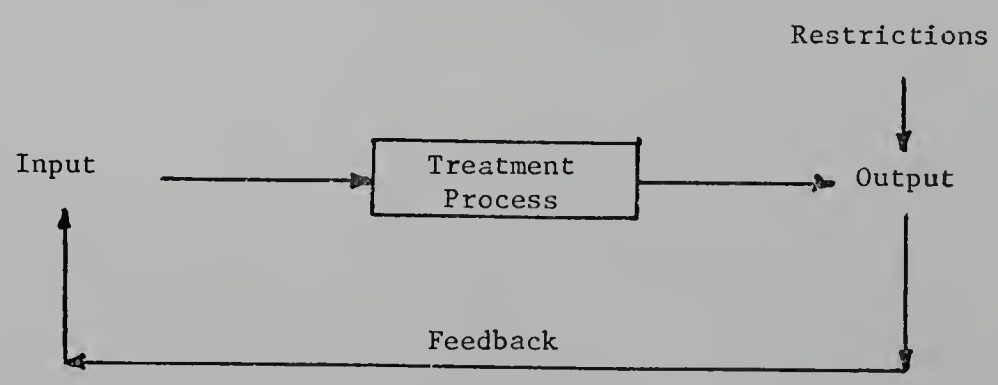

Figure 1. Elementary model of the patient treatment system.

Patient treatment in a community hospital is a complex process which utilizes specialized resources to produce identifiable outputs. Thus, the three parameters of a system—inputs, process, and outputs—are evident in patient treatment, and the basic systems model is applicable to the defined system (see Optner, 1968, pp. 3-62). An elementary patient treatment system model is depicted in Figure 1. Inputs are resources, defined in the broadest sense, which energize the system. Output results from operations performed by the processing unit on and with input resources. Outputs, the transformed system inputs, are proxies for the basic goals for which the system was organized. Patient treatment outputs and the restrictions on them are the major subjects of this chapter.

The process represents sets of activities which translate inputs to outputs. Restrictions on a system are internally or externally imposed contraints that bound the system. A restriction has two elements—an objective and a constraint. The objective is the result that is to be attained in specific output terms; the constraint provides dimensioned limits within which the objective can be pursued.

Together, objective and constraint facilitate the formulation of an output criterion, which is the measure by which alternative outputs are judged and rated as to relative desirability. Feedback involves the comparison of output with the established criterion and the generation of a system input designed to tend to eliminate any

detected discrepancy between output and criterion (Optner, 1968, pp. 13-14, 23-24, 27-28).

Patient Care Outputs

In PPB, programs are sets of activities which yield mission-oriented outputs; programs, then, become convenient subdivisions of the process parameter of the patient treatment system. Since programs are in effect the resource users, the analysis of resource allocation and utilization by hospitals requires a close scrutiny of the transformation processes implicit in programs. Casting the treatment process in the systems format will necessitate looking at these transformation processes, initially, in a general model, and subsequently in a specific model for a single output category—inguinal hernia.

The Patient Care program structure based on the *Eighth Revision, International Classification of Diseases, Adapted,* is presented on pages 57, 58 and 59; the structure is incomplete in that it shows detailed outputs for one program subcategory only—2.1I Diseases of the Digestive System—and not for the remaining subcategories. The structure has some essential features:

1. The basic output unit of the hospital is a fully or partially processed patient.
2. The output units are classified according to four variables:
    a. Discharge diagnosis of health problem (or problems)
    b. Stage of illness at hospital admission

c. Proportion of the total treatment process completed

d. Objective state of health at dismissal

3. The treatment process is the basic system upon which the program structure rests. The process is divided into logical stages; at each stage services are rendered to the patient, culminating in release from the process.

Structuring patient care output in this great a detail may prove to be inappropriate for resource planning. It may be possible to use a more aggregated output categorization in the planning process without sacrificing a significant portion of the rationality that is sought. However, a number of considerations opt for a micro approach at this exploratory stage in the research. A major consideration is the high degree of uncertainty as to how individual cases interact with facility, equipment, and personnel constraints over time. Most, if not all, of the variables in the treatment process are stochastic in nature, creating the potential for interactions critical to resource usage.

Program Structure for a Short-Term General Hospital

Programs

1.0 Preventive and Promotive Health Services

2.0 Patient Care Services

3.0 Education in the Health Professions and Occupations

4.0 Research in Health Science and Health Care

5.0 Other Community Health Services

6.0 Hospital Administration and General Support

Program Categories

2.0 Patient Care

- 2.1A Infective and Parasitic Diseases
- 2.1B Neoplasms
- 2.1C Endocrine, Nutritional, and Metabolic Diseases
- 2.1D Diseases of Blood and Blood-Forming Organs
- 2.1E Mental Disorders
- 2.1F Diseases of the Nervous System and Sense Organs
- 2.1G Diseases of the Circulatory System
- 2.1H Diseases of the Respiratory System
- 2.1I Diseases of the Digestive System
- 2.1J Diseases of the Genitourinary System
- 2.1K Complications of Pregnancy, Childbirth, and Puerperium
- 2.1L Diseases of the Skin and Subcutaneous Tissue
- 2.1M Diseases of the Musculoskeletal System and Connective Tissue
- 2.1N Congenital Anomalies
- 2.1O Certain Causes of Perinatal Morbidity and Mortality
- 2.1P Symptoms and Ill-Defined Conditions
- 2.1Q Accidents, Poisonings, and Violence

Program Subcategories

- 2.1I Diseases of the Digestive System
  - 2.1I1 Diseases of oral cavity, salivary glands, and jaws
  - 2.1I2 Diseases of esophagus, stomach, and duodenum

2.1I3 Appendicitis

2.1I4 Hernia of abdominal cavity

2.1I5 Other diseases of intestine and peritoneum

2.1I6 Diseases of liver, gallbladder, and pancreas

Program Elements

2.1I4 Hernia of abdominal cavity

2.1I41 Inguinal hernia without mention of obstruction

2.1I42 Other hernia of abdominal cavity without mention of obstruction

2.1I43 Inguinal hernia with obstruction

2.1I44 Other hernia of abdominal cavity with obstruction

Program Subelements

2.1I41 Inguinal hernia without mention of obstruction

2.1I411 Diagnosis and pretherapy care

2.1I412 Therapy and therapy-coincident care

2.1I413 Evaluation and control of therapeutic response and post-therapy care

2.1I414 Follow-up and after care

A second consideration is the possibility that meaningful tradeoff analyses between program subcategories will require development of the costs and benefits associated with each elemental output.

It would seem that marginal analysis performed at the subcategory level, without analyses at the element level, assumes that the individual elements within a subcategory vary little from the subcategory average in costs and benefits. This is a heroic assumption at this point in the research. One aspect of treatment, length of stay in the hospital, varies from an average of 2.6 days for the element, dental disorders (*ICDA, Revised,* 1962) to 15.1 days for the element, diseases of the liver except serum and infectious hepatitis, both elements of the same subcategory, Diseases of the Digestive System. Average length of stay for the entire subcategory was 8.1 days. The diagnosis with the shortest and longest average stays varied by 68 percent and 86 percent respectively from the subcategory average.

Another reason for defining the patient care program structure as presented is that the output units—treated patients—fit conveniently into current cost-benefit methodology applied to the analysis of diseases. The basic approach to the measurement of economic costs of disease, and the subsequent benefits to society from disease eradication, avoidance, or treatment, has been to estimate the direct costs of dealing with the disease, the outlays for prevention, detection, treatment, rehabilitation, research, training, and capital investment in facilities, and the indirect costs of the disease which are the output losses to the economy due to death, illness, or disability attributable to the disease (D. Rice, 1965; 1966). It would seem that as the methodology is improved, less aggregated outputs might be used, especially for planning and budgeting for specific organizations such

as a hospital, where a disease such as cancer spans a wide range of care patterns from a relatively short-stay treatment to the long stay for the terminally ill. Harris (1964, pp. 4-5) discussing attempts to assess the burden of financing health care argues that "there is much to be said for an entirely new approach, namely estimating the cost of treating each disease over time and a composite index (weighted) of all diseases."

A related reason deals with the other side of these analyses, the cost side. The case orientation recognizes that cost and resource usage differences are attributable to differences in hospital case-mix. M. Feldstein (1967, p. 15-25) reported that case-mix has a significant effect on hospital costs, based on a study of data from the Hospital Service, British Health Service. This means that certain cases are more costly than others, and that these differences must be brought into cost-benefit studies if meaningful marginal analyses are to be made. Some of the differences relate to quality-of-care increments for specific cases that would be lost if more aggregated output units were used. For example, a particular output element within a program subcategory may require a substantial period of intensive care, while another element may require little intensive care. The effect of intensive care on the total treatment of the first diagnosis could not be examined in a subcategory average.

A fifth reason for the proposed output structure is that it appears to be applicable across the entire spectrum of care, from prevention to rehabilitation, and not just to the acute illness phase.

The structure reflects a health problem orientation which would seem to be suitable at any level of the total health care system.

Patient Care Output Concepts

Baligh and Laughhunn (1969, p. 300) consider hospital outputs in developing a linear optimization model for application to inpatient admissions. They state:

> One of the most difficult conceptual problems encountered when investigating hospitals in general, and more specifically when attempting to derive useful decision models to aid in hospital planning, is the development of a meaningful definition of hospital *output*. A suitable definition is essential to any type of economic analysis.

The remaining paragraphs of this section provide the various concepts of patient care output that have been developed in the literature, and propose a structure of outputs based on the literature and on analysis of hospital medical records.

The discussion of hospital outputs in the literature is not extensive. Some authors make general statements that the hospital's product is patient care (Georgopoulos and Mann, 1962, p. 5). Others who have considered hospital outputs in more specific terms take a number of approaches:

1. They identify inputs, such as hours of nursing service, as outputs.

2. They identify outputs such as number of lab procedures run, number of x-ray films exposed, number of surgical procedures accomplished, etc., as final outputs rather than intermediate outputs.

3. They identify the patient with final output, but measure that output in imprecise units, such as patient days.

4. They identify the total hospital treatment of a patient as an intermediate product that is an input in the private physician's production function.

5. They identify the treated patient as a final output unit but provide no precise way of differentiating between individual units.

The identification of units of input of a resource utilized by an organization as outputs is to confuse means and ends. Budgeting with an object-of-expenditure or line-item orientation is frequently guilty of this type of confusion. There can be processes in which the means of achieving a particular output are very nearly as important as the output itself. The process of administering the law has been offered as such a process where the means of achieving just application of laws are as important as the goal of justice. The provision of medical, nursing, and paramedical services may also be processes of this type where the means of providing care are considered as an end as much as is the essential substance of the care delivered.

Processes of this type fit within the systems model that has been proposed without classifying particular inputs as outputs. If nonessential care in the form of personal comfort services are required by patients, then these requirements can be made a part of the output restrictions which can be translated back through the treatment process transformation functions, to yield specifications for particular types of inputs. Thus, if treatment with a heavy dose of "tender, loving care" is the specified output, a particular type of nursing service will be required as input. A desired input is specified by properly

constraining output. (Output restrictions are considered in a separate section of this chapter.)

The identification of intermediate outputs such as numbers of laboratory procedures performed, number of physical examinations, etc., as final outputs of the community hospital results somewhat from an inclination to measure the readily measurable rather than the truly meaningful but difficult to measure. Completed laboratory tests or physical examinations are clearly rather standardized outputs from relatively invariant production processes, which are easy to count. Intermediate hospital outputs serve as inputs to other hospital production functions, namely those functions which yield treated patients, the ultimate or final hospital output. Intermediate output levels are derived from final output objectives; the hospital striving toward some concept of patient care output optimality could not measure its progress toward such a goal by relating intermediate output levels to inputs.

Treating intermediate outputs as final outputs involves confusion of the type described above where inputs were termed outputs. Hospital intermediate outputs are inputs to patient treatment whose nature and number are determined by patient care objectives and the transformation functions which yield treated patients.

The third concept of hospital output, and one widely used in the hospital industry, is the patient occupancy day or patient day (day of hospital stay for one patient—total patient days is the summation of the individual patient hospital stays). This concept

refers to the patient but it is an extremely imprecise measure, implying that all patient days are homogeneous units. This is not the case, as Rice indicates (R. Rice, 1966, p. 89):

> Crude measures of hospital output, such as patient days of care, are readily available. But using these measures is like measuring wheat output by adding up the number of containers of wheat when the containers are not all of the same size, not all filled to the same level, or not filled with the same mix or grade of wheat.

Baligh and Laughhunn (1969, pp. 300-301) also comment on the patient day as an output unit:

> While this concept undoubtedly measures a *property* of hospital output, it is definitely inadequate for purposes of economic analysis since it implicitly assumes that all patient days are homogeneous units of output with respect to *resource absorption*. This is clearly not the case because the requirements of different equivalence classes of patients are multi-dimensioned. Further, output measured as patient days completely fails to distinguish between types of patients served with respect to the objectives of the hospital in terms of value of patients.

Patient days could be appropriate units of output for certain of the nonessential elements of care where rate of resource absorption could be quite homogeneous. The rate of usage of dietary (standard diet patients) and hotel services could be quite homogeneous for all patients at certain stages of their care. Thus, patient days of intensive care, of intermediate care, and of minimal care may be ouput unit groupings providing a considerable degree of within-group homogeneity. A seemingly apparent problem with a subdivision of patient days is that they begin to refer to intermediate outputs and not to final output, with the particular types of patient services being potential inputs in a single treatment process for a particular patient.

The last two approaches to hospital output view the hospital-treated patient as the terminal output of the community hospital, with considerable ambiguity as to how these patients are to be grouped, but they represent two diametrically opposite views of the hospital-physician relationship.

The position of Rice utilizes the traditional relationship of physicians and hospital in which the doctor is the "contractor" who subcontracts a portion of his patients' total health care to the hospital. The final hospital output, the patient released from the hospital with approval of the attending physician meaning in receipt of the full hospital-based treatment process, is an intermediate output which is an input to the physician's production function that yields a final product of total health care (R. Rice, 1966, p. 90-91).

The view of the hospital as a collection of special personnel and equipment at the disposal of the practicing physician is traditional, but this relationship is undergoing significant change (Somers and Somers, 1967b, pp. 103-4, 106-8; Klarman, 1965, pp. 131-6). Some of this change has already occured in the larger hospitals and referral centers where the practicing physician finds large housestaffs of specialists and in some cases salaried physicians on the hospital payroll challenging his role as the manager of his patients' care. It seems that an alternative production arrangement exists and is spreading in the larger hospitals, in which the hospital is in control of the total patient care production function, and the practicing physicians'services are one of many inputs to that process.

Brown disagrees with this view of hospital production because the physician is seldom a hospital employee, is not supervised by the hospital, and does not produce services sold directly to the hospital (M. Brown, Jr., 1970, p. 66). Brown's view seem to ignore the trends in hospital care and in the practice of medicine in hospitals. These trends, noted by the Somers and by Klarman, definitely are tending to cast the physician in the role of provider of services in a hospital-based production process.

All of this would be of little import to this discussion of outputs if the alternative arrangements had little effect on the nature of hospital patient care outputs. But this is not true. The final output of the hospital under the Rice concept could be something different than under the alternative concept that has been suggested. The basic difference would be in the extent of services offered by the hospital, with more physician and other professional services being offered within hospital patient care under the broadened concept of hospital role. The final output would be modified by the increment of additional services provided to the patient as part of his hospital treatment.

The final approach to hospital output measurement utilizing the "treated patient" as the final output unit also has some weaknesses. The term treated patient is as ambiguous a concept as is the patient day, again implying a uniformity in transformation process and, hence, in resource absorption among units that is not the case. Categorization of treated patients is required to create output

units with some degree of homogeneity in the use of resources. Very little guidance has been provided in the literature as to how treated patients should be classified.

Baligh and Laughhunn (1969, pp. 293-295, 301-303) suggest the development of equivalence classes of patients based on patient care requirements. Average requirements vectors are developed for the patients in each equivalence class, the vectors are multiplied by the number of patients in the equivalence class, and the resulting products are then summed over all classes to yield total patient care requirements. The highly symbolic development by these researchers leaves unspecified the bases for placing patients in equivalence classes, other than relative uniformity in case requirements. Hospital output is defined by these authors as

> a weighted sum of the number of patients treated within each equivalence class during the period. The set of weights specified by the hospital administration reflects the basic importance of the different equivalence classes. As defined, this measure of hospital output is, in contrast to patient days, related to resource absorption since the equivalence classes were defined . . . in terms of requirements which, in turn, are related to hospital resources by a transformation process.

It would seem simpler and clearer to recognize "requirements" mentioned by Baligh and Laughhunn as goals, and equivalence as relating to production functions that are unique for particular classes of patients. Production processes, represented by production functions, are resource absorbers, not outputs. Since production processes in the hospital are addressed to the treatment of disease and injuries, then a proper categorization of diseases and injuries seemingly

becomes the ultimate basis for placing patients in equivalence classes. A very important question is raised by this analysis and that is whether any categorization of diseases yields classes of health problems that are treated, or can be treated, by relatively standardized production processes. Resource planning for the community hospital, to be tractable, must be based on the discovery of some suitable degree of treatment process regularity and of a relatively limited number of production processes to cover treatment for a broad range of diagnosed conditions.

Dellinger (1969, pp. 16-18) proposes the classification of patient hospital treatment outputs according to classes of diseases, but does not specify what these classes should be. A quick survey of patients' medical records indicates readily that "classes of diseases" is much simpler to conceive than to apply to actual cases. Multiple health problems in a single patient is a rather common occurrence, so that the analyst has the task of creating special output classes to encompass the multiproblem patients.

Another complicating factor is that patients arrive at the hospital with the same class of disease, but at differing stages of the disease's course. The possibility exists that different treatment processes will be required for the same disease confronted at different stages. Then one must ask whether the patients treated in different treatment processes for the same disease represent one or many output classes.

Finally, coupling the stage of disease and multiple-problem

aspects of patient care reveals a potential problem of output classification of staggering proportions. The saving feature may be that differences that are crucial to proper medical treatment will not be crucial to the model for planning resources for that treatment. Only further investigation following this study can confirm or refute the hypothesis implied in such a statement.

Hospital Patient Treatment System Outputs—A Proposal

The fundamental characteristics of the patient care output units proposed in this study were presented on pages 56 and 57. These general features will be expanded upon to arrive at concepts of community hospital patient care outputs that overcome some of the weaknesses in other output units that have been proposed, and that deal with some of the complexities of output measurement that have been noted.

Output classifying variables: diagnosed problem

Since the primary classifying variable for patient care outputs is the discharge diagnosis of the health problem or problems of the patient, an initial task must be the recognition of the various classifications which are possible. Patients may be admitted to the hospital with:

1. A single health problem.
2. Multiple health problems, nonrelated.
3. Multiple health problems, some related, others nonrelated.
4. Multiple health problems, all related.

An analysis of summaries of patient records for a 400-bed teaching

hospital for the first half of 1969 provided interesting data relating to diagnosed problems. More than 97 percent of the patients admitted to the hospital had multiple health problems identified in the course of their hospital treatment, over 95 percent having more than two problems. The reason for most of the multiple diagnoses was the elaboration of diagnostics because of the concurrent educational programs. The records did not show whether treatment had been received for all problems identified or, to an inexpert analyst, whether problems were or were not related. An analysis of the completed medical record of multiproblem patients, with an assist from someone expert in the treatment of the particular problems, would be required to generate information facilitating the proportions of patients falling into categories (2) through (4) above. It is sufficient for this analysis to recognize the four categories, and to appreciate to a degree the importance of the multiproblem patient in hospital outputs.

This four-way breakdown is deemed necessary for a number of reasons. A basic understanding of the single-problem category would carry with it some understanding of the degree to which specific problems or conditions exist and are treated singularly.

In dealing with the patient with multiple problems it becomes necessary to know the extent of treatment with respect to the problems that are identified. Are all problems identified treated to some degree all the time? If not, what are the patterns of treatment for multiproblem patients? Does the fact that some

problems derive from other problems guarantee their treatment? If not, what are the likely patterns of treatment for related problems? Support of the underlying assumptions of this research requires the emerging of some recognizable patterns of care that facilitate understanding of the treatment process and the planning of resources for patient care.

There are a total of 671 detailed disease and morbid condition categories which are aggregated to 97 subgroupings, which, in turn, are collected under 17 main groupings in the *Eighth Revision, International Classification of Diseases, Adapted.* The final 17 main groupings are the program categories listed on page 58. There is a nonzero probability that a patient admitted to any hospital treatment may have any of the 671 conditions diagnosed as one of his health problems. Thus, the first patient classification break yields a potential of 671 basic output categories.

The promise of simplification of the output structure, at this stage, for planning purposes appears to be great. First, any hospital will treat a very high proportion of its patients for a relatively limited range of diagnosed conditions. Again, analysis of teaching hospital data shows that about 120 primary diagnoses covered about 70 percent of the patients treated in the first six months of 1969; approximately 300 diagnoses were required to account for 90 percent of the patients treated during this same period. The teaching hospital does not serve a localized community but acts as a regional referral center seeking a broad range of problems for

teaching purposes. Thus, the data are not meant to be representative of the typical community hospital. One could expect that a large proportion of the community hospitals would expend the preponderance of their patient treatment on a narrower range of diagnoses because of the differences in total hospital program and services, and in size of these hospitals and the teaching hospital to which the data apply.

Another possibility for simplification exists in the potential combination of diagnostic categories because of similarity of their treatment processes. Again, this applies to the eventual planning problem and not to the problem of recognizing hospital outputs in this study.

Output classfying variables: stage of illness at admission

The second classifying variable for patient care outputs relates to the degree of illness of the patient for each identified problem at hospital admission. The hypothesis supporting the inclusion of this variable is that stage of illness is an important determinant of the production function describing the treatment of the respective patients. This hypothesis, undoubtedly, must be tested, and if rejected, stage of illness could disappear as a classifying variable. At this stage of analysis the variable should remain.

A very simple classification scheme is proposed in which three stages of illness are recognized: initial, intermediate, and advanced. These stages are believed to be applicable to the full range of

diseases identified, but that such application requires clear specification of patient variables for each stage of each disease. This view is based on the statement of Weed (1970, p. 42), cited in Chapter II, that there are particular variables that are associated with particular disorders, and that the physician's responsibilities include identification of those variables and restoration to, or maintenance of, a normal state for those variables. Implicit in this statement is the feasibility of measuring normal state and abnormal states of patient condition variables. The varying levels of the abnormality could be used to specify stage of illness as found at hospital admission.

One need not be expert in the treatment of diseases to recognize the possibility that a patient with a disease in the advanced stage may require more physician services and may spend a longer period in treatment with a greater amount of the care being of a concentrated nature than would be the case for a patient in the initial stage of the disease. Patient condition variables in advanced stages of abnormality would seem to require more extensive and/or intensive effort to return them to a normal state than would less abnormal variables.

Output classifying variables: Proportion of total treatment process completed

The patient, for one reason or another, may not complete the full treatment process prescribed for his health problems, becoming an output unit unlike other patients in the same diagnostic

category, admitted at the same stage of illness, in that the production process was terminated prematurely. Thus, the partial-treatment patient's consumption of hospital resources would be different than for the full-treatment patient.

One reason for failure to complete treatment would be death of the patient during the process. This would apply most frequently, it seems, to patients admitted at advanced stages of illness, for patients experiencing severe complications from diagnostic or therapeutic procedures, or from hospital accidents.

Another common reason for a failure to complete treatment is patient withdrawal from the process. The patient, for any of several reasons, terminates the treatment process without consent of the physician. The hospital's rather ineffective follow-up mechanisms contribute to the magnitude of this occurrence. Broadened efforts in expanding hospital participation in rehabilitative and other forms of follow-up care should reduce the importance of this classifying variable over time.

A final reason for partial treatment may relate to some of the secondary or tertiary diagnoses. The problems of lesser importance, which do not materially threaten the health of the patient in the near-term, may be treated incompletely with a view toward total treatment in a subsequent hospitalization or in some other location, such as a private physician's office. These cases refer to situations where it would be impractical to consider the total treatment as a single episode and a single output unit.

Output classifying variables: Objective state of health at dismissal

The final classifying variable to be proposed deals with objective measures of the state of health and related prognosis of the patient having completed partial or total treatment. Several outcomes have been proposed in the literature which provide the basis for the outcomes that will be proposed in this study.

Navarro (1969a, p. 97) proposes a series of health system outcomes, three of which are reflected in the health states that will be proposed. Navarro's list includes:

1. Dead/Alive
2. Diseased/Healthy
3. Disabled/Fit
4. Dissatisfied/Satisfied
5. Uncomfortable/Comfortable

The last two states are subjective measures of state of health.

Balintfy (1962) utilizes dismissed patients as output units, placing them in four categories:

1. Dismissed without positive diagnosis
2. Dismissed with treatment - condition improved
3. Dismissed with treatment - condition not improved
4. Dead patient

One of the categories that must be used as a measure of state of health—in this case the total absence of health—is death. Many deaths occur in hospitals, as each year the proportion of the total number of deaths in the country that occur in hospitals increases.

Death has already been mentioned in the preceding section as one of the reasons for partial treatment. Patients are classified as output units as either being dead or as being alive in a specified state of health.

At this point it may be useful to refer to the diagram in Figure 2 on page 78. At the bottom of the diagram can be found the output units for one branch of a multibranch-decision tree. The number of branchesis dependent on the number of diagnostic categories that are used for the purpose of establishing output classes. Theoretically, there could be 671 initial branches reflecting the full range of detailed diagnoses. The one branch that is developed yields an output patient:

1. With discharge diagnosis—category C (primary diagnosis).
2. With multiple nonrelated health problems (secondary and tertiary, etc. diagnoses).
3. Admitted at an advanced stage of the primary illness.
4. Subjected to the full treatment process.
5. Dismissed cured, no disability indicated.

The total number of output units can be found at the righthand side of the diagram; the nature of the outputs can be discovered by tracing out the respective branches of the tree. If sixty primary diagnoses are used, over 11,000 output categories are created at the right of the diagram. However, for planning, the categories could stop at the "proportion of treatment process completed" stage, at which point there would be 1,440 output classes. Further analysis could be devoted to testing the sensitivity of the resource requirements to the various

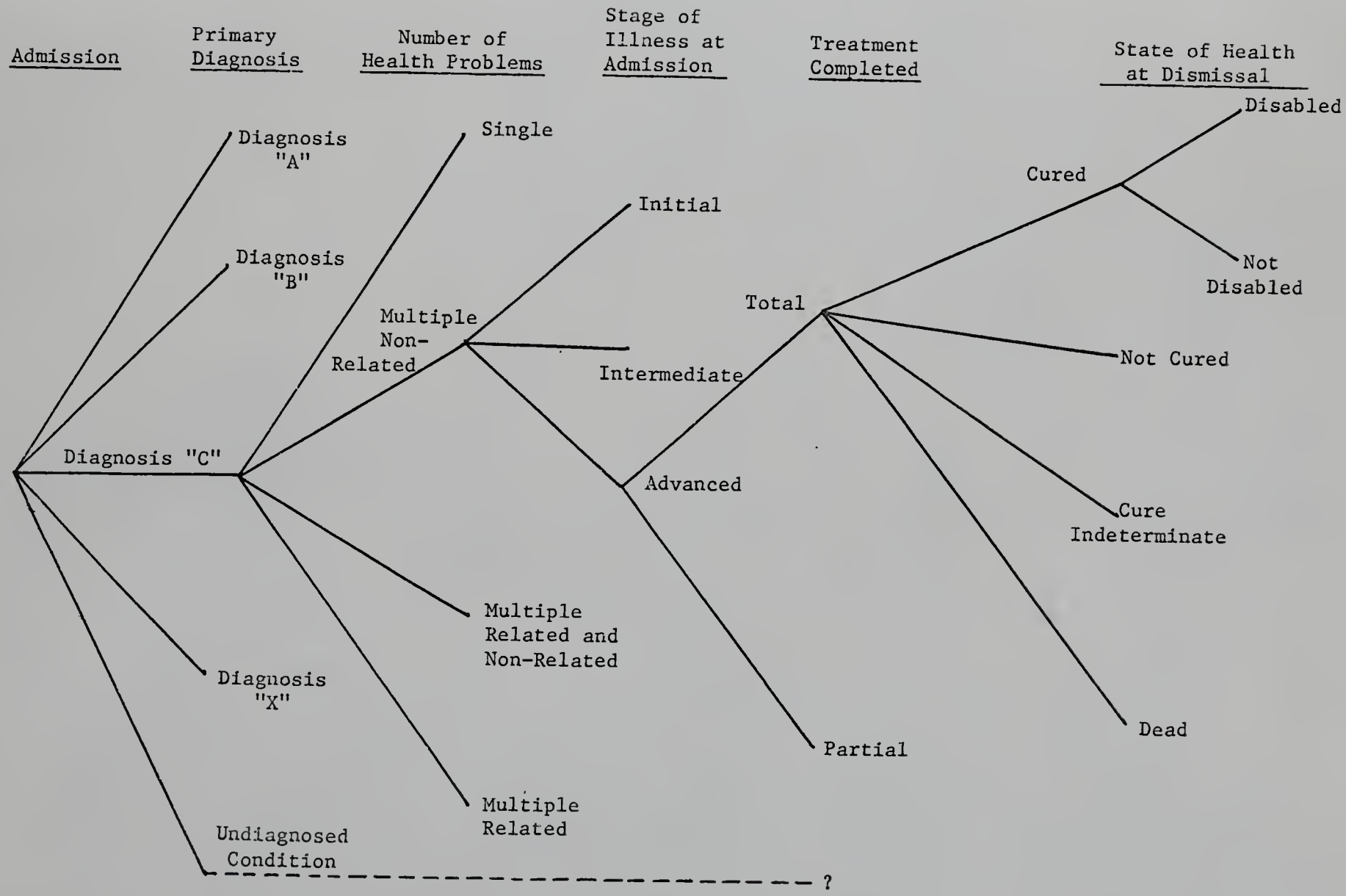

Figure 2. Classifying variables and resultant patient care outputs for the community hospital.

classifying variables. Some further simplification might be possible. It must be remembered, however, that multiproblems have not been handled separately, and that the classification beyond the number of problems stage deals with the primary diagnosis only. It is possible that sixty diagnostic categories would be sufficient to cover all of the prevalent single and multiproblem patients so that no additional output classes would be created. In any case, the patient treatment system output structure is seemingly quite complex.

Mention should be made of the special diagnostic class for ill-defined conditions, that is, undiagnosed problems. The total treatment effort is seemingly indeterminate since none but the last variable, state of health at dismissal, applies to this class of output. Crichton (1970, pp. 35-72) provides a vivid account of a patient who received a month of care at a cost of nearly $6,200 for a fever of undiagnosed origin. Little hope exists of defining standard production processes for undiagnosed conditions, and at present they must remain outside of the analysis.

Patient Treatment System Output Restrictions

System restrictions are composed of objectives and constraints, as described on pages 55 and 56. It would be impractical to develop specific output objectives for a community hospital in this analysis. Aside from the fact that the objectives would apply only to some hypothetical hospital, or to a single hospital selected for case study, there would be additional obstacles. The major barrier would be the lack of a precise specification of the constraints that were operating. A general discussion of constraints could deal with the

type and nature of the limits imposed, but not with specific levels of those limits. Such a discussion will be presented in the remaining pages of this chapter.

Constraints on patient treatment system outputs can be imposed within the system or can be imposed from the system's environment. The various constraints that will be identified and briefly discussed are of both types, internally and externally imposed.

Hospital accreditation standards

The Joint Commission on Accreditation of Hospitals (JCAH) has established extensive standards which hospitals seeking accreditation must meet. In the foreword to their October 1, 1969, revised standards, Porterfield (1969) writes:

> The measurement of quality, particularly with respect to health services, has long been a practice of debatable precision. To what extent can the degree to which the physician and other health professional approaches the boundaries of knowledge, skill, judgment, and application in the care of the patient be reflected by quantitative measurement? The inability, not only of the patient, but even of the physician himself, to evaluate performance in quantitative terms has been a strong factor in the preservation of the somewhat mystical doctor-patient relationship. . . .
>
> [T]he American College of Surgeons and subsequently the Joint Commission on Accreditation of Hospitals have pursued this goal for the institutionalized patient by means of a program entailing attempts to identify the optimum setting in which the service may be provided. The characterization of the most effective physical plant, organization, procedures, and resources, augmented by continuing self-evaluation and self-improvement, should serve to define the most propitious environment in which the highest quality of health service may flourish.
>
> At the very least, these ambient circumstances tend to facilitate the highest quality of practice. Add only the values inherent in a periodic objective outside professional assessment of these factors, and one has done one's best. The certificate of accreditation is meant to convey the fact that an institution,

> its governing body, its personnel, and its medical staff have sought excellence, have accepted outside appraisal and have achieved substantial conformance with professionally developed and nationally applied criteria.

JCAH accreditation standards cover many of the output constraints that will be presented, providing some of the more significant restrictions on the hospital treatment process. Certain of the constraints apply to the medical staff, covering qualifications for hospital staff membership and for specific clinical privileges, medical staff organization and classification of staff, and mechanisms for continual review and evaluation of clinical practices.

The accreditation standards state that staff members must be qualified "for the performance of the clinical privileges granted to him" (JCAH, 1969, p. 14). This qualification is determined by the physician's peers upon application for staff membership and via review of his clinical practice through various review committees, such as hospital utilization and tissue committees. Thus, the treatment processes of one physician are scrutinized to some degree by his peers. The privilege to use the hospital for patient treatment is controlled by peers via the mechanism of granting hospital staff membership.

Another aspect of physician care relates to the development of adequate documentation on the care of each patient. The accreditation standard views appropriate documentation as a major responsibility of the physician.

Standards that apply to the provision of nursing services cover the direction, staffing and organization, and administration of

nursing, and policies and procedures relating to the utilization of nurses services. The standard (JCAH, 1969, p. 33) states that: "There shall be evidence established that the nursing service provides safe, efficient, therapeutically effective nursing care through the planning of each patient's care and the effective implementation of the plans."

In addition to standards for personnel, the accreditation standards call for minimum services to be provided for quality control procedures and criteria, and for facility operating procedures or mechanisms for developing operating policies. Patient care outputs will be restricted by the JCAH standards for they affect both resources and production functions.

Some of the constraints recognized may affect outputs because of decisions that are made relating to resources and to treatment that go beyond the accreditation criteria. Thus, care auditing may exceed JCAH recommendations, thereby placing additional pressures on production processes. Seemingly, peer auditing of care should tend to move all care in the direction of a recommended production process, recognizing the limitations on standardization that exist.

In a similar vein, facilities and services offered to the patient may exceed JCAH recommendations. This means that a more extensive array of resources may be at the doctor's disposal, enabling him to devise added production processes for the problems he diagnoses.

While discussing the fact that resources may exceed minimum requirements it must be recognized that this is not saying that resources

are unlimited. Patient treatment will be limited by a scarcity of resources, nonetheless. Examples come readily to mind of restrictions on care created by resource shortages:

1. The patient who dies waiting for a transplant organ.
2. The patient who dies because of a lack of renal dialysis unit.
3. The patient whose operation is delayed because of a crowded operating room schedule.

In all these cases patient care output is constrained,in the first two cases to the severest degree. Thus, resource availability will act as a restriction on patient treatment outputs.

Another important constraint on patient treatment output is the stage of the patient's illness at admission. Stage of illness was used as a classifying variable above in that it was believed to be a determinant of production process. A patient's stage of illness may be such that certain outcomes such as cure and, in extreme cases, the continuation of life itself are precluded. This use of stage of illness is distinct from the previous usage in that product process specification still permitted a range of output outcomes; as now used, the possible range of outputs is restricted regardless of treatment process.

A very important restriction on patient treatment outputs is the state of the art and science of the practice of medicine and the other health professions. A patient's care can approach and reach the boundaries of knowledge but seldom, if ever, can these boundaries be surmounted. Some patients cannot be cured, and therefore face disability or death as certain outcomes. This restriction may result from the stage

at which the illness was confronted. Some diseases reach an irreversible point in their course, after which medical art and science has little assistance to offer to curative efforts.

The interactions between multiple-health problems may provide a constraint on treatment outputs. These interactions may relate to direct interaction between the diseases themselves, or between the several diagnostic and therapeutic procedures designed for the individual problems. Disease interaction refers to the effects of multiple, related health problems, the classifying variable discussed above. The interaction of diagnostic and therapeutic procedures refers to constraints which are put on treatment processes, and hence on outputs, resulting from deleterious effects of the diagnostic and/or therapeutic procedures that could be used for one illness on an accompanying health problem. The very up-to-date example of this phenomenon is the effect of anti-rejection drugs for transplant patients on accompanying diseases.

Another constraint on the delivery of care outputs is related to the organization and delivery of health care. The way hospital care is conceptualized, and the way the health professions are organized for the delivery of care in response to that conception, has an important impact on the nature of the care process and consequently on care outputs. A significant improvement in nursing and paramedical care, which involved a "reorganization" of the hospital and a reorientation of the focus of the care effort, was the move to progressive patient care. The classification of care was an important step in this development. The rapid

expansion of intensive care facilities and services testifies to the importance of reflecting patient needs in the care process.

Up to this point, the output restrictions that have been considered have dealt with hospital standards, personnel qualifications, care auditing, the impact of the disease or diseases, resource limitations, stage of illness, and the state of the art and sciences of the health professions. The last group of output restrictions relates to the patient and his personal needs.

The first of the patient-related restrictions on treatment outputs is the patient's extra-hospital situation. This situation relates to job and to family needs of the hospitalized patient. Weed considers a development of patient profile and social setting as an important element of each patient's data base for these patient characteristics should bear on the treatment he receives (Weed, 1970, pp. 13-15). Coupled in this restriction is the patient's economic status. The home or job situation may set tentative targets for length of hospital stay as well as for therapeutic procedures. Certain problems may be handled piecemeal, for example, to avoid long patient absences from home or job.

Another important restriction on patient treatment outputs is the tolerance of the patient for drugs and for diagnostic and therapeutic procedures. There are common allergies to many drugs; the dangerous allergic reaction to penicillin by some patients is an example. Certain therapeutic procedures may place too great a strain on a diseased body system to risk using them. Some of the tolerance may relate to the patient's capacity to adjust psychologically to alterations in body

appearance or function, which rather than limiting therapy may add additional processing involving psychiatric counseling.

A final patient-related output restriction relates to the expressed needs for the provision of physical comforts and for emotional support, and also to the doctors, nurses, and other health professionals "needs" with respect to care provided. Patients vary considerably in the demands they place on hospital personnel. The "problem patient" is discussed in the literature (Rainwater, 1961, p. 74+). Even patients who are not particularly problematic differ in the amenities and support they demand as their treatment progresses.

On the other hand, the providers of health care may have varying inclinations to provide care based on their own personal needs and the role they perceive for themselves in the patient care process. The traditional roles assigned to the various actors may conflict with their learned roles and quite likely with the role "created" by the changes occurring in medical and nursing care as time passes.

The restrictions that have been identified are believed to be important ones, but by no means is the list considered complete. Rather the items identified seemingly cover the full spectrum of origins of output constraints—patient, health professional, disease, state of illness, etc. A more extensive exploration of output restrictions is required, as is a more intensive investigation of the constraints, singly and in combination, on hospital output. Such analysis is an essential prelude to the development of meaningful effectiveness criteria for patient care in short-term hospitals.

CHAPTER IV

THE PATIENT TREATMENT SYSTEM—TREATMENT PROCESS: PROVISION OF ESSENTIAL MEDICAL SERVICES

The second major parameter of the patient treatment system is the treatment process, the set of production processes which transform various input resources into the types of outputs discussed in Chapter III. The objective of this chapter is to develop a conceptual model of the treatment process, which abstracts the important features of the production relationships implicit in hospital patient treatment. The treatment process is complex, and involves the application of specialized reasoning and procedures that lie outside the expertise of the economist or management theorist. However, it is the production process that is modeled, a process well known to economist and management theorist, rather than the specialized mechanics of the curing of human illness.

The patient treatment system now appears as in Figure 3; more detail can be presented at this stage of analysis based on the

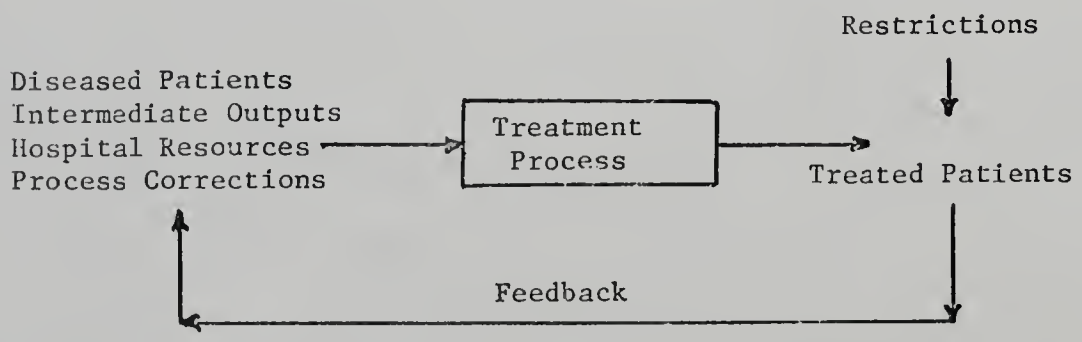

Figure 3. Intermediate model of the patient treatment system.

identification of final and intermediate outputs, and on the discussion of restrictions that have been presented. Intermediate hospital products are shown as inputs as are process corrections, the latter addition indicating a comparison of outputs with established output criterion and the generation of a correction signal, when required.

Hospital resources are basic resources in this instance, excluding those absorbed in the production of intermediate outputs or in creating process corrections. Hospital resources and feedback inputs are discussed in Chapter VI. The remainder of this chapter will be devoted to the development of a model of the basic hospital process which takes diseased patients and produces treated patients. The description includes the identification and classification of some arbitrary stages of the treatment process, and a development of the fundamental characteristics of these stages.

The patient is more than the equivalent of a raw material that is entered into a production process, for he takes a more or less active role in his own diagnosis and therapy (Rainwater, 1961, p. 71+; Wilson, 1963, pp. 285-289). The patient is simultaneously the focus of the treatment effort and a participant in that effort. The patient is an important participant in the diagnostic stages of treatment, for he is one important source of information relating to symptoms and past medical history through his voluntary and elicited comments (Feinstein, 1964b, p. 761). In addition, he yields further information to the physician as the object of physical examination and laboratory testing.

In later stages of treatment the patient may provide a large measure of his own daily care.

The conceptual structure of hospital patient care, first presented in Chapter II, is reflected in the model of the treatment process that is developed. It will be recalled that patient care was viewed as consisting of two major elements: (1) essential medical services provided and managed by physicians, and (2) supplemental care services provided by nurses, by other health professionals, and by a variety of nonprofessional health workers. The patient, a very important input resource, interacts extensively with the providers of both types of care. On the one side is the recognized doctor-patient relationship which generates the basic decisions, plans, and actions upon which all other care is based, with the exception of patient-initiated care. On the other side are the many relationships between patient and nurses, allied health professionals, technicians, and other hospital workers which develop in the course of meeting patient needs and patient wants.

For purposes of this analysis it is proposed that the two major elements of patient treatment are produced concurrently in two interdependent but separate subprocesses. Thus, one subprocess yields essential medical services and has describable components, activities, and outputs; another subprocess yields supplemental care services and it too can be described in terms of structure, activities, and outputs. Each subprocess is described and analyzed after which the important interties between the two are considered. The principal aim of the

analysis is to model those features of the subprocesses that bear on resource usage, and not to delve into the processes with the objective of understanding the nuances of the treatment of diseases and injuries.

A Subprocess: Provision of Essential Medical Services

The provision of essential medical services in the community hospital seemingly has two component activities that bear importantly on resource usage; they are (1) the application of high professional skills by the physician, and (2) the accomplishment of the functions of overall manager of the treatment process. Both activities contain the possibility of individuality in approach. In the technical aspects of treatment, the variation stems largely from the high degree of uncertainty that still remains in the formulation of diagnosis, prognosis, and treatment of disease and injury in humans (Feinstein, 1964b, p. 761; Ledley and Lusted, 1959, p. 10; Garner, 1961, pp. 884-5). The resultant variability creates production processes having a moderate range of mutations.

Application of Professional Skills

The application of high professional skills in the provision of essential medical services is the critical core of the entire treatment process, for decisions made in this realm have an impact on all other treatment activities, including those initiated by other health professionals and by the patient. The physician's professional skills are

his skills as a clinician—as a scientific healer. As Feinstein states (1964c, p. 945):

> The healing that a patient seeks as clinical therapy is composed of a mixture of art and science. To deal appropriately with its human material, therapy must have art; to perform its experiments reproducibly and effectively, therapy must have science. The art is long established as an ancient and noble tradition; its application makes the clinician a healer. The science is ever young, constantly growing, always changing; its application makes the clinician a scientist.

Patient treatment, according to Feinstein (1964b, pp. 761-762), is in actuality a long series of reproducible clinical experiments. This view recognizes the uncertain nature of treating human diseases in which problem definition, experimental design, and measurement and interpretation of results leading to generalization are evident. In patient treatment these features of experimentation are given the names, diagnosis, prognosis, and treatment.

The application of clinical skills is divided into component stages. They are:

1. Diagnosis—the collection, processing, and interpretation of personal, clinical, and laboratory data for the purpose of suggesting a group of diseases that account for the observed symptoms and signs, and the selection from among those diseases, by additional diagnostic procedures, those diseases most likely to be present (based on Feinstein, 1964b, pp. 757-781; Engle and Davis, 1963, pp. 512-519).

2. Prognosis and Therapy—the collection, processing, and interpretation of clinical and other data for the purpose of suggesting a group of patients, having similar diagnosed conditions and descriptive data, that were treated in the past. The prognosis is modeled after the observed course of the disease in the suggested patient group; therapeutic procedures that are used for the patient at hand produced the optimal result in the formerly treated patients (based on Feinstein, 1964b, p. 761). The therapy extends beyond the inpatient phase of care to follow-up and rehabilitative care.

3. Evaluation and Control—the collection, processing and interpretation of clinical and laboratory data relating to the patient under treatment, for purposes of comparison of his therapeutic response with progress criteria established for the prognostic group of patients, in order to determine the selection, timing, and changes of subsequent therapeutic procedures (based on Feinstein, 1964c, pp. 944-947, 951-954, 963-964).

Each of these stages is considered in the remaining paragraphs of this chapter, as are the resource implications of the performance of the activities associated with each stage. The stages flow one into the others such that at many times in the treatment process all stages are undertaken simultaneously. The separation here represents an abstraction for purposes of modeling. Clinical care involves extensive use of data gathering and decision and planning processes. Other aspects of this care which involve the taking of specific actions or the "laying on of hands" evolve from these processes.

Diagnosis.—The diagnostic process is a decision process that can be divided into a series of steps (see Ledley and Lusted, 1959, pp. 9-21; Engle and Davis a, b, and c, 1963, pp. 512-543; Jacquez, 1964, pp. 23-35):

1. *Investigation*—the gathering and checking of personal, clinical, and laboratory data according to purposeful frames of references.

2. *Integration and Evaluation*—the clustering of discreet data items into meaningful sets of related findings, and the assignment of relative diagnostic values to these sets of findings.

3. *Differentiation*—the identification of the health problems likely to be present in the patient from the range of problems known to create the observed or similar manifestations.

4. *Diagnosis*—the identification of the patient's particular health problem or problems.

Diagnosis requires extensive data gathering which can involve a number of activities utilizing hospital resources, the activity depending to a great extent on the types of data being collected. Personal data refers to nonclinical features of the patient such as age, sex, race, occupation, family, etc., and their collection requires the physical presence of the patient but not a disease (Feinstein, 1964b, p. 758). The collection of this data can be delegated to nonphysicians or to the patient via a self-administered questionnaire. In any case, the patient is an active data provider.

Laboratory data collection requires the presence of a disease. These data relate to cells, tissues, fluids, tracings of body outputs, etc. that may contain signs of disease (Feinstein, 1964b, p. 758), and are collected from a passive patient who has samples extracted from his body, or who is attached to diagnostic equipment. This collection requires the personal services of a skilled laboratory data gatherer, and possibly the utilization of diagnostic equipment. A minimal patient input may result in the form of preparation for diagnostic activity.

Clinical data require a diseased patient for they relate to symptoms and signs of a disease in a human host (Feinstein, 1964b, p. 759 and 1964d, pp. 1162-1187). These data are collected in the processes of history taking and physical examination, and the patient and physician interact to a great degree in their assembly. Physician substitutes have been used for taking histories and conducting physical examinations, providing an intermediate output, clinical data, for the attending physician

(see Anderson and Towers, 1970, pp. 1-8). Some aspects of history taking have also been proposed and tried as a self-administered patient exercise, yielding clinical data as an intermediate output (Gitman, 1970, p. 743; Feinstein, 1964d, pp. 1180-1181). Clinical data require an active patient as data provider and an active physician or physician assistant as data gatherer.

In diagnosis, initial clinical data provide a list of diseases which might generate the signs and symptoms observed in the patient. Certain routine laboratory data are gathered on all patients, and some additional tests are made routinely for certain age and sex groups. Performance of non-routine laboratory tests is based on the clinical findings, seeking to further narrow the list of possible diseases for the particular patient. Thus, data gathering flows smoothly into the subsequent diagnostic stages. In fact, diagnosis, portrayed as a sequence of discrete stages, is a continuous process, comprised of the four major activities identified, with continuous feedback occurring between activities. Integration and evaluation is occurring simultaneously with investigation and identification; the component activities have been separated for analytical purposes.

Integration and evaluation of the collected data is a responsibility which rests ultimately with the physician, or with the team of cooperating physicians working on the case. Some intermediate integration and evaluation may take place when nonphysicians such as physician assistants and laboratory technicians are involved in the data collection. This is especially true in the case of laboratory

data where the report of clinical data provided to the physician results from some grouping of discrete data elements into meaningful sets of findings. Where intermediate outputs appear in the diagnostic process, their production process can be viewed as running concurrently with the diagnosis being performed by the physician.

Laboratory findings are an important class of intermediate hospital outputs; the processes that yield these outputs utilize a variety of hospital resources. The routine and special tests that are requested in the course of diagnosing diseases have common appelations and more or less standard production processes. Resource planning would require some regularity in the use of available laboratory procedures in the diagnosis of specific diseases. Once patterns of laboratory procedure usage were determined, resource projection would be quite feasible.

Identification of the patient's health problem (or problems) requires that the combination of personal, clinical, and laboratory data, and the subsequent analyses of those data, have led to the selection of a most probable disease (or most probable diseases). Such identification may be most important as Ledley and Lusted (1959, pp. 9-21) suggest, as a program category within the physician's memory, calling forth sets of important patient variables that must be manipulated and monitored, sets of patients presenting the same diseases that have been treated in the past, and a range of applicable therapeutic processes.

Prognosis and therapy.—As Garner states (Garner, 1961, pp.886-887):

> Diagnosis and treatment are intimately related in a continuous stream of events. The logical process of evaluating positive and negative factors and the variety of possibilities is developed into a differential diagnosis. From a formal diagnosis there emanates the application of therapeutic measures appropriate to that diagnosis.

Data play an important role in prognosis and therapy, especially clinical data. As stated above, these data suggest a group of patients who have been clinically treated in the past who most nearly resemble the patient at hand. Implied in this identified group of patients is a forecast of the likely course of the disease, and treatment regimens that have dealt more or less successfully with the diagnosed problems. Out of these separate indications evolve the general therapeutic strategy for the established diagnosis and prognosis, and ancillary therapy addressed to specific complaints of the patient.

The provision of therapy includes (based on Feinstein, 1964b and c, pp. 757-781; 944-965):

1. Selection of specific therapeutic procedures as suggested by diagnosis, prognosis, and other elements of the basic patient data.

2. Development of plans for the implementation and evaluation of therapy.

3. Implementation of therapeutic procedures.

The complete analysis of patient data yields diagnosis, likely prognosis, and therapeutic strategies of varying effectiveness. The first step in providing therapy to the patient is deciding which of

the suggested therapeutic strategies would most likely be satisficing in the current sense. Such a decision includes an implicit value theory approach in which expected effectiveness is gauged. A subjective assessment of the degree of effectiveness of the respective potential therapies and of the likelihood of their success is made. This decision may be made by an individual physician, or by a physician in consultation with other physicians.

Planning for therapy implementation and for its evaluation are additional decision processes which according to management theory (Drucker, 1966, pp. 238-249; Dror, 1963, pp. 44-58), should involve the making of a set of current, risk bearing decisions seeking to attain patient treatment goals by optimal means, with some understanding of decision impact over time. Therapy planning involves a substantial overlap of professional skills and treatment management activities.

Implementation of therapeutic procedures involves extensive interaction between the physician and the patient, and the employment of many other hospital resources in the form of personal and equipment services. Provision of therapy intimately combines health problem and treatment process management. Professional skills are applied liberally while other resources are managed so as to mesh with the physician's personal efforts. Personal observation of hospital care for this study suggests that at least in certain aspects of this stage of the subprocess physicians perform both management roles effectively. The reason seems to be a clear dependence of health problem treatment on the management

of the treatment process. In other aspects of essential medical services, the dependence is not apparently as strong and treatment process management appears to be slighted.

Evaluation and control of therapeutic response.—Evaluation and control is in many respects a condensed version of the three prior stages of the subprocess, in that additional diagnosis, prognosis, and selection and application of therapeutic procedures occurs. A difference exists in that the new steps are taken subsequent to initial diagnostic, prognostic, and therapeutic steps, and now response to therapy becomes an additional feature for observation, understanding, and incorporation into therapeutic strategies. An essential feature of this stage is periodic assessment of clinical and laboratory data as a measure of patient response, and comparison of that response with suitable progress criteria.

Resource implications of evaluation and control are very much like those for application of therapy. Some additional implications will be considered in the following section. Evaluation and control are managerial functions and are clearly applied to health problem management. The research performed suggests that, again, treatment process management is performed most effectively when it bears importantly on health problem treatment.

Patient Treatment Management

The other set of activities comprising essential medical services relates to the accomplishment of the overall management of the patient

treatment process for each patient. Personal observation of hospital treatment in the course of this study suggests that certain treatment management functions are not performed as routinely by physicians as is the application of the skills of the profession. In fact, in some cases, there appear to be important treatment management functions that are not being performed by any member of the care team.

A clear distinction in terminology must be made at this juncture. Physicians recognize a form of management in patient treatment—the management of the health problem or problems of the patient. This use of the term management relates to the physician's control of the effects of disease or injury on the human host, and control of the course of the disease or injury over time. Management in this context did not appear to extend, with any degree of predictability, to the broader management problem implicit in patient care, that of managing the patient treatment process. Modern hospital care involves the use of many resources, including highly specialized personnel and machines (see *Fortune*, January, 1970). In short, patient treatment in a short-term hospital is clearly a process which must be purposefully managed.

The manager is considered to have basic functions in any situation requiring his services. Thus, the theory states that there are universal elements in administration regardless of the particular organizational environment. A list of managerial functions, based mainly on Fayol (1949) and Gulick and Urwick (1937), common in whole or part to all practicing managers, includes:

1. Planning
2. Organizing
3. Staffing
4. Directing
5. Coordinating
6. Evaluating and reporting
7. Controlling
8. Budgeting

The patient treatment manager is freed of much of the responsibility in two of these areas: (1) certain aspects of staffing and (2) all of the mechanical and certain of the decision aspects of the budgeting of resources for patient care. The remaining functions seem to require a major effort from the attending physician, or from his designated representative for each patient provided hospital treatment.

Treatment planning.—All planning decisions contain an element of uncertainty or risk because they create effects in future time periods. Thus, current patient care planning decisions have a time-distributed impact. The time dimension may be considerably shorter in patient treatment planning than in some other planning problems. However, the criticality of the timing of the treatment process to the achievement of an acceptable treatment output spectrum makes planning an essential care function. Planning decisions according to Dror (1963, pp. 44-58), should seek to attain goals by optimal means. In patient treatment defining optimality is difficult. Optimality could imply exhausting every therapeutic means, regardless of cost to the patient under treatment or of spillover costs to his fellow patients. Optimality in patient treatment seemingly should relate to a cost-effectiveness measure of alternative treatment strategies in which direct benefits and costs to the subject patient, and external benefits and costs to the remaining

patients are weighed, and the strategy selected which maximized total benefits to total costs.

Weed (1970, pp. 41-48) discusses treatment planning as one of the aspects of the problem-oriented patient record. He feels that the formulation and explicit statement of treatment plans should include:

1. Plans for the collection of further data.
2. Plans for treatment with specific therapeutic procedures.
3. Plans for the education of the patient about his illness and its treatment.

Care team staffing, organization, direction, and coordination.— In modern patient care every physician is assisted by a sizable team of nurses, by other allied health professionals, by technicians, and by numerous nonprofessional health workers. Because of pressures to increase the productivity of the physician, the number of ancillary personnel per physician is expected to increase significantly in the next five years (Mase, 1969, p. 915). Furthermore, the team will increasingly assume an hierarchical form as additional quasi-professional personnel are utilized to assist nurses and allied health professionals now on the care team, or expected to be added to the team. Thus, staffing, organizing, directing, and coordinating the patient care team becomes a major managerial responsibility. Failure to perform these functions may deny the full benefit of the team-of-specialists approach to care. In effect, the care team manager becomes a project manager for the care of each patient, combining the efforts of the various care team members who also report to several "line" managers in the hospital organization.

The staffing and organization of the patient care team involves the selection of participants, the definition of the respective role to be played by each participant, the establishment of formal communication patterns, and the specification of a chain of command. Mase (1969, pp.918-919) views the care team as consisting of four types of individuals, differentiated as to their knowledge, skills, and capacity for independent action. The following table based on Mase's table (Mase, 1969, p. 919) shows the relationship of these personnel.

TABLE 7

A Numerical Representation (0 to 4+) of the Amount of Knowledge, Skill, and Capacity for Independent Action of Health Care Team Members

Team Member	Knowledge	Skill	Capacity for Independent Action
Level I	4+	4+	4+
Level II	4+	4+	2+
Level III	2+	4+	1+
Level IV	1+	4+	0+

Thus, a four-level hierarchy is possible within the care team, with individuals with more knowledge, skill, and capacity for independent action directing the activities of those with less of these attributes. Patient treatment may appear to be a situation having a minimal organizational function when the opposite seems to be true.

Directing the care team relates to the delegation of authority and specific duties within the team, to the leadership styles employed by those in leadership positions, and to the definition and communication of the care objectives for the particular patient by those responsible for setting these objectives. Many of the nursing, allied health professional, and quasi-professional roles represent the formalization of delegated duties once performed by physicians. The clear definition of roles for these personnel coupled with intense, specialized training makes them able performers of their special skills. Other delegation may have to be accomplished on an ad hoc basis, determined by the features of the particular treatment.

The leadership styles utilized by the various care team members having leadership responsibility should fit within leadership models which have been proposed in management theory literature. Blake and Mouton (1964, pp. 12-15) feel that a manager has a dominant leadership style, accompanied by at least one backup style. The particular style (or styles) used depends on several sets of factors in combination—the organization, the leadership situation, the manager's personal values and personality, and chance or random factors. The choice of style used, whether emphasizing production or people relationships, results from pressures from within the manager and from his environment. The approach is somewhat intuitive.

In hospital patient treatment management, Blake and Mouton could be interpreted as anticipating a variety of managerial styles, with the

possibility that situation, personality, and chance factors weigh heavily in style explanation.

Fiedler's leadership theory would go farther toward predicting the leadership style that would tend to be most effective in the patient treatment process, depending on the favorability or unfavorability of the task situation as measured along some important axes. There are two basic leadership styles in the Fiedler model. One type, the relations-oriented leadership style, is characterized by

> a person who is motivated to seek prominence in interpersonal relations, who is concerned with good relations with others, who is considerate in his interactions with group members, and who tends to reduce anxiety and increase the personal adjustment of his co-workers. (Fiedler, 1967, p. 30)

The second type of leadership is practiced by the person who

> rejects those with whom he cannot work, and obtains needed gratification and self-esteem from performance of the task. He is, therefore, concerned with performing the task and he is willing to relegate interpersonal relations to a secondary position. (Fiedler, 1967, p. 30)

The important variables for determining task favorability are leader-member relations, task structure, and leader position power (Fiedler, 1967, p. 134-141). Provision of patient care seems to involve a relatively unstructured task, but the power of the position of the physician in the care team appears to be quite strong. The last variable, the quality of leader-member interpersonal relations, depends on the behavior of the respective care team members, especially the physician.

Fiedler's research indicates greater effectiveness for a task-oriented style of leadership for situations exhibiting good leader-

member relations, unstructured task, and strong position power. When leader-member relationships are moderate to poor, a slight relations-oriented leadership is deemed more effective. Thus, if leader-member relations are brought to a sufficient quality, a tendency to task-oriented leadership could be expected in patient care. The importance of the task being performed in patient treatment also seems to foster task orientation, regardless of the quality of leader-care team relationships.

The formulation of patient treatment objectives and the communication of those objectives to other care team members by those having objective setting prerogatives seems to be a necessary element of effective treatment management. Most of the self-initiated performance by team members should take cognizance of the care objectives that are being pursued. The most important objectives are the primary care objectives of the physician. Lockward et al. (in Weeks and Griffith, eds., 1964, p. 16) assert:

> The doctor-patient relationship is the hub of patient care. All other services—radiate from this center of activity as the spokes of a wheel.

Other objectives may also be important. Certain ancillary personnel in the care team may have their own care objectives, freed from direct dependence on the physician by a well-defined role. Some interpretation of physician's objectives may be required within the care team to facilitate performance of lower level roles.

Coordination is seemingly required to use effectively the services of the many specialists dealing almost simultaneously with

the patient. Hawley (in Eisele, ed., 1967, p. 257), commenting on patient care committee findings, states:

> During a recent study by a patient care committee, . . . a frenetic scene was put together from the testimony of hospital personnel representing several departments. It was learned that technicians, orderlies, nurses, visitors, interns, and attending physicians frequently intersected each other in uncoordinated traffic in the patient's room. The apprehensive patient surrounded by a milling crowd is not infrequently found in hospitals everywhere, and this is but one example of the lack of coordination between departments caring for the patient in the modern hospital. The quality of care rendered to the patient by several individuals may be seriously compromised if it is not skillfully organized and coordinated, and the technical excellence of the finest service may be impaired by multiple conflicts.

The situation described by Hawley suggests that the important role of care coordinator frequently is not filled, and care suffers. Coordination will be greatly aided by the clear statement of objectives and the development of meaningful care plans. Also, the organization of the care team and the way it is led will affect team coordination.

Patient treatment evaluation, reporting, and control.— Evaluation, reporting, and controlling of patient treatment involves the monitoring of the key patient variables, maintaining a running record of the values of these variables for review, and the making of additional decisions and the taking of consequent action to adjust the treatment process to bring the patient's status more in line with preconceived progress measures (Weed, 1970, pp. 53-66; Feinstein, 1964c, pp. 947, 953-954). This phase of the management of patient treatment relies heavily on the collection and interpretation of clinical and laboratory data, and its comparison with patient progress milestones that should be part of the care plan. The data and milestones

would relate to those patient status variables whose values are affected measurably during the course of the diagnosed diseases.

Much of the data collection and reporting is delegated to other care team members, and some interpretation of lab data is provided by individuals other than the attending physician. Ultimately, interpretation of patient progress, and the initiation of indicated treatment process adjustments are the responsibility of the attending physician. Because of the relatively high degree of uncertainty as to diagnosis and prognosis at the outset of treatment, process adjustments are the rule and not the exception (Weed, 1970, pp. 42-43; Feinstein, 1964b, p. 761).

The resource implications of patient treatment management are of a somewhat different nature than those associated with the application of professional skills. Treatment management is simultaneously a consumer of resources and also a determinant of the rate of usage of other care resources.

The total resources that are committed to treatment process management, counting those additional resources which seemingly should be devoted to it, are substantial. The full extent of the resource commitment may not be appreciated because of its dispersal over a great number of patients. Also, the shared nature of the management of treatment within the care team tends to obscure the total effort.

The treatment management activities of the physician appear to vary from physician to physician, and seem to depend on the individual's awareness of the full extent of the management problem

confronting him. It seems that treatment management activities consume an inappropriately low measure of physician input at the expense of care quality.

At present, predicting the resource commitment to treatment management would be difficult in terms of both quantity of services and identity of the care team provider. Further research that would explore the treatment management problem definitely seems to be in order. Additional discussion of this matter is reserved for Chapter VIII which considers recommendations for further research.

The other side of the resource question relates to the function of the manager to control the allocation and rate of usage of the resources in his domain. Thus, the total variable resources utilized in patient treatment are affected markedly by treatment management, and any change in type and amount of managerial resources can have an affect on all other resources. This means that understanding of the care management function is essential to understanding of the entire patient treatment process. It is evident at this point that a more clearly established treatment management pattern would have contributed significantly to the ease with which the treatment process could be modeled. Additional implications of treatment process management on the character of the treatment process are also explored in Chapter VIII.

The Patient Treatment Process: Provision of Essential Medical Services--Process Equations

The analysis of the provision of essential medical services as a phase of the patient treatment process has yielded some classificatory

schemes and has dealt in varying degrees of explicitness with the relationships that exist within this important subprocess. It is appropriate at this point to provide some general production relationships which reflect the analysis in this chapter. The formulae anticipate slightly the analysis of hospital resources to be provided in Chapter VI.

Process Equations: A Proposal

The patient treatment process, general:

I. $O_i = f_1 [E, S]$

where: O_i = *ith* class of hospital patient treatment output
E = essential medical services
S = supplemental patient care services

A. $E = f_2 [PS_1, M_1]$

where: PS_1 = application of professional skills by physician
M_1 = patient treatment system management

1. $PS_1 = f_3 [D_1, PT_1, EC_1]$

where: D_1 = diagnostic services—physician
PT_1 = prognostic and therapeutic services—physician
EC_1 = evaluation and control of therapeutic response—physician

a. $D_1 = f_4 [C_{11}, P_{11}, L_{11}, S_i]$

where: C_{11} = clinical data, prediagnosis—physician
P_{11} = personal data, prediagnosis—physician
L_{11} = laboratory data, prediagnosis—physician
S_i = application of professional skills, *ith* physician

i. $C_{11} = f_5 [S_i, n_i, a_i, e_i, p]$

where: n_i = professional services, *ith* nurse
a_i = professional services, *ith* allied health professional
e_i = services of the *ith* equipment item
p = services of the subject patient

ii. $P_{11} = f_6 [S_i, a_i, p]$

iii. $L_{11} = f_7 [S_i, n_i, a_i, p, w_i, e_i]$

where: w_i = services of *ith* ancillary non-professional health worker

b. $PT_1 = f_8 [D_1, C_{12}, L_{12}, S_i, a_i, p, e_i]$

where: C_{12} = clinical data, pretherapy and therapy coincident—physician

L_{12} = laboratory data, pretherapy and therapy coincident—physician

c. $EC_1 = f_9 [PT_1, C_{13}, P_{13}, L_{13}, S_i, a_i, p, e_i]$

where: C_{13} = clinical data, post-therapy—physician

P_{13} = personal data, post-therapy—physician

L_{13} = laboratory data, post-therapy—physician

2. $M_1 = f_{10} (m_{11}, m_{12})$

where: m_{11} = management of the patient's hospital treatment process

m_{12} = management of patient's utilization of health care delivery system

a. $m_{11} = f_{11} [X_i]$

where: X_i = management of hospital treatment process by the Xi*th* physician manager or agent

b. $m_{12} = f_{12} [Y_i, p]$

where: Y_i = management of the patient's utilization of the health care system by the Yi*th* physician manager or agent

CHAPTER V

THE PATIENT TREATMENT SYSTEM—TREATMENT PROCESS: PROVISION OF SUPPLEMENTAL CARE SERVICES

The second subprocess of the patient treatment process produces supplemental care services, which have been defined in Chapter II as having two important elements, provision of primary and secondary supportive care. Each of these elemental forms of supplemental care services can be divided into stages reflecting successive periods in the care process. The stages that are proposed are:

1. Pretherapy care
2. Therapy-coincident care
3. Posttherapy care

The type and amount of resources used at each stage in each elemental process vary, yet there appears to be enough within-stage uniformity to justify the proposed segmentation.

A Subprocess: Provision of Supplemental Care Services

The elemental process of supplemental care has been divided further to yield the subprocess of:

1. Application of professional skills.
2. Management of certain of the phases of the care processes.

A graphic portrayal of supplemental care, in Figure 4 on page 112, should provide some assistance in visualizing the many subdivisions of supplemental care services.

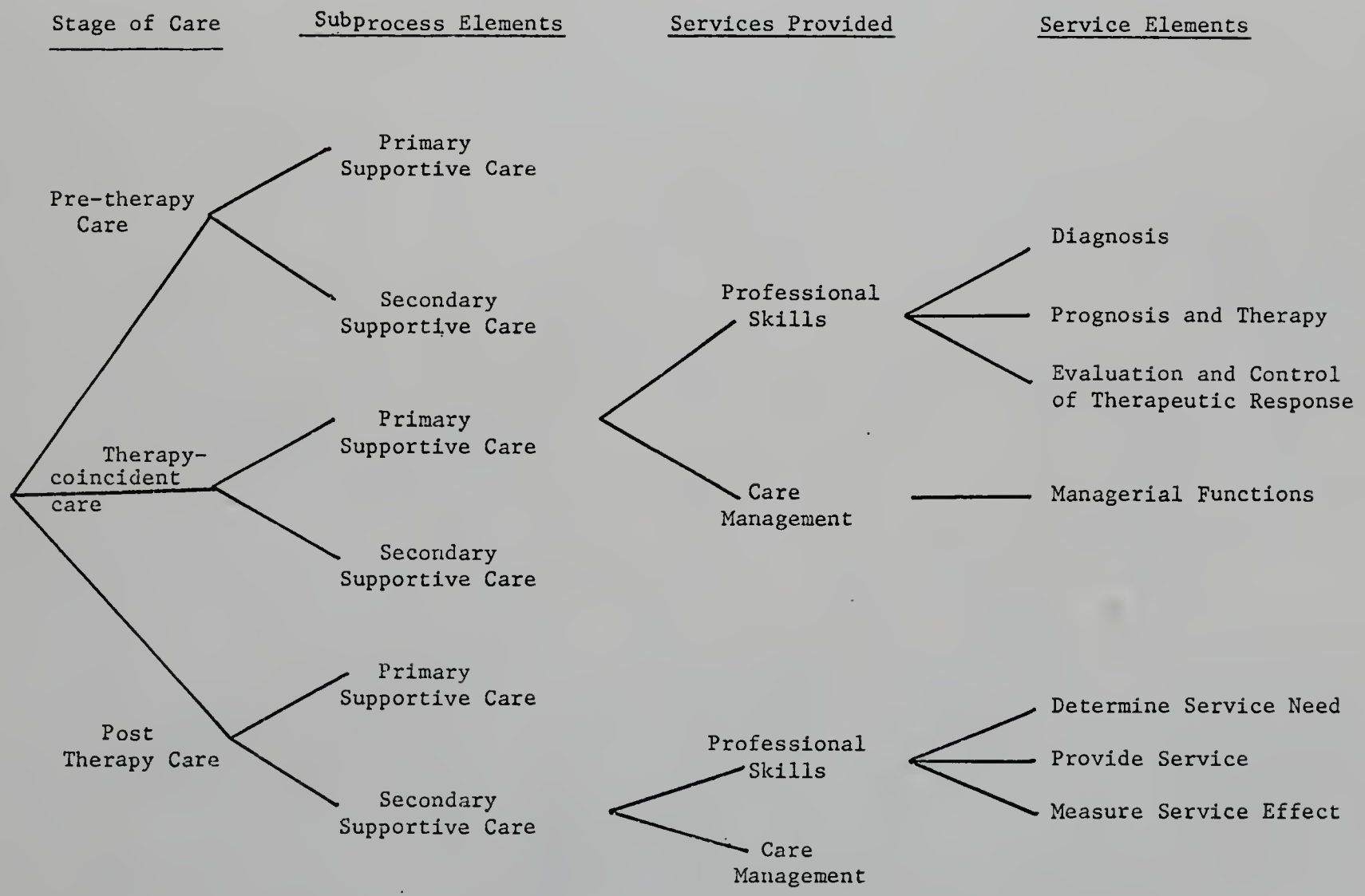

Figure 4. Diagrammatic presentation of the patient treatment subprocess: Supplemental care services.

The potential for variation in the processes providing supplemental care services and the consequent difficulty in projecting resource usage appears to be great. The proclivity of physicians and other care providers to delegate duties to other care team members varies from individual to individual. Thus, the division of total care activities among the respective team members can vary, creating a range of potential production processes yielding essentially the same output.

Some process variation results from desirable substitution of resources in meeting the shifting hospital workload. For example, identical services may be provided by registered nurse, by licensed practical nurse,and by nursing assistants under different workload pressures.

Primary Supportive Care: Professional Skills

The provision of patient care in the modern community hospital reflects a distinct team approach to treatment. As James (1969, pp. 862-863) points out:

> The armamentarium and system of medical care have become so complex that it is impractical for the physician alone to deliver complete health services to individuals or groups. . . . to make more efficient use of his time, he must utilize large numbers of allied health professional workers as an extension of his own diagnostic and therapeutic efforts.

Harrell (1969, p. 855) in a related article traces succinctly the evolution of the allied health professional and nurse as they performed delegated tasks formerly performed by the physician. The performance

of purely service functions by nurses and allied health professionals has given way to more theoretically based professional roles of various types.

Primary supportive care services are those services provided by the nursing staff and by other health professionals that are essential to progress in the treatment of the patient's health problems. These services may be:

1. Formulated by the physician, then delegated to another care team member for implementation or further delegation.

2. Formulated by the nurse or other health professional based on their perceptions of patient need, and either implemented or delegated to another care team member.

The application of professional skills by nurses and the other health professionals can be portrayed as having the same three component activities as reported for essential medical services:

1. Diagnosis—determination of the services needed by the patient.

2. Prognosis and therapy—provision of the required services.

3. Evaluation and control of therapeutic response—assessment of the patient's response to the services provided.

The provision of professional skills discussed in this chapter is clearly the responsibility of the nursing service and other allied health professionals, regardless of who formulates the care plan. The services that are provided are great in number and diverse in nature, but seem to be summarized meaningfully under a relatively limited number of categories. The proposed categories are (developed from Weeks and Griffith, eds., 1964, p. 133; Griffith, Weeks, and Sullivan, 1967, p. 151):

1. Application of diagnostic procedures.
2. Application of therapeutic procedures.
3. Preparation and dispensing of medications.
4. Accomplishment of preparatory procedures.
5. Patient condition monitoring and assessment.
6. Communication with patient and other care team members.
7. Recording of pertinent patient care data.

Each of these functional categories will be considered for each of the three stages of patient care—pretherapy, therapy-coincident, and posttherapy.

Application of diagnostic procedures

Diagnostic procedures are implemented throughout the patient care process, being utilized to help establish the diagnosis of the patient's health problems and to assess the patient's response to therapy. However, the preponderance of this activity seems to occur in the pretherapy stage of the treatment process.

Diagnostic procedures are any investigative tasks designed to generate information relating to the patient's symptoms and underlying state of health. Thus, procedures such as measurement of vital signs, chest x-rays, spinal taps, and heart catheter examinations, as well as assessment of physical and/or emotional handicaps requiring rehabilitative therapy, are typical diagnostic activities.

Diagnosis of the patient's health problem(s) to determine the nursing and other health related services essential to patient treatment progress is a function shared by physicians, nurses, and other

health professionals, with a major responsibility resting with the physician (see Magraw, 1968, pp. 827-831). Rinehart (1969, p. 100) also states:

> The physician is the leader of the patient care team; he delegates responsibilities to the participating members. The physician keeps all informed of the diagnosis, prognosis, severity of disease, and the basic disease process. . . .
>
> The physician employs the assistance of the various medical consultants and requests the indicated diagnostic studies. He conducts regular patient care rounds and conferences. He prescribes the treatment plan: diet, fluids, activity, medications, treatments, physiotherapy, and occupational therapy. . . .

Rinehart seems to leave little of the determination of the need for patient services to the members of the care team other than the physician, yet it is clear from her discussion of the respective roles for nurse, nutritionist, physical therapist, psychologist, and others that care team members do in fact assess the patient's needs, and do provide services not necessarily initiated by a physician (Rinehart, 1969, pp. 100-110).

The nursing staff participates in a broad range of diagnostic procedures, from the relatively simple measurement of the patient's vital signs to performing or assisting in the performance of intricate procedures. Medical technologists also participate to a great degree in diagnostic activities, obtaining blood and other samples from the patient, and performing most of the laboratory tests that aid the physician in diagnosis, prognosis, and assessment and evaluation of therapeutic response. The nurse works directly with the patient, providing direct diagnostic services. The medical technologist, on the other hand, provides data as an intermediate patient care output.

The specific services provided by nurse and medical technologist depend on the patient and on the health problem (or problems) being treated.

The physical, occupational, and speech therapists (and other rehabilitative therapists) perform diagnostic or evaluative activities for the purpose of establishing a base for a program of treatment of physical and/or emotional disabilities associated with disease or its therapy. Physiotherapy diagnosis is addressed to the recognition and assessment of physical impairment and the prescription of a therapeutic regimen designed to maximize the effectiveness of the remaining capabilities. Occupational therapy can be addressed to both emotional and physical problems, and diagnosis must lead the therapist to a recognition of the particular services required by the patient, be they of a creative nature for emotional problems or creative and/or manual activities for the physically impaired. Again, the particular activities of the physical and occupational therapist will depend on the subject patient and his problems.

The clinical psychologist performs diagnostic activities such as patient interviewing and testing, seeking evidence of psychopathology or health in the patient (see Rosenthal in Bandler, ed., 1968, pp. 213-224). All health professionals perform activities designed to determine the need for their services, and each assessment presents a diagnostic problem of varying degree of difficulty. The neglect of specific mention of social workers, rehabilitation counselors, specialized nurses, and others does not imply a lack of importance in their roles.

The examples are meant to typify the activities under consideration, not to describe these activities exhaustively.

Application of therapeutic procedures

Nearly all of the care team members are involved in the application of therapeutic procedures of one form or another. There are some basic differences in the procedures which they apply that evolve from specialization in function by the team members and the consequent concentration on a rather limited aspect of the patient's care. Some of the procedures are administered at the request of the physician in charge of the patient, while other procedures are performed at the discretion of the appropriate health professional in consultation with the physician (see Magraw, 1968, pp. 827-829).

The nursing staff provides relatively few essential therapeutic services to the patient without specific orders from a physician. Thus, patient medication and ambulation, and other therapeutic measures required by the patient are ordered by the physician and performed by the proper nurse. Some therapeutic measures essential to treatment progress have become part of the routine performance of nurses trained to function in special care units. Nurses, with varying levels of training, perform a wide range of therapeutic measures, with some substitution between the different personnel for given tasks. The function and performer depend on the health problems of the subject patient, and on the workload imposed by his fellow patients.

The physical therapist performs a fairly well defined spectrum of procedures which employ the therapeutic properties of exercise,

heat, cold, light, electricity, ultrasound, and massage in the treatment of physical impairments. The occupational therapist uses creative arts, manual skills, recreation, and prevocational activities as tools in the treatment of the physically and emotionally disabled.

Clinical psychologists, social workers, speech therapists, rehabilitation counselors, and other allied health professionals perform therapeutic procedures suitable to their special training and to the special needs of each patient. Again, the specific performers and functions that are a part of the treatment process depend on the particular patient and his health problems.

Preparation and dispensing of medications

A group of activities which relate to the therapeutic efforts of the physician, and to those provided by nursing and allied health professional personnel, involves the preparation and dispensing of medications. Medications are prescribed by the physician with possible consultation from the hospital pharmacist, are prepared by the hospital pharmacist, are delivered to the patient floors by couriers, and are administered by nurses or by trained technicians. Some standard medications are kept in each patient service area, from which they are drawn on physician order to be administered by nurse or technician.

Accomplishment of preparatory procedures

Preparatory procedures are those activities that are undertaken by the care team member to prepare himself and/or the patient for subsequent diagnostic or therapeutic procedures. This definition

means that every member of the care team engages in some form of preparatory activities.

The nursing staff gets involved in many of the procedures preparing the patient for diagnosis or therapy. These activities are done almost entirely at the request of a physician. Some of the more routine preparatory measures are frequently delegated to lower level nurses or to nonprofessional health workers.

Care team members other than nurses get involved in preparatory procedures, usually self-preparation prior to implementation of therapy. The development of an exercise plan for a convalescing post-surgical patient by a physical therapist is an example of this form of preparation.

The phases of a nurse's or allied health professional's effort out of contact with a patient, but expended in anticipation of that contact are crucial to effective treatment. Such preparation is a sign of scientific, theory-based treatment and it must be reflected in the treatment process.

Patient condition monitoring and assessment

The third vital aspect of treatment is the monitoring and assessment of patient condition designed to measure therapeutic response and progress. All health professionals who provide therapeutic services to the patient, as well as others having a specific monitoring and assessment role relating to another professional's therapeutic actions, have a responsibility for the periodic observation of the patient's treatment process.

The nursing service is engaged heavily in patient condition monitoring and assessment, again generally on physician's orders except where incorporated in a specialized role. Other health professionals monitor and assess the effects of their services on the appropriate patient condition variables, and adjust their therapeutic efforts as indicated.

Condition monitoring and assessment provides a vital link in the subprocess, provision of primary supportive care, by tying treatment outputs to a notion of expected results. Thus, this activity exerts the control over the range of production functions employed by the various health professionals in the treatment of patients with particular health problems. Condition monitoring and assessment also provides an important overlap between the two subprocesses, namely provision of essential medical services and of primary supportive care.

Communication with patient and other care team members

The last two types of activities on the list of primary supportive care activities are of a slightly different nature than the preceding five. The activities relating to the communication among care team members and with the patient to a great degree facilitate the provision of effective patient care. Communication with the patient and with other care team members is a major responsibility of all care team members. Patient treatment involves a great amount of interaction between the patient and those providing his care. Communication is the process by which important information flows to both patient and care provider—information to the patient relating to his illness and

his role in its treatment, and personal and clinical data to the care team member. Equally important is the flow of communication between members of the care team. The conveyance of care objectives and plans appears to be essential to treatment process coordination. It also seems apparent that effective communication between team members will tend to reduce the chance variation in the treatment process that might result from uncoordinated efforts.

Recording of pertinent patient care data

The final activity of record keeping derives from a need for documentation as perceived in different quarters—first, for purposes of facilitating and controlling the treatment provided, and second, to satisfy the documentation requirements of treatment process management.

Record keeping is in many respects an aspect of the management of patient care, yet effective recording of pertinent data on the patient is deemed a vital activity in the provision of essential medical services and primary supportive care services. Reference has been made in this study to Weed (1970) and to the problem-oriented record. Quality of care is the primary concern of Weed, and he argues that a properly constructed and utilized patient record serves that goal. Rinehart, providing the viewpoint of a registered nurse, also points to the importance of the patient record in implementing and auditing nursing care (Rinehart, 1969, pp. 203-216).

Secondary Supportive Care: Professional Skills

Secondary supportive care is designed to provide for the physical and emotional needs of the patient, but it is not deemed essential to progress in the treatment of diagnosed health problems (see Howland, 1963, p. 233). Some argument can be found that all care that is provided is essential to treatment progress, but observation of hospital care indicates that there are certain items of care that are foregone when personnel or other resources are scarce.

Secondary supportive care is also designed to meet patient wants, within certain reasonable bounds. Secondary supportive care, frequently provided concurrently with essential services of medical personnel and of nurses and other health professionals, can be categorized to facilitate its consideration in this analysis. The categories of supportive care are viewed as (based on Rinehart, 1969, pp. 20-22; Durbin and Springall, 1967, pp. 36-37; Nadler, 1965c, pp. 49-52; O'Malley, 1969, pp. 2155-2158):

1. Admission and discharge processing.
2. Assistance in patient hygiene.
3. Assistance in patient nutrition.
4. Promotion of patient physical comfort.
5. Provision of emotional support to the patient and his family.
6. Transportation of the patient and patient-related items.

Secondary supportive care, as defined, is provided almost exclusively by the nursing staff and by non-professional personnel. Many of these activities bear on patient health, and in some cases relate clearly

to patient progress. However, the activities, in the main, are a routine part of operating a modern hospital where healthful conditions are requisite.

Admission and discharge processing involves those activities required to: (1) prepare the patient for his hospital stay and (2) upon completion of his hospital stay to prepare the patient for his release from the inpatient phase of his treatment. Upon admission the patient must be located in the proper place in the hospital, depending on his condition, and settled as comfortably in his quarters as is possible in the particular situation (Rinehart, 1969, p. 20). It must be made clear that the discussion pertains to both elective and emergency admissions, and that the admitting procedures would understandably differ for the two cases.

Discharge processing involves the preparation of the patient and his records so that the patient can be released from the hospital. Patient records, especially as they pertain to patient billing, are made current before discharge. The patient is generally transported by hospital personnel from his hospital room to a hospital entrance.

Assisting the patient provide for his personal hygienic needs is an important supportive care function. Services of this type are designed to promote patient cleanliness and general care of hair, skin, teeth, etc. The amount of nursing effort devoted to this class of activities is dependent to a great degree on the patient's condition and his relative ability to care for himself (Rinehart, 1969, pp. 56-71; Matheny et al., 1968, pp. 113-119).

Assistance in patient nutrition involves the serving and monitoring of relatively standard and highly specialized diets. Some patients may be unable to feed themselves for condition-related reasons and must be fed or assisted in feeding (Matheny et al., 1968, pp. 128-133; Shafer et al., 1964, pp. 48-51).

The physical comfort of the patient derives from his own physical status and from his hospital environment. Normal or near-normal body processes are requisite to patient comfort, and so the nursing staff and other hospital personnel monitor and assist important physical processes. Also important in promoting comfort are efforts devoted to achieving comfortable bed posture and to assisting in patient ambulation (Matheny et al., 1968, pp. 97-140).

The other aspects of the patient's physical comfort relate to his hospital environment—to the appearance of the room, to the noise level, and to the quality of the patient's relationships with hospital personnel. The patient's environment can be controlled within certain limits by the care team members through their attention to room conditions and to their relations with each other and with the patient (Matheny et al., 1968, pp. 64-72).

The emotional state of the patient can be an important factor in the progress attained in treating the patient, and it also has an impact on the nonessential aspects of his care. The patient experiences a considerable amount of apprehension at various stages of his hospital stay. Researchers report on the regression of the ill person to a childlike state and to the dependent behavior associated with that

state (Wilson, 1963, pp. 285-290). Care designed to inform, encourage, and otherwise bolster the morale of the patient is generally a part of hospital treatment provided by the care team members, contingent upon effort by the patient to return to a more independent state (see also Smith and Gips, 1963, pp. 89-99; Mason, 1967, pp. 12-19).

Transporting of the patient, the final class of secondary supportive care services, might be considered as essential to patient progress since the delivery of certain forms of essential care require that the patient be moved from his bed to the site where care is provided. However, other forms of secondary supportive care also facilitate essential care or add to its effectiveness, but these forms, like transportation of the patient, have no direct impact on the patient's condition. The patient is transported most frequently for diagnosis and for therapeutic procedures that require the use of special equipment or facilities that cannot be moved to the patient or used conveniently or safely in his room.

Transportation of patient-related items involves the movement of a variety of things—medications, meals, linens, bandages and drapes, portable equipment, beds, stretchers, etc. Studies of nursing activities report various efforts that seem to be summarized best as transporting items needed or wanted by patients.

All of the aspects of supportive care except admission and discharge processing are viewed as being provided within the concept of progressive patient care that has been adopted widely in modern

community hospitals. In progressive patient care the patient progresses from a state of high dependency and concentrated care provided by hospital personnel to a relatively independent state in which he provides a good deal of his own care. Essential medical, nursing, and paramedical services also vary in intensity of application over the course of treatment, tending to be more intensive in the early stages of hospitalization than during the later stages. Thus, the production processes that yield the respective forms of care may each take as many as three basic forms: (1) processes related to the intensive patient care stage, (2) processes related to the intermediate stages of patient care, and (3) processes related to the minimal care stages of treatment.

To complete the picture of the processes involved in the provision of essential medical services and in supplemental care requires that the subprocesses yielding intermediate outputs which become inputs to be the basic treatment processes that have been identified, be recognized. These intermediate output yielding processes are associated with recognizable hospital units structured to provide specialized outputs. Table 8, page 128, shows a cross listing of selected hospital organizational units and the basic treatment processes to which they provide outputs; also shown are general activities which cannot be readily allocated to any of the phases of direct patient treatment.

The radiology departments provide diagnostic and therapeutic outputs to the physician providing essential medical services. Diagnostic x-ray procedures are used for a variety of investigative purposes;

TABLE 8

Intermediate Outputs Supplied to Patient Treatment
by Selected Hospital Activities

Outputs from:	Supplied to:			
Hospital Activity	Essential Medical Services	Primary Supportive Care	Secondary Supportive Care	Administration and general Support
Radiology	X			
Clinical Labs	X			
Special Med Svcs Labs	X			
Operating Room Services	X			
Central Sterile Supply	X	X		
Pharmacy	X	X		
Housekeeping			X	
Dietary			X	
Volunteer Services			X	
Patient Services			X	
Medical Records				X
Business Offices				X
Personnel				X
Director's Office				X
Operations Research				X
Purchasing				X
Physical Plant				X

therapeutic procedures using x-ray emission are also commonly used. The clinical and special medical services labs perform the routine and special lab tests required for the diagnostic phases of essential medical services. The important outputs are various elements of information supplied to physicians for integration and interpretation with data from other sources.

The operating room services refer to the combined output of special operating room teams that support the physician in the performance of surgical procedures. A description of a surgical team and their functions is provided in Chapter VII.

Central sterile supply provides the many sterile items required in diagnostic and therapeutic procedures. Some representative outputs of central supply are sterilized surgical dressings, intravenous and other solutions, special diagnostic and therapeutic packs, dressing trays, suction apparatus, oxygen tents, splints and orthopedic equipment, intravenous equipment, gauze, rubber gloves, sterile disposables, etc.

The hospital pharmacy provides required medications as well as advice on their single and joint use. Modern pharmacy practice requires knowledge about therapeutic interaction of drugs as well as possible chemical interactions that may be harmful to the patient. Pharmacy medications are used in providing essential nursing services while pharmaceutic advice is an input used by physicians in the essential medical services process.

Housekeeping and dietary provide outputs that are clearly inputs to secondary supportive care. Housekeeping affects the patient's physical environment as well as maintaining hygienic conditions essential to the control of hospital cross-infection. Dietary services provide the many diets required to meet varied patient nutrition needs, while adjusting to special constraints imposed by disease.

Volunteer and patient services are provided to assist the hospital staff in the performance of duties not requiring specialized professional training. These services are applied mainly in transporting the patient and patient-related items, and in providing emotional support to the patient.

The remaining activities cannot be meaningfully allocated to patient treatment. These activities are of an administrative or general support nature, and their extent depends mainly on patient load and on the extent and complexity of hospital organization and operations.

Supplemental Care Services: Care Management

Care management is an essential aspect of the provision of supplemental care as was the case with the other major subprocess of patient treatment, essential medical services. Once again the basic managerial functions seem appropriate for application to the management of primary and secondary supportive care.

Planning of care is advocated in the literature for all health professionals providing supplemental care. Little and Carnevali

(1967, p. 66) in discussing the essentials of nursing care plans, advocate assessment of patient problems and needs, the setting of care objectives, the planning of care procedures, and the establishment of performance criteria. These elements comprise an approach to the patient that would seem to be appropriate for any professional seeking to serve the patient.

Organizing and staffing are primarily responsibilities of nursing supervisors who exercise some control over large organizations with personnel of varied skills. However, other health professions could present organization and staffing problems to those in supervisory positions. In any case the functions are accomplished to achieve the proper care-team structure, to promote reporting and communicating relationships, and to get the proper individual performing the various tasks.

Directing relates to the leadership of the care-team, and also implies the effective delegation of responsibility to promote timely response to patient wants and needs. Finally, direction refers to the definition and communication of care objectives, enabling care-team members to initiate many activities on their own, thereby reducing the supervisory load.

Supplemental care providers are key performers as care monitors and reporters. Evaluation, reporting, and control activities are undertaken on behalf of the physician in the realm of essential medical services, as well as in the supplemental care area. Certainly, the prerogatives of the supplemental care provider are circumscribed clearly,

but he remains an important patient condition monitor, a reporter of the detected condition, and in some cases, a corrector of that condition.

Essential Medical Services/Supplemental Care Interties and the Patient

Essential medical services and supplemental care have been described as though they were discrete processes when in fact, they intertwine in a complex fashion. The focus of the intersection of these subprocesses of patient treatment is the patient. The patient is a functioning system, though somewhat improperly when diseased, that is plugged into the patient treatment system. The patient receives numerous patient treatment services including those self-care services he provides, and emits outputs in the form of signs that describe his health status and his progress toward a homeostatic state.

The patient system could be viewed as encompassing the final output process, accepting intermediate outputs from the essential medical services and supplemental care subprocesses, and yielding the final product, the treated patient. A different view is believed to be more descriptive in this analysis.

The patient system is viewed as an additional subprocess in the patient treatment system whose nature changes from patient to patient within reasonable limits for a particular diagnosed condition. The patient provides services to his own care that enter treatment as part of other recognized subprocesses. He also yields intermediate

outputs in the form of signs and symptoms as the result of the interaction of therapy with body processes. The final output, treated patient, is the result of the joint functioning of the three identified subprocesses—essential medical services, supplemental care, and patient.

A division of the patient subprocess that is consistent with the proposed treatment system is appropriate. This division yields a pretherapy patient, therapy-coincident patient, and posttherapy patient, each distinct from the other in the way the patient can participate in his own care, in the way the patient's body processes are functioning, and in the status and trend in variables reflecting the patient's condition relative to a designated homeostasis.

The Patient Treatment Process: Provision of Supplemental Care—Process Equations

The analysis of the patient treatment process has yielded some classificatory schemes, and has dealt with the relationships that exist within this very complex process in varying degrees of explicitness. It is appropriate at this juncture to provide some general production relationships which reflect the analysis in this chapter and which anticipate slightly the discussion of hospital resources to be provided in Chapter VI.

Process Equations: A Proposal

The patient treatment process, general:

I. $O_i = f_1 [E, S]$

where: O_i = *ith* class of hospital patient treatment system output
E = essential medical services
S = supplemental care

Supplemental care:

A. $S = f_{13} [SC_1, SC_2, M_2]$

where: SC_1 = primary supportive care services
SC_2 = secondary supportive care services
M_2 = management of supplemental care

1. $SC_1 = f_{14} [PS_2]$

where: PS_2 = application of essential nursing and allied health professional skills

a. $PS_2 = f_{15} [D_2, PT_2, EC_2]$

where: D_2 = diagnostic services—nurses and allied health professionals
PT_2 = prognostic and therapeutic services—allied health professionals
EC_2 = evaluation and control of therapeutic response—nurses and allied health professionals

i. $D_2 = f_{16} [C_{21}, P_{21}, n_i, a_i, e_i, p]$

where: C_{21} = clinical data, prediagnosis, nurses and allied health professionals
P_{21} = personal data, prediagnosis, nurses and allied health professionals
n_i = professional services, *ith* nurse
a_i = professional services, *ith* allied health professional
e_i = services of the *ith* equipment item
p = services of the subject patient

ii. $PT_2 = f_{17} [D_2, C_{22}, P_{22}, n_i, a_i, p. e_i]$

where: C_{22} = clinical data, pretherapy and therapy—coincident, nurses and allied health professionals

P_{22} = personal data, pretherapy and therapy-coincident, nurses and allied health professionals

iii. $EC_2 = f_{18}\ [PT_2, C_{23}, n_i, a_i, p, e_i]$

where: C_{23} = clinical data, posttherapy, nurses and allied health professionals

P_{23} = personal data, posttherapy, nurses and allied health professionals

2. $SC_2 = f_{19}\ [PS_3]$

where: PS_3 = application of optional nursing and allied health professional services

a. $PS_3 = f_{20}\ [SN, SP, SE]$

where: SN = determination of nursing and allied health professional service need

SP = provision of nursing and allied health professional service

SE = determination of nursing and allied health professional service effect

i. $SN = f_{21}\ [n_i, a_i, p]$

ii. $SP = f_{22}\ [n_i, a_i, p]$

iii. $SE = f_{23}\ [n_i, a_i, p]$

3. $M_2 = f_{24}\ [m_{21}, m_{22}]$

where: m_{21} = management of the patient's hospital treatment subprocess(es)

m_{22} = management of the patient's utilization of health care delivery subsystem(s)

a. $m_{21} = f_{20}\ [n_i, a_i]$

b. $m_{22} = f_{21}\ [X_i, n_i, a_i]$

The Patient Treatment Process: Detailed Model

The workings of the patient treatment process have been examined and described in detail, and it is now possible to present a more detailed

diagram of that process. Figure 5, on the following page, shows the three subprocesses of patient treatment and some suggested interaction patterns (arrows) between the subprocesses. The patient treatment management functions are shown as enveloping the remaining components of the treatment process.

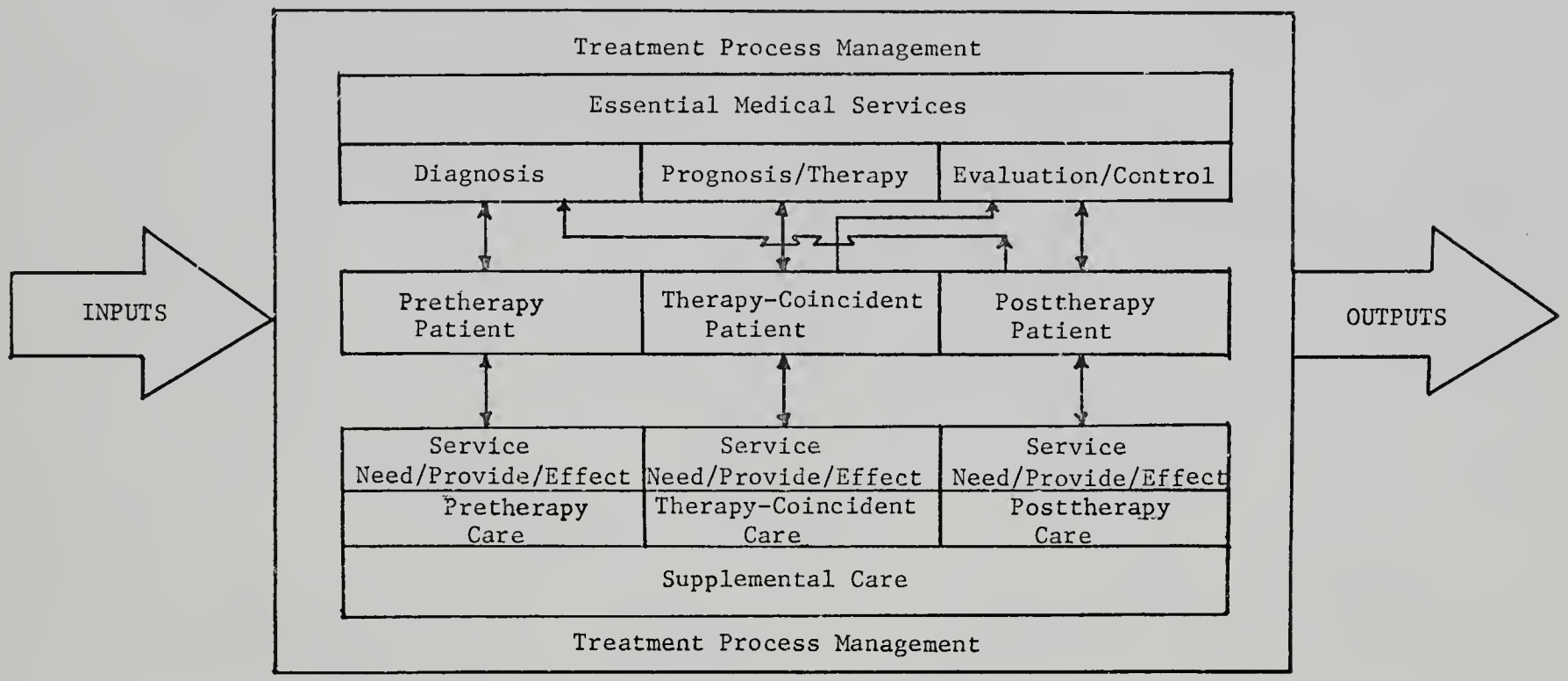

Figure 5. Detailed model of the patient treatment system.

CHAPTER VI

THE PATIENT TREATMENT SYSTEM—INPUTS

The final parameter of the patient treatment system relates to inputs, the array of resources utilized in providing hospital patient care. The objective of this chapter is to identify the important types of resources used in patient treatment, classifying them in a manner consistent with the model developed in Chapters IV and V. Input resources are the personnel, equipment, buildings, and supplies that are the ultimate concern of the hospital planner. Planning, programming, budgeting has been proposed as the process within which the patient treatment system model might be used. PPB is a rational process which starts with objective formulation and the planning of outputs serving those objectives, and culminates in the programming of inputs whose nature is determined by the output specifications and by the technology implicit in the patient treatment process. Thus, input resources are constrained as to types and amounts by output preferences and by existing treatment practice and technology.

Hospital resources used in the treatment of human illness can undoubtedly be classified in several different ways, each scheme having some utility. The plan of this chapter is to identify the major types of services rendered by resources in hospital treatment, and then to discuss generally the discrete resource units that provide these services.

The two basic resources used in providing care for hospital patients are labor and capital. A proposed method of subdividing the hospital labor resource is as follows:

1. *Professional*—occupations requiring a minimum baccalaureate degree educational preparation and for which performance is largely self-determined following established codes of professional performance and conduct. This class can be further divided to reflect those professionals involved directly in patient care, those involved indirectly in patient care, and those who participate in some capacity in support of patient care.

2. *Quasi-professional*—occupations generally requiring a baccalaureate degree or other post-high school training for successful performance of duties for which the level of performance and conduct are codetermined by the performer and supervisor(s) within the hospital's administrative structure. This class can be further subdivided into subclasses reflecting direct participation in patient care, indirect participation in patient care, or performance in support of patient care.

3. *Nonprofessional*—occupations with no minimum educational requirements for which performance and conduct are largely determined by the job description and by supervision. These occupations are performed mainly in support of patient care.

Capital, the second of the major resource types, can also be divided into important classes:

1. *Fixed capital*—used over a relatively long period of time. Examples are the hospital buildings, room furnishings, diagnostic and therapeutic equipment, and so forth.

2. *Circulating capital*—used up in one cycle or relatively few cycles of the patient treatment process. Examples are medical and surgical supplies, pharmaceuticals, x-ray and other types of photographic film, food items, and so forth.

Stigler defines capital as "all economic goods except people and perishables" (Stigler, 1966, p. 275). This rather simple definition leaves a very small portion of the total hospital input resources as questionable items of labor and capital, namely those perishable food

items used in the hospital's dietary department and certain perishable pharmaceuticals. For the sake of this analysis these few perishable items will be considered as circulating capital that is used up in relatively few cycles of the patient treatment process.

Labor and Capital Services in Hospital Treatment

Chapters IV and V are concerned with the development of a model of the process of treatment of a patient in a short-term hospital. The general process equations that are identified in each of these chapters include variables that relate to the services of labor and capital that are provided in hospital treatment. It seems obvious at this point in the research that resource services, whether provided by persons or machines, would be best defined in a manner consistent with the processes and subprocesses of the treatment model. With this constraint in mind, the following general categorization of hospital resource services is proposed.

1. *Diagnostic services*—personal or equipment services that are rendered for purposes of generating information to be utilized in one or more of the diagnostic subprocesses that are a part of a particular patient's hospital treatment. These services can involve direct contact with the patient as by physician or nurse, but can also be supplied by individuals or equipment that are a part of diagnostic or therapeutic processes, such as radiologic studies, clinical laboratory analyses, electro-encephalographic analyses, and other processes that yield intermediate outputs to direct patient care.

2. *Therapeutic services*—personal or equipment services that are addressed to the treatment of the patient's identified health problem (or problems) or to the amelioration of reported symptoms. The services may be classified as to their essentiality in returning the patient to a homeostatic state. These services always involve direct patient contact, and the personal

services are rendered only by those health professionals qualified for direct patient care, including physicians, nurses, and certain of the allied health professionals. Included in this category are certain treatment management services provided by direct-care professionals. These services may be further subdivided into general and special therapeutic services. The character of general therapeutic services is determined on an ad hoc basis dependent on the found state of the patient at the particular instant in time. Special therapeutic services have a more regular nature in that particular patterns of service have been identified and incorporated into special care service packages. Examples of this latter type of service are operating room team services, coronary care unit team services, premature nursery team services, etc. The subdivision is proposed to take advantage of the existence of relatively more standardized production functions within hospital treatment.

3. *Care-monitoring services*—personal and equipment services that are rendered for the purpose of measuring and evaluating the patient's response to therapy. These services generate information relating to patient status which affects both diagnosis and prognosis and therapy. These services are always essential, always involve direct contact between the service provider and the patient, and the personal service portion can only be provided by those health professionals qualified for direct patient care. Included in this category are certain treatment management services provided by direct-care professionals.

4. *Care-supporting services*—personal or equipment services that are rendered in support of persons and equipment involved in direct patient care. These services yield information and other material outputs to providers of therapeutic services, and they also may be classified as to their essentiality in returning the patient to a homeostatic state. Provision of these services requires little if any contact with the patient. The services are rendered by nurses, certain health professionals, and other nonprofessional health workers. Included in this category are those treatment management services provided by persons involved in indirect patient care. (This category should not be confused with supportive care, described in Chapter V. Supportive care involves the rendering of direct patient care services.)

5. *Administrative and general support services*—personal services that are rendered to create and maintain an environment within which effective patient treatment can be provided. These services relate to the acquisition, allocation, and management

of all hospital resources, excluding those decisions reserved to direct patient care professionals. The residual treatment management services are included within this category. (For a related classification scheme, see *Techniques of Analyzing a Professional Service Department*, United Hospital Fund of New York, 1966.)

A major objective of the categorization scheme and of the treatment system model has been to define basic processes and services independent, to the degree possible, of the current organization of the delivery of hospital care and the consequent service-provider roles that derive from that organization. Future delivery of hospital treatment is assumed to require the same general processes and services that have been identified, even with a modified organization and changed roles for the respective service providers. For example, the emergence of the physician's assistant suggests a potential change in the provision of certain diagnostic, therapeutic, and evaluative services away from the physician to the paramedical person. The services will continue to be provided within the same general processes, nonethless.

Quantity of Labor and Capital Services Demanded for Patient Care

The quantity of labor and capital services demanded for patient care in a particular community hospital is a function of several variables, namely:

1. Patient load as measured by:
    a. Number of inpatient admissions and average length of stay
    b. Number of outpatient clinic visits
    c. Number of day-care patient admissions
2. Patients' health problems and stage of illness at admission.

3. Patients' socio-economic status.

4. Scope of hospital's patient care program.

5. Size, nature, and care interests of hospital's salaried and attending health professional staff.

6. Scope of hospital's educational program.

For hospital resource planning purposes it may be useful to distinguish three main groupings of labor and capital services from this list of variables. Labor and capital services might be viewed as:

1. Hospital capacity and usage-related.

2. Patient and health problem treatment-related.

3. Hospital program-related.

The purpose of this categorization is to distinguish those resources related to the patient treatment process that are of primary interest in this study, from resources that seem to be more dependent on hospital capacity and throughput, and from resources that derive from the size and complexity of patient care and educational programs. The resource planning model that might derive from this research would not attempt to relate every hospital resource to the treatment processes that are identified, but only those resources whose quantities were truly dependent on the treatment of specific illnesses and injuries.

The quantities of patient treatment-related resources for a particular period of time by a hospital could be projected using the proposed model of patient treatment, carrying the desired output spectrum back through the treatment process model to yield required inputs. The quantities of hospital throughput-related and program-related

resources would have to be projected, by means other than those described in this study.

Hospital Labor Resources

A classification of health occupations is made by Weiss (1966, pp. 38-84; 1968, pp. 48-64). He examines the classification schemes utilized by the Census Bureau for classifying health care occupations, after which he proposes a new classification scheme he believes is more useful for analytical purposes.

Weiss recognizes a basic criterion for health occupational classification, that jobs in the health family be functionally similar. Defined according to this criterion, jobs will be closer substitutes and "will have similar characteristics with respect to rules governing compensation, hours of work, and training and education requirements" (Weiss, 1968, p. 50). It is apparent from Weiss' comments that job content similarity is also important. He is concerned with having all occupations whose function involves the provision of health services classified as a part of total health manpower.

The work of Scoville (1965, p. 48) which provides some basis for Weiss' study, formed job titles on the basis of job content. Two important dimensions are identified for purposes of job classification, technical focus or function of the job and the level of job content. One of the technical focus areas in Scoville's scheme is health. Level of job content is related to skills, responsibility, educational

requirements, training requirements, and working conditions (Weiss, 1968, p. 53). Five levels of job content are identified by Scoville.

Weiss proposes two additional criteria for defining health service jobs: (1) "the job can only be performed by persons whose principal training has been oriented toward the provision of health services; (2) transfer of persons performing the job to a job not oriented toward the provision of health services would entail either a great deal of retraining or failure to utilize acquired skills" (Weiss, 1968, p. 55).

Jobs oriented toward health care seem to be better classified using the Weiss approach rather than the Census approach, at least for those occupations involved directly in the patient treatment process. However, there are a large number of jobs performed in support of patient treatment which Weiss would exclude from the health services industry. The excluded occupations are, in the main, covered inadequately in the Census. Weiss' occupational classes are considered to be useful in representing an important segment of hospital labor involved in patient care.

Weiss divides health jobs into two main groups, those concerned directly with patient care and those only indirectly concerned with the care of the patient. Direct patient care jobs fall into four job families (Weiss, 1966, pp. 78-79):

1. *Patient care, mental*—includes jobs oriented toward care of the mentally ill.

2. *Patient care, nursing*—includes jobs oriented toward provision of nursing care.

3. *Patient care, medical*—includes physicians, paramedicals, and other direct patient care jobs not otherwise classified.

4. *Patient care, dental*—includes jobs concerned with the patient's dental health.

Indirect patient care jobs are grouped into five job families by Weiss (1966, pp. 80-81):

1. *Technical and laboratory focus*—includes jobs concerned primarily with "functions such as operating medical equipment, making medical and dental appliances, and making tests and measurements" (Weiss, 1968, p. 62).

2. *Administration and planning, health*—includes jobs oriented toward the administration and planning of health care.

3. *Data processing, health*—includes jobs concerned with the ordering, classifying, indexing, and retrieval of health care data.

4. *Environmental health focus*—includes jobs concerned with the identification and control or elimination of environmental health problems.

5. *Health research*—includes jobs concerned with research in the basic and applied health sciences.

Some problems remain with the occupational grouping proposed by Weiss. A major problem appears to be a lack of consistency and specificity in creating the direct patient care categories. Patient care mental relates to a class of health problems as does patient care dental, but patient care-nursing relates to a diverse set of provider services rendered to patients with an equally diverse spectrum of health problems. Patient care medical is another broad category including physicians, veterinarians, and allied health professionals. The basic flaw in this category seems to involve the grouping of individuals whose service focus and job content are dissimilar enough to make them inappropriate cohabitants of the category.

The difficulties cited may not be harmful for Weiss' purposes, although the patient care, nursing and patient care, medical categories seem unfortunate in light of his expressed objectives. For the purposes of this research it would seem appropriate to restrict patient care, medical to physicians and veterinarians, moving the allied health professionals to another category: patient care, allied health professional.

It also seems advisable to form two additional categories, one to cover those occupations which require direct patient care services from nonprofessional providers, and another to cover those services that Weiss incorporated in patient care, medical as services not elsewhere classified. A category entitled patient care, technician services is proposed which would include all services provided directly to the patient by nonprofessional care team members. A final category: patient care, other supportive services is proposed to cover those supportive services rendered to the patient by providers not included in the other patient care categories.

The modified categorization of health occupations that has been proposed provides a framework which encompasses those individuals providing direct and indirect patient services in the hospital patient treatment system. Tables 9, 10, and 11 on pages 148-152 provide a listing of typical health occupations found in hospitals, cross-listed against occupational categories from the *1960 Census of Population*. (The content of these tables is similar to tables provided by Weiss, 1966, pp. 46-48.)

TABLE 9

Typical Hospital Occupations and Detailed Occupational Categories From the *1960 Census of Population:* Providers of Direct Patient Care Services

Hospital Occupation	1960 Census Detailed Occupation
Patient Care: Medical	
Physicians and Surgeons	Physicians and Surgeons
Anesthesiologist	
Psychiatrist	
Neurologist	
Family practitioner	
Osteopaths	Osteopaths
Patient Care: Dental	
Dentists	Dentists
Orthodontists	
Pedodontists	
Patient Care: Nursing	
Registered Professional Nurse	Nurses-professional
Licensed Practical Nurse	Practical nurses
Nursing Assistant	Attendants, hospitals and other institutions
Nurse-Anesthetists	Nurses-professional
Nurse-Midwife	Midwives
Patient Care: Allied Health Professional	
Occupational Therapist	Therapists and healers
Physical Therapist	" "
Speech and Hearing Clinician	" "
Recreation Therapist	Recreation and Group Workers
Clinical Psychologist	Psychologist
Social Worker	Social and welfare workers, excluding group
Medical Technologist	Chemist
Patient Care: Technician Services	
X-Ray Technician	Technicians: Medical and Dental
Cottage Parent	" " "
Nuclear Medicine Technician	" " "

TABLE 9—*Continued*

Hospital Occupation	1960 Census Detailed Occupation		
Electrocardiograph Technician	Technicians:	Medical and	Dental
Electroencephalograph Technician	"	"	"
Cardiovascular Technician	"	"	"
Inhalation Therapist	"	"	"
Operating Room Technician	Technicians:	Medical and	Dental
Oxygenator Technician	"	"	"
Orthopedic Cast Technician	"	"	"
Patient Care: Other Supportive Services			
Chaplain	Clergy		
Patient Services Representative	Religious Workers		

Source: Table 201, Vol. 1, Part 1, *1960 Census of Population;* Teaching Hospital Personnel Roster.

TABLE 10

Typical Hospital Occupations and Detailed Occupational Categories From the *1960 Census of Population:* Providers of Patient Care Supporting Services

Hospital Occupation	1960 Census Detailed Occupation
Technical and Laboratory Focus:	
Laboratory Technician	Technicians: Medical and Dental
Photo Lab Technician	Photographic Process Workers
Pharmacist	Pharmacist
Orthotist	Technicians: Medical and Dental
Optician	Optician
Lab Helper	Attendants: hospitals and other institutions
Non-Health Industry Focus:	
Sterile Supply Aide	Attendants: hospitals and other institutions
Medical Transcriber	Stenographer, Typist
Seamstress	Dressmakers and seamstresses, excluding factory
Dietitian	Dietitian and nutritionist
Chef	Cooks, excluding private household
Cook	" " " "
Baker	Baker
Food Service Aide	Kitchen workers, n.e.c., excluding private household
Housekeeper	Chambermaids and maids, excluding private household
Custodial Worker	Janitors and Sextons
Medical Record Librarian	Librarians

Source: Table 201, Vol. 1, Part 1, *1960 Census of Population;* Teaching Hospital Personnel Roster.

TABLE 11

Typical Hospital Occupations and Detailed Occupational Categories From the *1960 Census of Population:* Providers of Administrative and General Support Services

Hospital Occupation	1960 Census Detailed Occupation
Administration and Planning, Health:	
Hospital Director, Assistant and Associate Directors	Mgrs, officials & prop., n.e.c. salaried
Director of Internal Finance and Accounting	Mgrs, officials & accountants
Operations Research Director	
Accountant	Accountants
Insurance Manager	
Clinical Labs Director	Mgrs, offcls, prop, n.e.c. salaried
Central Sterile Supply Manager	" " " "
Floor Unit Administrator	" " " "
Blood Bank Director	" "
Dietetics Director	Dietitians & Nutritionists
Administrative, Secretarial, and Clerical Support:	
Administrative Assistant	Secretaries
Fiscal Assistant	"
Staff Assistant	"
Secretary	"
Clerk, Clerk/Typist	File clerks, Payroll and Timekeeping Clerks, Clerical and kindred workers (n.e.c.), Typists, Bookkeepers
Receptionist	Receptionists
Teller	Tellers
Duplicating Equipment Operator	Office Machine Operators
Physical Plant and Equipment Maintenance:	
Maintenance Supts & Supervisors	Foreman, Construction & Maint.
Carpenter	Carpenters
Plumber	Plumbers & Pipefitters
Electrician	Electricians

TABLE 11—*Continued*

Hospital Occupation	1960 Census Detailed Occupation
Painter	Painters, Construction & Maint.
Maintenance & Refrigeration Mechanics	Mechanics & Repairmen
Storekeeper	Stock Clerks & Storekeepers
Stock Clerk	" " "
Data Processing: Health	
Data Systems Director	Mgrs, offcls, prop, n.e.c. salaried
Computer Systems Program Mgr	" " " " "
Computer Systems Analyst	
Computer Programmer	
Computer Operator	
Keypunch Operator & Supervisor	

Source: Table 201, Vol. 1, Part 1, *1960 Census of Population;* Teaching Hospital Personnel Roster.

In Table 9, Weiss would exclude the Chaplain from the health services industry because the main focus of his services was not patient care, because his training was not oriented toward health services provision, and because transfer of the clergyman to a non-health field would require little if any retraining. Similarly, many of the occupations listed in Tables 10 and 11 would not qualify as either direct-or indirect-care occupations in Weiss' classification scheme. The jobs that are listed, however, are typical labor resource units for hospitals. In many cases the non-health jobs are poorly classified in the 1960 Census of Population.

The Patient as an Input

A discussion of the labor resources utilized in hospital patient treatment is incomplete if the patient is excluded. The patient is a vital human resource, forming with the attending physician, the heart of the patient treatment process. The patient presents the health problems to be recognized and treated, and subsequently delivers services in his own care.

The patient considered in this chapter as an input resource is to be differentiated from the patient subprocess of Chapter IV. In fact, patient services may be viewed as being inputs to all three subprocesses recognized in Chapters IV and V, essential medical services, supplemental care, and the diseased or injured human system. The patient services that are inputs to essential medical services and supplemental care are basically communications of various forms relating

to diagnosis, therapy, and care monitoring and evaluation. Patient services rendered to the patient subprocess are more tangible forms of direct care.

The services that are called forth from the patient are highly dependent on the quality of the interpersonal relationships between the patient and the physicians, nurses, and allied health professionals involved in the care effort (see Wilson, 1963, pp. 273-295). The quality of the relationships, in turn, depends on the skills of the patient and the various health practitioners in the hospital and social setting. These social relationships and their implications for the hospital care process have been explored by a number of researchers.

The concept of progressive patient care (PPC) anticipates that the patient's progress in treatment will be characterized by an increasing assumption of care activities by the patient in his own behalf. The patient unless incapacitated by his illness or injury, enters the hospital care process through a minimal care section of the hospital. There in addition to supplying information to the physician, the patient feeds, bathes, and performs other self-services much as he would in a hotel room. During the more intensive phases of therapy and during periods of relative incapacitation following therapy, the patient's inputs to the care process may be restricted to the passive supply of information to therapy evaluation and rediagnosis subprocesses. As physical capacity returns to the patient he resumes more and more of the responsibility for various phases of his care, depending upon care team members less as his hospital term progresses. Finally, the

patient may be discharged from the same minimal care unit through which he passed upon admission, having returned to a nearly independent state.

Patient inputs to the treatment process in the short-term hospital are vital inputs. The absence of these inputs as in certain pediatric and geriatric patient treatments, complicates many phases of care, especially the phases of essential medical services. The reduction in the quality of the personal and clinical data for these patients affects the efforts that must be expended in diagnosis, prognosis and therapy, and in care evaluation in order to achieve acceptable quality in the care delivered. A more intensive application of effort by professionals rendering essential services seems to be required to offset the reduced patient input.

Patient inputs can be assessed as to their essentiality in the care process. Certain of the inputs are strictly of a supportive nature, such as personal grooming and entertainment. Other inputs such as coughing and deep breathing following anesthesia, ambulation, and changing of bed position may be vital activities in the recuperation of the patient and in the prevention of dangerous complications.

Several students of health care have noted the depersonalization of the care process in modern care in the short-term hospital (see Snoke et al., 1961, pp. 51-54). Such depersonalization can reduce the quantity of patient inputs, and can also restrict the quality of the remaining inputs because of the patient's confusion and inability to establish meaningful relationships with the bewildering collection

of professionals and nonprofessionals that participate in the care process. The resource implications of this trend in care seem to be significant. The strong suggestion is that reduced or missing patient inputs must be supplemented or replaced with care-team inputs if care quality is to be maintained.

Hospital Capital Resources

The community hospital's fixed capital resources for patient care consist of specialized buildings and equipment. Fixed capital in the form of buildings will not be analyzed in this study as it is viewed as being the subject of a special planning and budgeting exercise devoted to the provision of facilities designed to meet relatively long-term, general space needs. This analysis is focused on patient treatment, a short-term process, and its absorption of the capital resources which can be varied with relative ease in the shorter time spans.

Hospital Fixed Capital

The equipment which is used in the patient treatment process can be divided into several categories based on the type of services the equipment provides, or assists in providing in patient treatment. A very important category of equipment would be special and general purpose direct-patient care equipment. A further breakdown of this category according to the direct-care objectives to be served is as follows:

1. *Diagnostic equipment*—used to assist in the diagnosis of the patient's health problems.

2. *Therapeutic equipment*—used to provide, or assist in the provision of therapy to the patient for identified health problems.

3. *Life saving*—equipment which is used to assist normal body functioning in order to reduce or remove a threat of imminent death to the patient.

4. *Life sustaining*—equipment used as a supplement or substitute for one or more body systems on a periodic, continuous, or intermittent basis to sustain the patient's life.

5. *Monitoring*—equipment used to monitor the patient's condition.

Some examples of direct-care equipment can be provided. Radiologic equipment is used widely for diagnosis, therapy, and treatment monitoring. A renal dialysis unit is a life-sustaining type of equipment and performs the functions of a human kidney on a periodic basis. A defibrillating machine serves a life saving objective for patients suffering a particular type of coronary attack. Other equipment items could be cited which served one or more direct care objectives.

A second important category of hospital equipment provides, or assists in the provision of care supporting services. Some major subcategories of equipment can be specified:

1. Special and general purpose hospital room furniture and fixtures.

2. Special building systems—communication, gases, etc.

3. Transportation equipment—wheel stretchers, miscellaneous trucks and carts.

4. Special and general purpose laboratory equipment.

5. Kitchen and dining hall equipment.

6. Laundry equipment.

7. Housekeeping equipment.

8. Recreational equipment.

The final category of hospital equipment assists in the provision of administrative and general supporting services. This equipment may also be subdivided according to the more specific purpose it serves. The subcategories are:

1. Office furniture and fixtures.

2. Office equipment.

3. Lounge and waiting area furniture and fixtures.

4. Maintenance and groundskeeping equipment.

5. Firefighting equipment.

6. Hospital utilities equipment—electric, water, steam, etc.

Another aspect of equipment related to function can be discussed in a general way, that being the number of functions that can be performed by a single machine. For purposes of resource planning it seems useful to identify three categories of performance: single-function, limited-function, and multiple-function equipment. The greater the range of functions that can be performed by items of equipment the greater will be the flexibility that can be attained in reacting to the imposed patient load.

Other variables will seemingly have an important effect on the quantities of equipment that would be required to handle a given patient treatment load, as well as on the personnel and other hospital facilities that would be used in conjunction with the equipment. These variables

are the equipment's productivity, portability, and operating characteristics. Equipment productivity when related to demand for equipment services yields an estimate of the number of units of the particular equipment item that is required. Productivity has two important dimensions, total output capacity and throughput rate. Each of these factors can have some effect on where the equipment is used, in the patient's room or in a central location (excluding the effects of other equipment characteristics). Multiple patient service stations and/or lengthy service time could preclude the use of the equipment item in the patient's room.

Another factor which affects point of use of the equipment is the size of the equipment or its portability. Many items of equipment are designed to be used at the patient's location; however, other items of equipment are too large or require special installations which preclude their use at the patient's bed, dictating the need for a special central facility.

The operating characteristics of hospital equipment affect the patient's environment and also the nature of the personnel required for equipment operation. The noise level, odors, or other output from a machine may be offensive and even dangerous to the treated patient as well as to his neighboring patients. Equipment posing a safety hazard when used at the patient's bed must instead, be centrally located.

Machine operating characteristics also determine the job skills required in the operator. Some very complex machinery can be handled by relatively low skilled personnel, while other items of

equipment require consummate skill in operation. Thus, the capital equipment utilized in patient treatment has an impact not only on the numbers of personnel required in the treatment process, but on their personal and job-related attributes as well.

Hospital Circulating Capital

The circulating capital of a hospital takes many forms. It would be possible to group circulating capital items as were fixed capital items, according to the services the items provided or assisted in providing. Such a classification with a further subdivision according to the type of supplies involved appears as follows:

1. Direct Care Services
    a. Medical supplies
    b. Surgery supplies
    c. Medical gases
    d. Pharmaceuticals, chemicals, and pharmacy supplies
    e. Rehabilitation supplies
    f. X-ray and other photographic supplies
2. Care Supporting Services
    a. Laboratory supplies
    b. Food and dietary supplies
    c. Linens and other textile supplies
    d. Housekeeping supplies
3. Administrative and General Support Services
    a. Office supplies

A study of expenditures for circulating capital items for a 400-bed teaching hospital revealed something of the nature of the importance of the various categories in hospital operation. Approximately one-third of the total items purchased accounted for two-thirds of the total expenditures for circulating capital items. Within this group of items the relative importance of each of the proposed subcategories in terms of proportion of total expenditures is as follows:

Category	*Percent of Total*
Medical and surgical supplies	34.64
Pharmaceuticals	21.09
Food products	16.92
X-ray and other film	8.71
Office supplies	5.65
Laboratory supplies	3.24
Housekeeping supplies	2.95
Linens and other textile products n.e.c.	2.35
Dietary supplies	2.04
Pharmacy supplies	1.08
Medical gases	0.87
Chemicals	0.16
Error	0.30
	100.00

Medical and surgical supplies includes such items as syringes, specimen bottles, disposable gloves and masks, daily care kits, sterile surgical drapes, suture removal trays, sutures, catheter tubes, sponges, needles, and so forth. Pharmaceuticals include proprietary and generic pharmaceutical products dispensed in the hospital. The remaining categories include items suggested by the category titles. The error was generated in accounting for the 380 individual items that were categorized.

Labor and Capital in the Hospital Budget

The relative importance of labor, fixed capital, and circulating capital inputs for the teaching hospital that was analyzed for this study was as follows:

Input Resource	*Percent of Total Budget** 1964-65	1969-70
Labor	61.4	61.6
Circulating Capital	35.9	35.4
Fixed Capital	2.7	3.0
	100.0	100.0

*Based on current dollar outlays

Expenditures for labor were slightly more than one and three-quarters times larger than were expenditures for circulating capital, and over twelve times as great as outlays for fixed capital for the fiscal years analyzed. Payroll data for non-federal, short-term general and other

special hospitals, in the main community hospitals, is portrayed in Table 12. The teaching hospital data, converted to a nearly identical basis are also shown for comparison purposes (see Table 12).

TABLE 12

Payroll Expense as a Percentage of Total Annual Hospital Expense,* Selected Years 1950-1969

Year	Community Hospitals	Teaching Hospitals
1950	60.1	N/A
1955	66.0	N/A
1960	67.3	N/A
1965	67.3	63.1
1969	65.0	63.5

Source: Hospitals, Guide Issue: August, 1970.

*Total expense includes all expired cost from which no benefit will extend beyond the current year. Payroll expense includes all wage and salary including estimated fringe benefits; excluded are housestaff stipends and payments to student nurses and other trainees.

Since community hospitals exhibit a slightly higher proportion of annual outlays for labor than does the teaching hospital, and since circulating capital or supplies should be about equal proportionately, a slightly lower proportion of annual community hospital outlays might be expected for fixed capital. In spite of the well publicized use of exotic forms of capital goods in patient care, the treatment process continues to be labor intensive.

A Special Input: Feedback

One very important class of system inputs is feedback, process correction information resulting from a comparison of actual process output with preestablished output criteria. Output criteria according to Optner (1968, p. 23), are amalgamations of system objectives and constraints which become targets for the systems process. Feedback then is a form of process output "redelivered as input, introduced into the process from which the output was derived" (Optner, 1968, p. 27). Feedback is the system function which facilitates control over the operation of the system.

One of the elemental processes within essential medical services and supportive care was an assessment of the patient's response to the therapeutic procedures that were implemented. Feinstein defines the clinical care of the sick and injured as a repeated therapeutic experiment (Feinstein, 1964a, p. 566). Thus, the care objectives and constraints that constitute output criteria relate to outcomes associated with the prognostic group of patients. Any feedback signals that are generated result from comparison of the therapeutic response of the patient at hand to responses associated with the prognostic patients. Feinstein finds contemporary clinical indexes of therapeutic response to be "either nonexistent, inappropriate, inconsistent, or poorly delineated" (Feinstein, 1964c, p. 953) in spite of their importance in clinical practice.

Feinstein argues that clinical data "which describe specific reactions of the individual host to his disease" (1964c, p. 964) is a key form of information for use in appraisal of therapy. As he states (Feinstein, 1964d, p. 1165):

> Laboratory materials and techniques are alone inadequate for the evaluations of prognosis and therapy and for observations made at the bedside. The material studied in these clinical procedures is intact sick people who cannot be replaced by any of the materials suitable for investigation by laboratory methods. The reasoning used for the experimental judgements performed in prognosis and therapy is scientifically incomplete if it is confined mainly to laboratory data that identify comparable features of disease, but omit the equally important human distinctions of sick people.

Thus, Feinstein views an active physician and a responsive, informative patient as the heart of evaluation and control of therapeutic response. The patient's output of clinical and laboratory data become treatment process inputs that are interpreted by the physician, consequently prompting actions by him designed to modify the treatment process when deemed necessary.

Feedback inputs can affect the treatment system in at least three general ways. Feedback can promote modification of:

1. Other inputs.
2. The treatment process or its subprocesses.
3. Output criteria through changes in objectives or through removal or diminution of constraints.

Feedback is a catalytic type of input which through the control mechanism should bring system outputs within allowable limits without harmful process oscillation.

The generation and use of feedback involves the use of hospital resources wherever direct-patient care services are rendered. Homeostasis is a dynamic balance achieved by a system functioning in a changing environment. Achievement of the desired homeostatic state in a hospital patient undoubtedly requires the manipulation of human and machine services in search of the desired equilibrium. Planning for hospital patient care must account for a degree of "cut and try" in the care process.

CHAPTER VII

THE PATIENT TREATMENT SYSTEM-TREATMENT PROCESS: AN APPLICATION

One of the objectives of this research is to apply the general patient treatment process model to a particular diagnosis, inguinal hernia without complication or accompanying health problems. This chapter is a description of the application of the patient treatment process model, developed in Chapters IV and V, to patients with this specific health problem. The elements of care that are reflected in the description of each aspect of the treatment process were, at one stage in the analysis, part of a sizable collection of treatment process data that were assembled in the model building phase of the research. This chapter, then, provides an application of the model to the data from which the model was derived.

A basic assumption supporting the treatment system model is that appropriate patterns of care for particular health problems can be specified, providing a level of detail as to the care procedures administered that is sufficient for planning purposes. Specifically, this means that a course of treatment appropriate for uncomplicated inguinal hernia can be incorporated in the general model, and that similar results could be obtained by incorporating the appropriate care patterns for other relevant diagnoses in the general model.

The basis for this assumption appears to exist in research into hospital utilization by McNerney et al. (1962, pp. 456-470, 545-559) and by Riedel and Fitzpatrick (1964, Appendix C, pp. 254-264). In this research, panels of physicians considered several subject diagnoses and developed criteria for the evaluation of the effective use of the hospital in the treatment provided for each of the respective diagnoses. These criteria related to indications for admission to the hospital, hospital services required by the diagnosed condition, hospital services consistent with the particular diagnosis, expected length of hospital stay, contingencies that might extend the length of hospital stay, and indications for discharge from the hospital (Riedel and Fitzpatrick, 1964, pp. 256-257). Of these, the second through the fifth of the categories of criteria provide services or conditions which have a direct impact on hospital resource usage. A similar approach was used by Falk et al. (1967, pp. 1118-1136) and by Schonfeld et al. (1968, pp. 2097-2110) to establish medical care standards for persons with various diagnosed health problems. The criteria apply, in the main, to the provision of essential medical services. The services of other health professionals, of both essential and non-essential types, are implicit in several of the items on the list, but much of this phase of patient treatment is reflected inadequately.

The criteria in spite of their limitations, demonstrate the feasibility of specifying care patterns for particular diagnoses and provide a valuable beginning of this specification for the diagnoses

that were considered. These data must be complemented and supplemented with data from other sources to fill in the missing aspects, and to develop some notion of the incidence of application of those services that are applied to some, but not all cases.

The remainder of this chapter deals with the important elements of hospital care and treatment for uncomplicated inguinal hernia, using the detailed treatment process proposed in Chapters IV and V. The various aspects of treatment for this problem were identified by reviewing published research, medical records, and medical record summaries, by observing hospital care, and by interviewing physicians, nurses, and paramedicals involved in direct patient care in a large teaching hospital.

The patients that were studied in detail were males, 45 years of age or older, who entered the hospital on an elective basis for surgical repair of uncomplicated inguinal hernia. The treatment was in a teaching hospital accepting patients on referral from practicing physicians in various communities. The time period covered was from early in the second quarter of 1961 through the last quarter of 1970. In all cases, the patients had the hernia condition for several years prior to their hospital admission for surgical repair. No other diagnosed conditions were treated for any of the patients, and in only one case did a secondary diagnosis have an impact on the treatment process, that case involving a patient with a history of heart problems. In this case, additional investigation of heart functioning was conducted prior to surgery. Once these investigations were completed the treatment

process proceeded as might have been expected for any of the other patients.

The Treatment Process for Uncomplicated Inguinal Hernia

The hospital patient treatment process has been portrayed in preceding chapters as having two major subprocesses, provision of essential medical services and the provision of supplemental care services, and as having three somewhat distinct time periods, the pretherapy period, the therapy period, and the posttherapy period. Provision of essential medical services is accomplished by rendering professional medical services and by managing the treatment system. Supplemental care services consist of three component activities, primary supportive care, secondary supportive care, and subordinate management of elements of the care process. Primary supportive care is accomplished through the rendering of essential professional services to patients by nurses and allied health professionals. Secondary supportive care is accomplished through the rendering of optional services to patients by nurses and by other nonprofessional health workers.

It seems convenient to develop the more specific aspects of treatment of uncomplicated inguinal hernia utilizing the three time periods as zones within which to describe the relevant features of the two treatment subprocesses. In this approach, the character of the provision of essential medical services and of the provision of supplemental care services will be considered for each of the three time zones.

The Pretherapy Period

The general format of the development of each of the subprocesses for inguinal hernia treatment is to identify those services that are required by the diagnosis (that is, by the presence of the condition in the patient) and those services that although not required, are consistent with effective treatment of the diagnosed condition. On the one hand are those services which are rendered with absolute certainty to all patients, and on the other hand are those services that are rendered to some but not all inguinal hernia patients.

The provision of essential medical services

The activities associated with diagnosis and prognosis formulation by the physician for the patient with uncomplicated inguinal hernia are as follows (based on McNerney et al., 1962, p. 553, and medical records analysis):

A. Required Services

1. Medical history recorded, physical examination conducted.
2. Lab work and diagnostic studies ordered: complete blood count, urinalysis, chest x-ray, and electrocardiogram (EKG).
3. Laboratory, x-ray, and EKG findings reviewed and interpreted.
4. Diagnosis, prognosis, and plan of therapy formulated.
5. Preoperative supportive care and medication ordered.
6. Preoperative patient check completed and noted in record.

B. Consistent Services

1. Special lab work and diagnostic studies ordered: stool analysis, sigmoidoscopy.

Current treatment of uncomplicated inguinal hernia in most, if not all community hospitals would find some of the identified services performed either outside or within the hospital's walls. The particular location for the rendering of service would depend on the hospital, on the nature of the practice of the hospital's medical staff, and to some extent on the patient's needs. This research assumes that all identified services are performed within the hospital. This condition exists in a teaching hospital where the attending physician may be a member of the housestaff. The development of the process for treating uncomplicated inguinal hernia in a particular community hospital would have to reflect care patterns that are realistic for that institution. This, however, would merely reflect an adaptation of the general model.

Current practice would find the medical history recorded and physical examination accomplished by the attending physician. It is quite probable that a sigmoidoscopic examination would be conducted as an adjunct test to the physical examination, for patients old enough to require routine examination of the lower intestinal tract.

The electrocardiograph examination may be conducted by the attending physician or by a consulting physician (cardiologist) if the particular hospital does not employ EKG technicians. The exam findings are interpreted by the attending or consulting physician regardless of which person had conducted the examination.

The chest x-ray is interpreted by the attending physician or by a consulting radiologist. The film is reviewed and a record of the findings is placed in the patient's record.

The ultimate tasks of the attending physician in the pretherapy period are formulation of diagnosis and prognosis, and the development of the therapeutic strategy and plan. All of the collection, review, and interpretation of personal, clinical, and laboratory data by the physicians and the other care team members culminates in diagnosis, prognosis, and a plan of therapy.

The attending physician has the responsibility for obtaining a proper signature on the operative permit, for writing the orders for necessary lab work, for preoperative medications, and for preoperative primary supportive care. At some time prior to surgery the physician checks the patient, writing a preoperative progress note in the medical record indicating that the patient is ready for surgery.

The provision of supplemental care services—primary supportive care

The primary supportive care provided in the pretherapy period by nurses, allied health professionals, and health technicians to the patient with uncomplicated inguinal hernia can be specified as follows:

A. Required Services

1. Admission check list completed.
2. Nursing history recorded, nursing goals and orders developed.
3. Patient preoperative preparation: body shaved and scrubbed.
4. Urine sample obtained, urinalysis performed.

5. Blood sample obtained, blood work performed.

6. Chest x-ray and electrocardiograph examinations performed.

7. Preoperative medications formulated and/or dispensed.

8. Preoperative medication administered.

9. Preoperative check list completed.

B. Consistent Services

1. Preoperative patient check by operating room nurse completed.

2. Preoperative nurse/patient conference conducted.

3. Stool sample obtained, sample analyzed.

4. Patient preparation for sigmoidoscopy completed.

The patient admitted for elective surgery for repair of uncomplicated inguinal hernia is assumed to be cared for in a "progressive" manner, that is, he is placed in a unit for care that is appropriate to his current care needs. This means that the pretherapy period would be spent in a self-care or ambulant patient care area. The procedures that are described in this phase of the case analysis are appropriate to this type of care, being typical procedures for a self-care unit.

The admission checklist, reproduced in Appendix A, contains items of both primary and secondary supportive care. Though the respective elements on this checklist are carried out in close proximity in time, only the primary supportive care elements are considered at this point.

The primary supportive care items on the admission checklist are covered by items 4, 5, 6, 8, and 10 on the sample checklist. Vital signs, temperature, pulse, respiration, and blood pressure are measured and the patient's dietary and medications practices and tolerances are noted. If the attending physician performs a sigmoidoscopic examination of the patient as part of the physical examination, the patient will receive a preparatory enema to clear the lower intestinal tract. This preparatory procedure is performed generally by a nursing aide or orderly.

The second required service that is listed is a controversial one. Some participants in patient care would relegate the nursing history to the status of consistent primary supportive care service at best, while others consider the history as an optional service better classified as secondary supportive care. Still others would eliminate entirely the recording of a patient history by the nurse. The nursing histories that were reviewed as part of this research were not particularly noteworthy, but there were too few analyzed to support conclusions as to their merit in patient treatment. The service is listed here because it is considered to be a required service by professional nursing educators.

Guidelines for recording a nursing history are provided in Appendix B. Findings are recorded and supportive care goals and orders are formulated and listed in the patient's record. The basic objective of the nursing history is to provide data which will enable the nursing

service to establish a care pattern which reflects a minimum deviation from the patient's normal daily routine, as constrained by his health status at any particular stage of his hospital stay.

The preoperative preparation of the patient includes body shaving and scrubbing. For the inguinal hernia patient the body is shaved from umbilicus to midthigh.

The urine and stool samples are ordered from the patient and are analyzed in the clinical laboratories. The blood samples for the complete blood count and for type and cross match are usually obtained from the patient by a medical technologist and are also analyzed in the hospital's clinical laboratories.

The chest x-ray is taken in a central radiology division of the hospital. The exposed film is developed and then delivered to the radiologist for interpretation. The electrocardiograph examination (EKG) could be performed by an EKG technician, if such a technician is employed, or by a registered nurse. The graphic output is then delivered to the attending physician or to a consulting cardiologist for interpretation.

Preoperative medication formulation and dispensing are primary supportive care services provided by the hospital pharmacist. Medications are dispensed by a nurse in the hospital unit on physician order. The patient receives hypnotic drugs the day of surgery at an appropriate time prior to moving to the operating room.

The patient's vital signs are measured by a nurse the morning of surgery. The prescribed ambulation and food and fluid intake regimen are also supervised by the attending nurses.

The final activities performed by the admitting unit prior to delivery of the patient to the operating room relate to completion of the preoperative checklist. A sample preoperative checklist is included as Appendix C. The items on the checklist relate mainly to elements of preoperative primary supportive care that were to be accomplished prior to surgery. Completion of the checklist indicates that the minimum prerequisite services have been completed.

It has become somewhat routine practice in the hospital studied for the operating room nurse to visit the patient to detect any conditions that might inhibit or complicate the planned surgery. For example, a patient's size or weight may present special support or positioning problems in the operating room that need to be planned for by the operating room circulating nurse.

The list of consistent primary supportive care services presented also included an item: preoperative nurse/patient conference conducted. It is the practice in the hospital studied to have one of the registered professional nurses on the unit have a conference with the patient to discuss with him the imminent therapy and posttherapy care periods. This conference is designed to answer questions that the patient may have about his treatment so that some, if not all of the apprehension he is experiencing is ameliorated.

The delivery of the patient to the operating room has been chosen as the point in time for surgical patients at which the pretherapy period ends. For nonsurgical patients this transitional point may be less definitive, having to be identified as that time when diagnostic activities cease and the therapeutic regimen is begun. The signal for this transition may be found in the physician's orders in the medical record of the patient where the thrust of the orders is clearly in the direction of providing therapy for conditions diagnosed with some certainty. Treatment of conditions of questionable diagnostic certainty pose a special problem. There are some cases in which diagnosis and therapy in form of symptomatic relief run concurrently for days (see Crichton, 1970, pp. 35-72). These cases cannot be handled effectively with the proposed model. It is believed, however, that exceptional cases do not pose an insurmountable resource planning problem. For most cases, the notion of a somewhat standardized, staged production process seems valid.

The provision of supplemental services--secondary supportive care

The secondary supportive care services provided in the pretherapy period by nurses, allied health professionals, health technicians, and other health care workers to the patient with uncomplicated inguinal hernia are as follows:

A. Required Services

1. Patient physically housed.

2. Patient admission orientation completed.

3. Patient transported for tests; samples and medications.

4. Preoperative checklist completed.

5. Patient transported to operating room.

6. Patient's records and belongings transferred to postsurgery unit.

No consistent services are listed because the patient is ambulatory at this stage of treatment and is capable of caring for himself. Therefore, the less essential elements of secondary supportive care are considered to be self-provided.

The first required element of secondary supportive care relates to the physical housing of the patient by the nursing staff, getting the patient to his bed and storing any personal belongings that have been brought to the hospital. This element of care is a part of the admissions procedure not specifically noted on the admission checklist supplied as Appendix A.

The second group of activities is noted on the admission checklist, and involves orienting the patient to the hospital environment and explaining the unit rules and facilities to the patient. Item 9 of the top half of the admission checklist in Appendix A, and items 1 through 13 of the second half of the checklist constitute the patient orientation activities employed by the hospital that was studied.

The patient though ambulatory, is usually transported for both chest x-ray and electrocardiogram. This is done to reduce the potential for injury to the patient while obtaining specific elements

of his care. In either case a courier would deliver the patient to the sites of the respective tests, and would return the patients to the unit at the conclusion of the examinations. Other transportation services are provided by couriers in the form of pick up and delivery of urine, stool, and possibly blood samples.

The preoperative checklist, provided as Appendix C, includes some items of secondary supportive care. Items 4 and 5 of the top half of the sample checklist, and items 8, in part, and 9 of the bottom half of the checklist represent secondary supportive care required services.

The final activities performed by the admitting unit pertain to the patient's departure to surgery and to his anticipated transfer to another unit of the hospital which will provide postsurgical care. The patient is transported to the operating room by a courier. The patient's records and belongings are transferred to the postsurgical unit by a courier, the final activity in the pretherapy stage for the inguinal hernia patient.

The Therapy Period

The next stage in the patient treatment process relates to that period of time within which the therapeutic plan is implemented. The delineation of the therapy period is relatively easy for surgical patients. In these cases, the posttherapy period is the postsurgery period that is devoted to the patient's convalescence and return to a more or less independent state. In other nonsurgical cases therapy

and posttherapy periods may overlap to such an extent that distinguishing one from the other is difficult. In such cases, somewhat arbitrary points in the care effort may have to be identified which signal the end of the primary therapeutic efforts, and the beginning of posttherapy convalescence. The distinction is made for the purpose of separating those services supplied by physicians, nurses, allied health professionals, and health workers which are curative in nature or addressed to symptomatic relief, from those services that are expended in monitoring and measuring the patient's response to therapy, and in returning the patient to an independent state.

Provision of essential medical services

The therapeutic services rendered to the patient with uncomplicated inguinal hernia by physicians are as follows:

A. Required Services

1. Patient intubated and anesthesia induction completed.
2. Patient's inguinal hernia(s) repaired surgically; diagnosis confirmed by pathologist.
3. Anesthesia terminated and patient extubated.
4. Postsurgery recovery room care formulated and ordered.

No consistent essential medical services are recognized for the therapy period for the uncomplicated inguinal hernia patient. All therapeutic services that have been identified are considered to be required by the diagnosis.

A very important element of the surgical repair of an inguinal hernia is the anesthetization of the patient. In the cases studied,

general inhalation anesthesia was used. The anesthesia began on the average approximately twenty minutes prior to surgery. This period of time is used by the anesthesiologist to insert the endotracheal tube, and to induce the desired level of anesthetization in the patient. The presurgery anesthesia induction period could be expected to be about ten minutes in community hospitals because of the drive for output by the surgeon in private practice.

The duration of anesthesia averaged approximately two hours and twenty minutes per patient. At the conclusion of the surgery the anesthesia is terminated and the endotracheal tube is removed.

The operation for the repair of inguinal hernia, the inguinal herniorrhaphy, is performed by a general surgeon. In the cases studied for this research, another general surgeon assisted in the performance of the procedure. The average duration of surgery was about two hours. Some of the shorter operative durations were associated with the longer presurgery anesthesia periods. This may suggest that the surgical procedure is quickened when presurgery anesthesia is extended, so that the total time under anesthesia is kept within some predetermined bounds. In an exceptional case where presurgery induction lasted fifty minutes, about thirty minutes was shaved from the surgery time, yielding a total duration of anesthesia within the expected range.

In all surgical procedures requiring the removal of tissue, the excised tissue must be examined by a pathologist to confirm the presurgery diagnosis. In the case of inguinal hernia the tissue submitted to the pathologist is confirmed as a hernia sac.

Upon completion of the surgery, the attending physician formulates and orders recovery room care. In some of the cases studied, the orders specified routine recovery room practice plus prescribed medication for pain. In other cases intravenous fluids were ordered for infusion and monitoring in the recovery room. No other specific recovery room care orders were noted.

The usual operating room team for the inguinal herniorrhaphy consists of an attending general surgeon, an assisting general surgeon, an anesthesiologist, a scrub nurse who serves the physicians in the sterile zone, and a circulating nurse who "circulates" in the nonsterile zone, serving the rest of the operating room team. In addition various nursing assistants, couriers, orderlies, etc. may be involved in a particular case, performing tasks for the circulating nurse and others in the operating room.

Provision of supplemental care services—primary supportive care

Primary supportive care services rendered in the therapy period to the patient with uncomplicated inguinal hernia are as follows:

A. Required Services—Presurgery

1. Patient identified and preoperative checklist completed.
2. Patient moved to anesthesia induction area or operating room.

B. Required Services—Surgery and Anesthesia Induction

1. Patient identified.
2. Presurgery conference with patient conducted.

3. Anesthesiologist served during intubation and induction.

4. Final presurgery patient preparation completed.

5. Surgeon and anesthesiologist served during surgery.

6. Anesthesiologist served during extubation and anesthesia termination.

C. Required Services—Recovery Room

1. Routine and nonroutine recovery room care provided.

No consistent primary supportive care services are identified for the therapy period. All services that are identified are considered to be required by the diagnosed condition.

The presurgery primary supportive care services are performed by the circulating nurse. Great care is taken in the surgery units to properly identify the patient so that procedures are not performed on the wrong patient. The remaining items on the preoperative checklist, shown in Appendix C, are then accomplished by the circulating nurse as a check on the preparation of the patient by the admitting unit. The final presurgery activity is the transporting of the patient to the anesthesia induction area or to the operating room.

Once in the induction area or operating room the patient is again identified carefully. The patient's identifying records, etc., are also checked against the anesthesiologist's schedule of patients.

The circulating nurse then conducts a presurgery conference with the patient, the purposes being to calm apprehensive patients and to describe briefly the operative process that will follow.

The conference is aimed primarily at the patient who is apprehensive about the surgery or its outcome, and hence is resisting the effects of the preoperative medication. The patient should be relatively calm before intubation and induction are accomplished.

During intubation and induction the circulating nurse serves the anesthesiologist in anticipation of a potential adverse reaction by the patient to these activities. This stand-by service ends when the anesthesiologist declares the patient to be safely under anesthesia and ready for surgery.

The final presurgery preparation of the patient involving positioning of the patient on the operating table, final patient body preparation, and sterile draping are accomplished by the scrub nurse and circulating nurse. During surgery the scrub nurse and the circulating nurse serve the surgeon and anesthesiologist, the scrub nurse in the sterile zone that has been created about the patient, and the circulating nurse in the nonsterile operating room areas and beyond, and between the nonsterile and sterile zones. The circulating nurse inventories the blood and other supplies used during surgery.

After surgery the scrub nurse and circulating nurse serve the anesthesiologist during extubation, again standing by in anticipation of adverse patient reaction to the procedure. The scrub nurse remains "scrubbed" during this period in case the patient must be returned to a sterile zone in an emergency. Cardiac arrest is most likely to occur during intubation and induction and extubation.

Once the patient is safely extubated and released by the anesthesiologist he is taken to the recovery room and becomes the responsibility of the recovery room nurse, a specially trained registered nurse. The recovery room is staffed and equipped to provide the intensive care required by postsurgery patients. Certain elements of routine recovery room care were specified by nursing supervisors, but the recovery room record failed to make explicit note of certain of these elements. Patient temperature, pulse, respiration, and blood pressure are to be checked routinely every fifteen minutes at least six times prior to release from the recovery room.

Another element of routine recovery room care is deep breathing and coughing of the patient to prevent postanesthesia atelectasis. The recovery room charts reviewed failed to note the accomplishment of this reported routine activity. This would be done each time vital signs were measured.

The major items of nonroutine care provided to the patient in the recovery room relate to physician's orders for medication as needed for pain, and for intravenous fluids. The common pain medication was an injection of a morphine compound. Of the records studied, only a very few patients were shown to have received pain medication in the recovery room, though morphine was ordered for all patients as needed.

A similar situation exists with regard to the administering of fluids intravenously. Intravenous fluids started in the operating

room were to be monitored in the recovery room, and in one case intravenous fluids were to be started in the recovery room. The documentation in the patient's record did not show whether either order had been carried out. It is assumed that the orders were followed and that recording of activities was incomplete.

The average duration of recovery room stay for postherniorrhaphy patients was found to be about two hours, with recent patients remaining in the recovery room closer to one hour. It is not known whether the differences in duration of recovery room stay that were detected result from patient differences, modification of the care pattern for this diagnosis, or workload pressures in the hospital.

When the patient is awake and his vital signs are stable, he is released to a postsurgery unit in the hospital for the remainder of his postsurgery convalescence. The patient and his records are moved to the new unit by a courier, with a nurse in attendance if the patient requires nursing surveillance.

Provision of supplemental care services—secondary supportive care

No elements of secondary supportive care were discerned for the therapy period. None of the services rendered by nurses, paramedicals, and health workers could be considered as optional services. The services that were provided were either a part of the primary care plan, or were duties delegated by the physician to other care team workers.

The Posttherapy/Convalescence Period

The last stage in the hospital patient treatment process covers that period of time during which the patient convalesces following the

major therapeutic efforts. Even though the therapy and posttherapy periods overlap in practice, services rendered by the various health professionals can be placed in one or the other of the periods, admittedly with varying degrees of arbitrariness. The major thrust of the efforts in this time period are devoted to monitoring and evaluating therapeutic response and to returning the patient to a state of health and relative stability that permits discharge from the hospital phase of the total care process.

Provision of essential medical services

The services rendered by physicians in the posttherapy period to patients having had an uncomplicated inguinal hernia repaired surgically are as follows:

A. Required Services

1. Patient condition monitored and evaluated.
2. Daily care plan formulated and implemented.
3. Patient discharged from hospital phase of care with approval of attending physician.

No consistent services were detected for the cases studied. The physician input during the postsurgery convalescence period was minimal, and the services rendered were derived from evaluation of the daily status of the patient.

The portion of patient condition monitoring and evaluation performed by the physician is accomplished during his daily patient rounds, usually conducted twice a day, requiring about ten minutes in the morning and late afternoon. During rounds the physician reviews

the patient monitoring records prepared by the nursing staff, checks the wound, and removes stitches if necessary.

The physician also formulates a daily care plan depending on the condition of the patient. The care plan is recorded in the patient's record in the form of physician's orders to be carried out by the nurses and other care team members. The usual orders that were written in the cases studied dealt with medications, special laboratory tests, intravenous fluids, patient ambulation, and diet.

An average of four days after surgery the patients in the cases analyzed were discharged from the hospital with the approval of the attending physician. An appointment for a return to the outpatient clinic for follow-up and suture removal was made for each patient before his departure.

Provision of supplemental care services—primary supportive care

The primary supportive care services rendered in the posttherapy period to the patient who has had an inguinal herniorrhaphy are as follows:

A. Required Services

1. Routine nursing care provided.

2. Physician's daily care plan implemented.

B. Consistent Services

1. Special nursing care provided.

The nursing staff provides the lion's share of the services to the patient during the postsurgery phase of treatment. Certain aspects of the care have become routine procedure for postoperative

patients. The patient's vital signs, especially temperature, are monitored every four hours for the first twenty-four hours following surgery. The patient is turned, coughed, and deep breathed every two hours for the twenty-four hours following surgery as a routine procedure.

Another aspect of routine nursing care relates to patient ambulation. The patient is ambulated at least twice the morning after surgery, and then at least three times more during the next twelve hours. The patient is generally on his own after the first day.

The final activities that are a part of routine nursing care relate to patient cleanliness and toileting. While the patient is unable to move freely he will experience difficulty in attending to his own personal hygiene and toileting needs. The nursing staff assists the patient in bathing and in toileting. After the second day the patient is able to provide his own care.

Implementation of physician's orders constitutes a sizable portion of nursing services provided to the patient in addition to routine nursing care. The administering of medications and intravenous fluids were ordered services provided by nurses to all patients studied. The medications provided commonly to patients were shots and pills for pain, laxatives, and sleeping pills. The fluids were provided when oral intake of food and fluids was restricted.

The consistent services provided by the nurse to the patient derive from care orders by the physician, and from the nurse's own care plan developed for the patient. When intravenous fluids are

administered to the patient, the patient's fluid input and output is monitored. Input/output monitoring was performed an average of two full days (forty-eight hours) for the sample patients.

Services provided to the patient that are a part of the nursing care plan are tailored for each patient. Those services that qualify as primary supportive care generally have been determined to be related to other elements of essential care. For example, if it is determined in the nursing history that a patient avoids constipation only by drinking two cups of hot water each morning, it may be advisable to incorporate this practice in the patient's daily care as soon as possible to help prevent dangerous bowel impaction.

Provision of supplemental care services—secondary supportive care

The final segment of care activities provided to the inguinal hernia patient is highly individualized, being provided mainly by the nursing staff in response to perceived patient needs and wants. The secondary supportive care services rendered to the patients studied for this research can be summarized as follows:

A. Consistent Services

1. Special cleanliness services provided.
2. Special diet services provided.
3. Hospital room environment controlled.
4. Patient discharge processing completed.

White et al. identified five general criteria for measuring the intensity of care provided to a patient (White, Quade, and White, 1965). They are diet, vital signs, respiratory aids, suction,

and cleanliness. Two additional criteria suggested by Clark are toileting/output and turning/assisted activity (Clark, 1970). These seven criteria constitute a comprehensive set of categories of nursing services expended in direct patient care. However, optional services seem to be provided only in the areas of diet, cleanliness, and assisted activity.

Special cleanliness services can be provided to the patient in the course of his postoperative hospital stay. The commoner services performed are handwashing before meals and shaving of the male patients. Special diet services generally relate to responses to patient requests for coffee, soft drinks, snacks, etc.

Another set of consistent secondary supportive care services relates to control of the hospital room environment. The nursing staff is concerned with such activities as adjusting bed and side table positions, controlling room light, temperature, and ventillation, providing for patient privacy, etc.

The final services are rendered to the patient as a part of hospital discharge processing. The patient's belongings are packed and the patient is readied for departure. The final service is provided by a courier who escorts the patient to a hospital exit.

Indirect Care Services

The model that has been developed depicts the treatment process for patients in community hospitals. The elements of this model relate

almost exclusively to direct patient care. There are additional services rendered in the hospital because of direct patient care that are termed indirect patient care. Such activities as processing of patient records and completing required reports on usage of blood, narcotics, etc., are typical of indirect patient care. Direct care activities depend on hospital case-mix. Indirect care activities relate more to census than to case-mix, that is, more to total numbers of patients than to number of patients by diagnosis (see Clark, 1970, p. 15). Unfortunately, indirect care activities are poorly documented and one must refer to analyses of nursing activity patterns to get some notion of the quantitative relationships between direct and indirect care. It is also difficult to discern the qualitative relationships between these basic types of care from observations of care provision. The net result is that this research leaves many unanswered questions concerning indirect care that must await further research for answers.

Treatment Process Management

An important segment of indirect patient care services encompasses treatment process management. The portion of the model that relates to process management is based more on a priori analysis than on empirical findings. This is true because management activities are either not performed or, when performed are not documented. Some managerial activities are implicit in certain of the direct care activities performed. A few explicit managerial activities can be

recognized in patient care. Patient care management activities, either implicit or explicit in the inguinal hernia cases analyzed, are as follows:

1. Basic medical and nursing care plans formulated.
2. Care team organized.
3. Activities of subordinate care team members directed.
4. Patient care monitored, evaluated, and controlled.
5. Patient's care pattern recorded.

All but the second of these items are self-explanatory in light of the narrative supplied in the preceding pages. The second item deserves comment. The only organization of care team members that is apparent in the care observed is the traditional organization of hospital performers—physicians, nurses, allied health professionals, aides, etc.—based on traditional roles modified by a somewhat uncomfortable accommodation of new performers.

Some aspects of treatment process management, discussed in Chapter IV, are not apparent in the cases studied. Efforts aimed expressly at coordinating care team efforts or care of several patients are observed infrequently. In fact, evidence of lack of close coordination in the care effort is apparent, as in the running of essentially the same preoperative checklist by the admitting unit and the surgery unit, only minutes separated in time (see Georgopoulos and Mann, 1962, pp. 596-603).

Care plans are formulated by both physicians and nurses but are infrequently conveyed effectively to subordinate care team members.

Orders for care activities are apparent, but effective leadership of the care team is not.

Monitoring, evaluating, and control procedures are the most sophisticated of the managerial activities employed in the patient care process. This stems mainly from the fact that a human life is the object of the services rendered.

The recording of the clinical activities of all team members is inadequate. Many activities essential to the patient's progress are not documented in the patient chart. A problem-oriented record as advocated by Weed (1970), used conscientiously by all care team members, would be a significant step in remedying care record weaknesses.

Further research with the objective of investigating treatment process management is needed to provide further understanding of existing practices, and to suggest areas for improvement of management activities. The cases of treatment of inguinal hernia that were observed provided only minimal input to the segment of the model dealing with treatment process management.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

Conclusions

Since this study is exploratory in nature, seeking to perform the basic definition of a model of the patient treatment system, the conclusions that can be drawn are limited in number and extent. The researcher can merely note that the problem that was posed has been dealt with and a tentative solution has been proposed. It would be premature to comment on the utility of that solution to subsequent research efforts designed to create a greater understanding of the management and economics of patient treatment in community hospitals. Only the testing of the model in future research can provide the evidence that will confirm or refute the model's utility.

It is proper, however, to state what the model is able to do, and to mention weaknesses of the model that have become apparent at the end of the research effort. The conceptualization of patient care outputs goes beyond discussions of these outputs in the literature. The final output, the totally or partially processed patient is distinguished from intermediate outputs and inputs that have been termed final outputs by some students of hospital care. Some basic variables are also proposed which tend to place patients in equivalence classes.

The heart of the patient equivalence class question seems to reside in an understanding of the production processes that are utilized in the creation of treated patients. Thus, the development of the treatment process model represents a step in the direction of understanding patient care outputs of hospitals. One advantage of the proposed model of the treatment process is that it is believed to provide a division of care subprocesses and services that is somewhat independent of the current organization and management of patient care in community hospitals. The processes, subprocesses, and services that are identified are believed to be intrinsic to the care of a diseased or injured human, and not the result of the exertion of traditional roles of the care team members.

The division of the care process into the time zones labeled pretherapy, therapy-coincident, and posttherapy has proved to be especially useful for the surgical patient. The objectives and intensity of the services, and consequently the production processes employed, vary markedly from one time zone to the next. It is also believed that the splitting of the total treatment process into subprocesses and time zones will make it possible to identify common practices that are used in treating several diagnoses, where a total process comparison would not have permitted the identification of nearly as much commonality between diagnoses.

The basic weakness of the proposed model is that it deals much more effectively with direct patient care than with the indirect

care activities. The model was derived from actual patient treatment as observed in the hospital and as reported in patient records. The derivation suffers because indirect care activities are difficult to observe and relate to specific direct care activities, and because indirect care activities are poorly documented. One very important activity, preparation for patient contact, is missing from the model and must be brought into future models if the full resource implications of patient care are to be gauged.

The application of the model to a nonsurgical patient is apparently going to involve a greater degree of difficulty than was experienced in applying the model to a surgical patient. The three time zones of care that have been proposed—pretherapy, therapy-coincident, and posttherapy—will be harder to delineate for the nonsurgical patient. The major thrust of the efforts of a particular health professional will be difficult to discern in the transitional areas between time zones. Since the thrust of the efforts may be a major determinant of the performer of the particular service, this problem of identification can have significant resource implications.

Recommendations for Further Research

A research project that is immediately suggested is a partial test of the hypothesis underlying this research, that a manageable number of production processes can be found which can be used to treat the spectrum of health problems regularly presented to the

community hospital. This test should include at least two vital components: First, the prevalent complications associated with the treatment of inguinal hernia should be recognized, after which the general treatment model should be applied to these newly defined health problems. Also, other health problems frequently encountered and treated with inguinal hernia should be identified; these multiple-diagnosis patients could then be brought within the structure of the general treatment model or some variation of it.

Second, the general treatment model might be extended beyond the inguinal hernia problem to other problems requiring abdominal surgery as the therapy portion of their total treatment. Preliminary data suggests that many diagnoses that would require abdominal surgery can be compressed into a considerably lessened number of equivalence classes. Research that was conducted collaterally to the investigation of the care of the inguinal hernia patient related to treatment of acute appendicitis. There was a striking similarity between the treatment processes that were used for inguinal hernia and for acute appendicitis at every stage of treatment. Discovering the degree of commonality between the treatment processes for two distinct health problems offered considerable hope that the assumption of the existence of more or less standard production processes is a realistic one.

Another study could be devoted profitably to the testing the effectiveness of the proposed model for a nonsurgical patient.

If application problems exist, modifications to the model presented in this study could be proposed. The major area of difficulty does not seem to be related to the proposed treatment subprocesses, but to the delineation of time zones in the treatment process that proved so useful for the surgery patient.

Some fundamental questions pertaining to management of the treatment process were raised during this research. The most important question is: Who is the top manager of the treatment process? The seemingly apparent designate is the attending physician. This, however, does not seem to be proved by this investigation. The physician speaks of managing the patient's disease or injury, meaning the control of symptoms and of the course of the disease or injury through time. Treatment process management is accomplished only when it coincides with health problem management. Thus, of all the managerial functions, evaluation and control are seemingly best performed because these activities are so vital to health problem management. The managing of each patient's or a group of patients' total care seems to be ignored. Research addressed to this issue could lead to quite useful findings.

Once current production processes used in patient treatment have been described adequately, alternative processes can be explored. The minimal rendering of services by nearly all care team members after the first postoperative day suggests strongly that the remaining postoperative care could be provided in a less expensive

setting than the hospital unit. Separate minimal care facilities or the home have been proposed as the site of care, with services rendered by paramedicals such as physician assistants in collaboration with members of the patient's family. Such possibilities for alternative treatment processes can be investigated meaningfully using the proposed model as an analytical framework.

The use of the proposed model in pursuit of optimization in the allocation of resources to patient care requires at least two additional important steps. First, coefficients and units for the several variables in the production functions must be determined. The question of units arises because the services of different types of labor and capital are combined in the production functions. The development of coefficients requires that many more episodes of treatment be analyzed.

Second, output criteria for every class of patient care output are needed. This means possibly that a clearer statement of patient care objectives is required as is a better understanding of the constraints affecting patient care outputs.

APPENDIXES

APPENDIX A

SELF-CARE UNIT ADMISSION CHECK LIST ORIENTATION
AND ADMISSION PROCEDURE

1. Room no.____ 2. No. of STH admissions (counting this one)_____

3. How admitted? Ambulatory____ Wheelchair____ Other_____

4. T._____ P._____ R._____ B.P._____ Weight_____ Height_____

5. Allergies to foods or meds?_____

6. Is patient on any special diet or medicines at present time?____

7. Who present upon admission?_____

8. Is patient in distress? (Ex. pain, anger, nausea, weakness)

_____

9. Patient's understanding of reason for hospitalization?_____

_____

10. Was pre-op urine obtained upon admission?_____

EXPLAINED TO PATIENT:

1. Day room. Games and books_____ Coffee hour times on bulletin board_____

2. Sign-out board for patients leaving unit____Elevator location___

3. Cafeteria procedure (meal ticket)_____hours on bulletin board___

4. Check valuables: in safe at admissions desk_____.

5. Availability of juices and soft drinks at desk_____

6. Kitchen: Stove____, refrigerator_____, tea, coffee, bouillon____

7. Laundry: Washer____, dryer____, iron and board____, hair dryer__

8. Location of linen closet____, ice machine____, clean pitchers____

9. Operation of phone to call desk____, to call out____ no. to call in____

10. Operation of Bahama bed____, wall radio_____, air conditioner____

11. Storage of pillow____, blanket____, Maids make bed daily_____

12. How to obtain prescription medications (graphic sheets)_____

13. Information sheet given to patient containing above information

_____

Signed_____

APPENDIX B

NURSING HISTORY

A. Guide for the collection and organization of data:

1. Vital statistics

2. Appearance on first sight

3. Patient's understanding of illness and events leading up to the illness

4. Some indications of the patient's expectations

5. Brief social and cultural history

6. Significant data in terms of:

   a. Sleep patterns
   b. Elimination patterns
   c. Breathing
   d. Nutrition
   e. Skin integrity
   f. Activity
   g. Recreation
   h. Interpersonal and communicative patterns
   i. Temperament
   j. Dependency and independency patterns
   k. Senses

7. Some indication of that which is important to this patient. Statement of what makes him feel secure, comfortable, protected, safe, cared for.

B. Process of clinical thinking based on obtained data and appropriate parameters of knowledge.

1. Statement of the nursing care objectives in patient behavioral terms.

2. Identification of the factors which may enhance and/or inhibit the achievement of the stated objectives.

3. Statement of the nursing orders by which the objectives are to be achieved.

4. Evaluation of the objectives and nursing orders in terms of each item through the use of progress notes.

5. Modification of the objectives and nursing orders in light of the patient's progress.

6. Discharge summary or transfer note.

APPENDIX C

PREOPERATIVE CHECK LIST*

Addressograph:

Initial

_____ 1. History and physical on current chart

_____ 2. Old chart

_____ 3. Date of recent lab work
_____Urinalysis
_____Blood work
_____Type, cross match

_____ 4. Addressograph on chart

_____ 5. IBM cards on chart

_____ 6. Operative permit completed
Yes_____ No_____
If no, Doctor notified
Yes_____ No_____

Clerk's signature _____

_____ 1. Pre-op Prep (shaved and Checked)

_____ 2. Pre-op bath given

_____ 3. NPO since midnight or _____

_____ 4. Admission Height _____ Weight _____

_____ 5. TPR _____BP _____

_____ 6. Time voided _____

_____ 7. Catheter: Yes _____ No _____

_____ 8. Removal of:

_____ Prosthesis (eye, dentures, etc.)

_____ Jewelry

_____ Nail polish, makeup, pins, etc.

_____ 9. Armband with hospital number

_____10. Operative permit completed

_____11. Time pre-op medication given

_____12. Nurse's progress note that patient is ready for surgery

Nurse's signature_____

*Nurse is responsible for checking list

BIBLIOGRAPHY

Abdellah, Faye G., A. Martin, I. Beland, and R. Matheny. *Patient Centered Approaches to Nursing.* New York: Macmillan, 1961.

Altman, Isadore. "Some Factors Affecting Hospital Length of Stay," *Hospitals,* 39 (July 16, 1965), 68-73, 176.

Anderson, Alice L., and Isadore Altman. *Methodology in Evaluating the Quality of Medical Care: An Annotated Selected Bibliography, 1955-61.* Pittsburgh: University of Pittsburgh Press, 1962.

Anderson, Katherine H., and Lee Towers. "The Pediatric Assistant," *North Carolina Medical Journal,* 31 (January, 1970), 1-8.

Anderson, Odin W. *Hospital Use: A Survey of Patient and Physician Decisions.* Chicago: Center for Health Administration Studies, 1967.

Arrow, Kenneth J. "Uncertainty and the Welfare Economics of Medical Care," *American Economic Review,* LIII (December, 1953), 941-973.

Atkinson, W. C. "The Role of the General Practitioner on the Hospital Staff," *Journal of the National Medical Association,* 53 (September, 1961), 508-510.

Auer, Otis N. "Consultants' Symposium Considers Sequence of Patient Care," *Hospital Progress,* 37 (February, 1957), 71-72.

Babcock, K. B. "Hospitals and Quality Patient Care," *University of Michigan Medical Center Journal,* 33 (May-June, 1967), 96-98.

_____. "The Function of Hospitals: A Symposium, Patient Care: Yesterday - Today - Tomorrow," *Hospital Progress,* 46 (June, 1965), 96-100.

Bailey, Richard M. "An Economist's View of the Health Services Industry," *Inquiry,* VI (March, 1969), 3-18.

_____. "Philosophy, Faith, Fact, and Fiction in the Production of Medical Services," *Inquiry,* VII (March, 1970), 37-61.

Baligh, Helmy. "Hospital Administration and Economic Exchange," *Hospital Administration,* 14 (Winter, 1969), 51-66.

_____, and D. J. Laughhunn. "An Economic and Linear Model of the Hospital," *Health Services Research,* 4 (Winter, 1969), 293-303.

Balint, M. "The Doctor's Therapeutic Function," *Lancet,* 2 (July, 1965), 1177-1180.

Balintfy, Joseph Leslie. "Mathematical Models and Analysis of Certain Stochastic Processes in General Hospitals," D. Eng. Dissertation, Johns Hopkins University, 1962.

Baranik, T. R. "Health Education in the Community Hospital," *Hospital Progress,* 44 (July, 1963), 100-102.

Bateman, Worth. "Assessing Program Effectiveness," *Welfare in Review,* VI (Jan.-Feb., 1968), 1-10.

Bauerschmidt, Alan D. "The Hospital as a Prototype Organization," *Hospital Administration,* 15 (Spring, 1970), 6-14.

Bayne-Jones, Stanhope. "The Hospital As a Center of Preventive Medicine," *Annals of Internal Medicine,* 31 (July, 1949), 7-16.

Becker, Gary S. "A Theory of the Allocation of Time," *Economic Journal,* LXXV (September, 1965), 493-517.

Becker, H. "New Consensus: Health Care for Everybody," *Modern Hospital,* 108 (May, 1967), 110-114.

Bergman, Abraham B., ed. *Assessing the Effectiveness of Child Health Services.* Columbus, Ohio: Ross Laboratories, 1967.

Berry, L. M. "Rethinking Our Goals for Integrated Health Services," *Journal of the National Medical Association,* 58 (July, 1966), 291+.

Berry, Ralph E., Jr. "Product Heterogeneity and Hospital Cost Analysis," *Inquiry,* VII (March, 1970), 67-76.

_____. "Returns to Scale in the Production of Hospital Services," *Health Services Research,* 2 (Summer, 1967), 123-139.

Bienstock, Herbert. "Chancing Patterns of Costs and Structure in the Health Sector," *Annals of the New York Academy of Science*, 166 (Dec. 31, 1969), 934-947.

Bing, Robert K. "Requisites for Relevance: Changing Concepts in Occupational Therapy Education," *Annals of the New York Academy of Science*, 166 (Dec. 31, 1969), 1020-1026.

Blake, Robert R., and Jane S. Mouton. *The Managerial Grid.* Houston, Texas: Gulf Publishing Co., 1964.

Block, L. "Prototype Studies - 400, 600 Bed Hospitals," *Modern Hospital*, 93 (October, 1959), 116-122.

_____. "Prototype Studies," *Modern Hospital*, 94 (February, 1960), 95-98.

Block, M. "The Changing Role of the Nurse," *Nursing Times*, 64 (January, 1968), 12, 19.

Blumberg, Mark S. "Evaluating Health Screening Procedures," *Operations Research*, V (June, 1957), 351-360.

_____. "Men, Machines, and Hospitals," *Hospital Progress*, 39 (November, 1959), 71-76.

Blumenthal, I. S. *Social Cost of Peptic Ulcer.* Santa Monica, California: The RAND Corporation, P-3588, April, 1967.

Bordley, J. "The Role of the Community Hospital in the Nation's Health," *Medical Times*, 93 (May, 1965), 477-482.

Braybrooke, David, and Charles Lindblom. *A Strategy of Decision: Policy Evaluation as a Social Process.* New York: Macmillan, 1963.

Brown, Max, Jr. "An Economic Analysis of Hospital Operations," *Hospital Administration*, 15 (Spring, 1970), 60-74.

Brown, Ray E. "A Current Evaluation of Hospital Planning," in U. S. Public Health Service. *Principles for Planning the Future Hospital System*, Washington, D. C.: U. S. Government Printing Office, 1959.

_____. "The General Hospital Has a General Responsibility," *Hospitals*, 39 (July 16, 1965), 47-54.

Brown, Ray E. "The Hospital Redefined," *Hospital Progress*, 47 (November, 1966) 71-73.

Bugbee, G. "The Physician in the Hospital Organization," *New England Journal of Medicine*, 29 (October, 1959), 896-901.

California Medical Association, Committee on Fees of the Commission on Medical Services. *Relative Value Schedule*. San Francisco: California Medical Association, Feb. 12, 1956.

Carroll, Augustus J. *Program Cost Estimating In a Teaching Hospital: A Pilot Study*. Chicago: Association of American Medical Colleges, 1969.

Chase, Samuel B., ed. *Problems in Public Expenditure Analysis*. Washington: Brookings Institution, 1968.

Churchman, C. West. *The Systems Approach*. New York: Delacorte Press, 1968.

Clark, Louise. "Can the Nursing Workload Be Measured?" *Supervisor Nurse*, 1 (December, 1970), 14-24.

Clausen, Esther. "Categorization of Patients According to Nursing Care Needs," *Military Medicine*, 116 (March, 1955), 209-214.

Cleland, David I., and William R. King, eds. *Systems, Organizations, Analysis, Management*. New York: McGraw-Hill, 1969.

Commission on Professional and Hospital Activities. *Length of Stay in Short Term General Hospitals*. New York: Blakiston Division, McGraw-Hill, 1966.

Committee on Medical Care Teaching, Association of Teachers of Preventive Medicine, eds. *Readings in Medical Care*. Chapel Hill: University of North Carolina Press, 1958.

Conley, Ronald, Margaret Cromwell, and Mildred Arrill. "An Approach to Measuring the Cost of Mental Illness," *American Journal of Psychiatry* (December, 1967), 63-70.

Connor, R. J., C. D. Flagle, R. K. C. Hsieh, R. A. Preston, and S. Singer. "Effective Use of Nursing Resources: A Research Report," *Hospitals*, 35 (May 1, 1961), 30-39.

"Costly Machines to Save Lives," *Fortune*, LXXXI (January, 1970), 92-95.

Coughlin, R. E. "Hospital Complex Analysis: An Approach to Analysis for Planning a Metropolitan System of Service Facilities," Ph.D. Dissertation, University of Pennsylvania, 1964.

Crichton, Michael. *Five Patients: The Hospital Explained.* New York: Alfred A. Knopf, 1970.

Crystal, Royal A., and Agnes W. Brewster. "Cost-Benefit Analysis in the Health Field: An Introduction," *Inquiry,* III (Dec., 1966), 3-13.

Deeble, John S. "An Economic Analysis of Hospital Costs," *Medical Care,* 3 (June-September, 1965), 138+.

Dellinger, David. "Designing a Program Structure for a Hospital," paper presented at 10th Annual Hospital Executive Development Institute, Duke University, March 24-25, 1969.

Donabedian, Avedis. "Patient Care Evaluation," *Hospitals,* 44 (April 1, 1970), 131-136.

_____. "Promoting Quality Through Evaluating the Process of Patient Care," *Medical Care,* 6 (May-June, 1968), 181-202.

Dorfman, Robert, ed. *Measuring Benefits of Government Investment.* Washington, D. C.: The Brookings Institution, 1965.

Dror, Yehezkel. "PPB and the Public Policy-Making System: Some Reflections on the Papers by Bertram Gross and Allen Schick," *Public Administration Review,* XXIX (March-April, 1969), 152-154.

_____. *Public Policy-Making Reexamined.* San Francisco: Chandler, 1968.

_____. "The Planning Process: A Facet Design," *International Review of Administrative Science,* 29 (1963), 44-58.

Drucker, Peter F. "Long Range-Planning: Challenge to Management Science," in Hill, Walter and Douglas Egan, eds. *Readings in Organization Theory: A Behavioral Approach.* Boston: Allyn and Bacon, Inc., 1966.

Duff, Raymond S., and August B. Hollingshead. *Sickness and Society.* New York: Harper and Row Publishers, 1968.

Dunlop, J. T. "Some Facets of the Economics of Health Care Delivery," *Journal of Medical Education*, 45 (March, 1970), 33-38.

Dunn, Helen W., and Elizabeth Morgan. *The Nursing Audit*. New York: National League of Nursing, 1968.

Durbin, Richard L., and W. Herbert Springall. *Organization and Administration of Health Care: Theory, Practice, Environment*. St. Louis: C. V. Mosby, Co., 1969.

_____. "Systems Organization for a Hospital," *Hospital Management*, 104 (September-October, 1967), 36-37, 57-60.

Eckstein, Otto. *Public Finance*. 2nd edition. Englewood Cliffs, N. J.: Prentice-Hall, 1967.

Eisele, C. Wesley, ed. *The Medical Staff in the Modern Hospital*. New York: McGraw-Hill Book Co., 1967.

Ellis, David, and Fred Ludwig. *Systems Philosophy*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1962.

Engle, Ralph L., Jr., and B. J. Davis. "Medical Diagnosis: Present, Past, and Future, Part I," *Archives of Internal Medicine*, 112 (October, 1963a), 512-519.

_____. "Medical Diagnosis: Present, Past, and Future, Part II," *Archives of Internal Medicine*, 112 (October, 1963), 520-529.

_____. "Medical Diagnosis: Present, Past, and Future, Part III," *Archives of Internal Medicine*, 112 (October, 1963), 530-543.

Enke, Stephen. "Using Costs to Select Weapons," *American Economic Review*, LV (May, 1965), 416-426.

Enthoven, Alain. "The Planning, Programming, and Budgeting System in the Department of Defense: Some Lessons from Experience." U. S. Congress, Joint Economic Committee. *The Analysis and Evaluation of Public Expenditures: The PPB System*. III, 91st Cong., 1st sess., 1969, 901-908.

Estes, E. Harvey, Jr., and D. Robert Howard. "The Physician's Assistant in the University Center," *Annals of the New York Academy of Science*, 166 (Dec. 31, 1969), 903-910.

Evans, R. L. "Quality of Care Audits: Foundation for a Health Care Continuum," *Hospitals*, 40 (July 1, 1966), 75-78.

Falk, I. S., H. K. Schonfeld, B. R. Harris, S. J. Landau, and S. S. Milles. "The Development of Standards for the Audit and Planning of Medical Care 1. Concepts, Research Design, and the Content of Primary Physician's Care," *American Journal of Public Health*, 57 (July, 1967), 1118-1136.

Fayol, Henri. *General and Industrial Management*. London: Pitman and Sons, 1949.

Fein, Rashi. "Definition and Scope of the Problem: Economic Aspects," in A. Bergman, ed., *Assessing the Effectiveness of Child Health Services*. Columbus, Ohio: Ross Laboratories, 1967.

_____. *Economics of Mental Illness*. New York: Basic Books, Inc., 1958.

Feinstein, A. R. "Scientific Method in Clinical Medicine: 1. Introduction, Principles and Concepts," *Annals of Internal Medicine*, 61 (September, 1964a), 564-579.

_____. "Scientific Method in Clinical Medicine: 2. Classification of Human Disease by Clinical Behavior," *Annals of Internal Medicine*, 61 (October, 1964b), 757-781.

_____. "Scientific Method in Clinical Medicine: 3. The Evaluation of Therapeutic Response," *Annals of Internal Medicine*, 61 (November, 1964c), 944-965.

_____. "Scientific Method in Clinical Medicine: 4. Acquisition of Clinical Data," *Annals of Internal Medicine*, 61 (December, 1964d), 1162-1193.

Feldstein, Martin S. *Economic Analysis for Health Service Efficiency*. Amsterdam: North-Holland Publishing Co., 1967.

_____. "Economic Analysis, Operational Research and the National Health Service," *Oxford Economic Papers*, XV (March, 1963), 19-31.

_____. "Hospital Cost Variation and Case-Mix Differences," *Medical Care*, 3 (April-July, 1965), 95+.

Feldstein, Paul J. "Applying Economic Concepts to Hospital Care," *Hospital Administration*, 13 (Winter, 1968), 68-89.

_____, and John Carr. "The Relationship of Cost to Hospital Size," *Inquiry*, IV (June 16, 1967), 45+.

Fetter, Robert B. "Discussion of a Patient Classification System and a Basic Utilization Review Program," in *The Recognition of Systems in Health Services*. Arlington, Va.: Operations Research Society of America, 1969.

Feyerheim, A. M. "Nursing Activity Patterns: A Guide to Staffing," *Nursing Research*, 15 (Spring, 1966), 124-133.

Fiedler, Fred. *A Theory of Leadership Effectiveness*. New York: McGraw-Hill, 1967.

Field, H. H. "Application of Comprehensive Planning to the Urban Medical Center," *Hospitals*, 39 (November 16, 1965), 67-72.

Fisher, G. H. *Cost Functions and Budgets*. Santa Monica, Calif.: The RAND Corporation, P-3789, February, 1968.

_____. *Some Comments on Systems Analysis*. Santa Monica, Calif.: The RAND Corporation, P-3677, September, 1967.

_____. *The Analytical Bases of Systems Analysis*. Santa Monica, Calif.: The RAND Corporation, P-3363, May, 1966a.

_____. "The Role of Cost/Utility Analysis in Program Budgeting," in David Novick , ed. *Program Budgeting: Program Analysis and the Federal Government*. Cambridge, Mass.: Harvard University Press, 1965.

_____. *The World of Program Budgeting*. Santa Monica, Calif.: The RAND Corporation, P-3361, May, 1966b.

Ford, Loretta C. "The Five Elements of Progressive Patient Care," *Nursing Outlook*, 8 (August, 1960), 436-439.

Frankel, Marvin. "Federal Health Expenditures in a Program Budget," in D. Novick, ed., *Program Budgeting: Program Analysis and the Federal Government*. Cambridge, Mass.: Harvard University Press, 1965.

Freeman, John R., and Harold E. Smalley. *Hospital Industrial Engineering*. New York: Reinhold Publishing Co., 1966.

Garfield, Sidney H. "The Delivery of Medical Care," *Scientific American*, 222 (April, 1970), 3-11.

Garner, H. H. "Treatment-Review of a Medical Concept," *Journal of the American Geriatric Society*, 9 (October, 1961), 883-910.

George, Frances, and Ruth Kuehn. *Patterns of Patient Care.* New York: Macmillan, 1955.

Georgopoulos, Basil, and Floyd Mann. *The Community General Hospital.* New York: Macmillan, 1962.

Georgopoulos, Basil. "The Hospital System and Nursing: Some Basic Problems and Issues," *Nursing Forum,* 5 (1966), 8-35.

Gherig, Leo J. "Comprehensive Health Planning," *The Journal of Medical Education,* 43 (April, 1968), 464-470.

Ginzberg, Eli. "The Political Economics of Health," *Bulletin of the New York Academy of Medicine,* 41 (October, 1965), 1015-1036.

_____. "What Every Economist Should Know About Health and Medicine," *American Economic Review,* XLIV (March, 1954), 104-119.

Citman, Leo. "Automated Multiphasic Health Screening," *New York Journal of Medicine,* 70 (June, 1970), 1741-1744.

Gordon, Phoebe. "Who Does What—The Report of a Nursing Activities Study," *The American Journal of Nursing,* 53 (May, 1953), 564-566.

Greenhouse, Samuel. "The Planning-Programming-Budgeting System: Rationale, Language, and Idea-Relationships," *Public Administration Review,* XXVI (December, 1966), 271-277.

Greenlick, M. R. "Imperatives of Health Services Research," *Health Services Research,* 4 (Winter, 1969), 259-263.

Griffith, John, Lewis Weeks, and James Sullivan. *The McPherson Experiment: Expanded Community Hospital Service.* Ann Arbor, Mich.: Bureau of Hospital Administration, University of Michigan, 1967.

Gross, Bertram M. "The New Systems Budgeting," *Public Administration Review,* XXIX (March-April, 1969a), 113-137.

_____. "Problems of Resource Allocation in Health," *The Analysis and Evaluation of Public Expenditures: The PPB System,* 3, U. S. Congress, Joint Economic Committee. 91st Cong., 1st sess. 1969b, 1197-1223.

Gross, Mary E. W. "Administration and the Physicians," *American Journal of Public Health,* 52 (February, 1962), 183-191.

Grosse, Robert N. *Principles of Cost-Effectiveness Analysis.* Washington, D. C.: U. S. Industrial College of the Armed Forces, 1966.

Gulick, Luther, and Lyndall Urwick, eds. *Papers On the Science of Administration.* New York: Institute of Public Administration, 1937.

Gustafson, David H. "Comparison of Methodologies for Predicting and Explaining Hospital Length of Stay." Ph.D Dissertation, University of Michigan, 1966.

_____. "Length of Stay: Prediction and Explanation," *Health Services Research,* 3 (Spring, 1968), 12-34.

Haggerty, Robert J. "Evaluation of Health Services: Two Case Studies," in A. Bergman, ed., *Assessing the Effectiveness of Child Health Services.* Columbus, Ohio: Ross Laboratories, 1967.

Haldeman, Jack C. "New Horizons for Hospital Research," *Hospitals,* 35 (December 16, 1961), 36-41.

_____. "Seven Ways to Meet Seven Hospital Goals," *Modern Hospital,* 98 (March, 1962), 191-194.

_____. "Ten Fundamentals of Progressive Patient Care," *Group Practice,* 22 (October, 1960), 762-769.

Hallan, Jerome B., and Benjamin S. H. Harris. "The Economic Cost of End-Stage Uremia," *Inquiry,* V (December, 1968), 20-25.

Harrell, George T. "Education on a Health Sciences Campus," *Annals of the New York Academy of Science,* 166 (December 31, 1969), 855-861.

Harris, Seymour. *The Economics of American Medicine.* New York: Macmillan, 1964.

Hartin, Clinton E. "The Fifty Most Frequent Operations In PAS Hospitals 1967," *PAS Reporter,* (August 11, 1969).

Hawley, Robert. "The Patient Care Committee," in C. W. Eisele, ed., *The Medical Staff in the Modern Hospital.* New York: McGraw-Hill, 1967.

Hay, Leon E. *Budgeting and Cost Analysis for Hospital Management.* Bloomington, Ind.: University of Indiana Publications, 1958.

Hayes, John H., ed. *Factors Affecting the Costs of Hospital Care.* New York: The Blakiston Co., 1954.

Hayman, J. M., Jr. "Medical Research, Patient Care and Medical Education," *Bulletin of Tufts New England Medical Center,* 5 (July-September, 1959), 67-68.

Hayzelden, J. E. "The Value of Human Life," *Public Administration* (London), XXXXVI (1964), 427-441.

Heasman, G. A. "The Patient, the Doctor, and the Hospital," *Lancet,* 2 (July, 1962), 59-62.

Hedinger, Frederic R. "The Systems Approach to Health Services: A Framework." Ph.D. Dissertation, University of Iowa, 1968.

Hershey, Nathan. "Nurses Medical Practice Problems," *The American Journal of Nursing,* 62 (July, 1962), 82-83.

Heuston, M. C., and G. Ogawa. "Observations on the Theoretical Basis of Cost Effectiveness," *Operations Research,* XIV (March-April, 1966), 242-266.

Hinsey, J. C. "Contrasting Roles and Needs of University and Community Hospitals," *Journal of Medical Education,* 36 (December, 1961), 216-223.

Hirsch, Werner. "Toward Federal Program Budgeting," *Public Administration Review,* XXVI (December, 1966), 259-269.

Hitch, Charles J. "An Appreciation of Systems Analysis," *Journal of the Operations Research Society of America,* III (November, 1955).

_____. "Decision-Making in Large Organizations." (Royal Society Nuffield Lecture, October 25, 1966). U. S. Congress, Senate, Committee on Government Operations. *Planning-Programming-Budgeting: Selected Comment.* 90th Cong., 1st. sess., 1967, 10-17.

_____. and Roland McKean. *The Economics of Defense in the Nuclear Age.* Cambridge: Harvard University Press, 1960.

Howland, Daniel. "Approaches To the Systems Problem," *Nursing Research,* 12 (Summer, 1963), 172-174.

Howland, Daniel., and Wanda E. McDowell. "The Measurement of Patient Care: A Conceptual Framework," *Nursing Research*, 13 (Winter, 1964), 4-7.

Irvine, M. "Principles of Management Applied to Nursing Services, Part I," *Nursing Times*, 65 (June 19, 1969a), Supplement 97-100.

_____. "Principles of Management Applied to Nursing Services, Part II," *Nursing Times*, 65 (June 26, 1969b), Supplement 101-104.

"It's Time to Operate," *Fortune*, (January, 1970), 79.

Jacquez, John A., ed. *The Diagnostic Process*. Ann Arbor, Mich.: Maloy, Inc., 1964.

James, George. "Educational Role of New Health Science Centers in the Health Related Professions," *Annals of the New York Academy of Science*, 166 (Dec. 31, 1969), 862-868.

Jeffers, James R., and Mario F. Bognanno. "Medical Economics: An Introduction," *Inquiry*, VII (March, 1970), 4-14.

Jelinek, R. C. "A New Approach to the Analysis of Nursing Activities," *Hospitals*, 40 (October, 1966), 89-91.

_____. "A Structured Model for the Patient Care Operation," *Health Services Research*, 2 (Fall, 1967), 226-242.

Jewell, W. S., and B. L. Fox. *Decision Systems for Scheduling Elective Patients into Hospitals*. Berkeley: University of California, 1964.

Joint Commission on the Accreditation of Hospitals. *Revised Hospital Accreditation Standards*. Chicago: Joint Commission on the Accreditation of Hospitals, October, 1969.

Kahn, Herman, and Irwin Mann. *Techniques of Systems Analysis*. Santa Monica, Calif.: The RAND Corporation, RM-1829-1, 1957.

Keith, Emylon. "Modern Nursing in Hospitals," *The Journal of the American Osteopathic Association*, 58 (February, 1959), 361-366.

Kelman, H. R., E. Camerman, C. Herr, W. Perry, and K. Sword. "Monitoring Patient Care," *Medical Care*, 7 (January-February, 1969), 1-13.

Kincaid, Wm. H., and Charles L. Holtz, Jr. "Pre-Operative Stay for 12 Operations," *PAS Reporter*, July 14, 1969.

Kissick, William. "PPB in Health," *Medical Care*, 5 (July-August, 1967), 201-220.

Klarman, Herbert E., ed. *Empirical Studies in Health Economics*. Baltimore: Johns Hopkins Press, 1970.

Klarman, Herbert E. "Increase in the Cost of Physician and Hospital Services," *Inquiry*, VII (March, 1970), 22-36.

_____. "Present Status of Cost-Benefit Analysis in the Health Field," *American Journal of Public Health*, LVII (November, 1967), 1948-1953.

_____. "The Distinctive Economic Characteristics of Health Services," *Journal of Health and Human Behavior*, 4 (Spring, 1963), 44-49.

_____. *The Economics of Health*. New York: Columbia University Press, 1965.

_____. "The Economics of Hospital Service," *Harvard Business Review*, XXIX (September, 1951), 71-89.

_____, John O'S. Francis, and Gerald D. Rosenthal. "Cost-Effectiveness Analysis Applied to the Treatment of Chronic Renal Disease," *Medical Care*, 6 (January-February, 1968), 48-54.

Knowles, John H., ed. *Hospitals, Doctors, and the Public Interest*. Cambridge, Mass.: Harvard University Press, 1965.

Knowles, John H. "The University Hospital as a Community Health Resource," *Hospitals*, 40 (February 16, 1966), 62-66.

Lahti, P. T. "Early Post-Operative Discharge of Patients from the Hospital," *Surgery*, 63 (November 3, 1968), 410-415.

Lambertsen, E. C. "Defining the Right Roles Helps Assure the Right Team," *Modern Hospital*, 109 (December, 1967), 128.

Lave, Judith. "A Review of Methods Used to Study Hospital Costs," *Inquiry*, III (May, 1966), 57-81.

Lave, Lester, and Judith Lave. "Estimated Cost Functions for Pennsylvania Hospitals," *Inquiry*, II (June, 1970), 3-14.

Leaf, A. "Government, Medical Research, and Education," *Science*, 159 (February, 1968), 604-607.

Ledley, Robert S., and Lee B. Lusted. "Computer Aids to Medical Diagnosis," *Journal of the American Medical Association*, 196 (June 13, 1966), 933-943.

_____. "Reasoning Foundations of Medical Diagnosis," *Science*, 130 (July, 1959), 9-21.

Lerner, Monroe. *Hospital Use by Diagnosis: A Comparison of Two Experiences*. New York: Health Information Foundation, 1961.

Levin, Arthur L. "Cost-Effectiveness in Maternal and Child Health, *New England Journal of Medicine*, CCLXXVII (May 9, 1968), 1041-1046.

Lewis, C., B. Resnick, and G. Schmidt. "Activities, Events, and Outcomes in Ambulatory Patient Care," *The New England Journal of Medicine*, 280 (March 20, 1969), 645-649.

Lindblom, Charles E. "Decision-Making in Taxation and Expenditures," *Public Finances: Needs, Sources, and Utilization*, National Bureau of Economic Research. Princeton, N. J.: Princeton University Press, 1961.

_____. "The Science of 'Muddling Through'," *Public Administration Review*, XIX (Spring, 1959), 79-88.

Linnenberg, C. C., Jr. "Economics in Program Planning for Health," *Public Health Reports*, 81 (December, 1966), 1085-1091.

Lipkin, M., T. P. Almy, and F. T. Kirkham, Jr. "The Formulation of Diagnosis and Treatment," *New England Journal of Medicine*, 275 (November 10, 1966), 1049-1052.

Littauer, David. "Essentials and Objectives of After-Care Programs," *Journal of the American Physical Therapy Association*, 42 (February, 1962), 95-100.

Little, D., and D. Carnevali. "Nursing Care Plans: Let's Be Practical About Them," *Nursing Forum*, 6 (1967), 61-76.

Lockward, H. J., L. Giddings, and E. J. Thoms. "Progressive Patient Care: A Preliminary Report," in L. E. Weeks, and J. R. Griffith, eds., *Progressive Patient Care: An Anthology*. Ann Arbor, Mich.: Bureau of Hospital Administration, University of Michigan, 1964.

Long, Millard F. "Efficient Use of Hospitals," in *The Economics of Health and Medical Care*. Ann Arbor, Mich.: University of Michigan, 1964.

Lusted, L. B., and R. S. Ledley. "Mathematical Models in Medical Diagnosis," *Journal of Medical Education*, 35 (1960), 214.

Lyden, Fremont J., and Ernest G. Miller., eds. *Planning-Programming-Budgeting*. Chicago: Markham, 1967.

Lyndon, Benjamin H. "Social Work Education for Health Team Services," *Annals of the New York Academy of Science*, 166 (December 31, 1969), 1031-1037.

Maass, Arthur. "Benefit-Cost Analysis: Its Relevance to Public Expenditure Decisions," *Quarterly Journal of Economics*, LXXX (May, 1966), 208-226.

MacEachern, Malcolm. *Hospital Organization and Management*. Chicago: Physicians Record Co., 1957.

Magraw, R. M. "Interdisciplinary Teamwork for Medical Care and Health Service: Components and Organization," *Annals of Internal Medicine*, 69 (October, 1968), 821-835.

Mann, J., and D. Yett. "The Analysis of Hospital Costs; A Review Article," *Journal of Business*, 41 (1968), 191-202.

Marshall, A. W. *Cost/Benefit Analysis in Health*. Santa Monica, Calif.: The RAND Corporation, P-3274, December, 1965.

Mase, Darrel J. "Basic Principles in Manpower Utilization," *Pediatric Clinics of North America*, 16 (November, 1969), 915-920.

Mason, Mildred. *Basic Medical-Surgical Nursing*. New York: Macmillan, 1967.

Matheny, R., B. T. Nolan, A. M. Ehrhart, and G. Griffin. *Fundamentals of Patient-Centered Nursing*. St. Louis: C. V. Mosby Co., 1968.

McCorkle, L. D. "Utilization of Facilities of a University Hospital: Length of Inpatient Stay in Various Hospital Departments," *Health Services Research,* 1 (Summer, 1966), 91-114.

McCullough, J. D. *Cost Analysis for Planning-Programming-Budgeting Cost-Benefits Studies.* Santa Monica, Calif.: The RAND Corporation, P-3479, November, 1966.

_____. *Cost-Effectiveness: Estimating Systems Costs.* Santa Monica, Calif.: The RAND Corporation, P-3229, September, 1965.

McElroy, J. C. "Scientific Management Can be Achieved thru Standardization," *Hospital Management,* 100 (October, 1965), 175-177.

McGibony, John R. *Principles of Hospital Administration.* 2nd edition. New York: G. P. Putnam and Sons, 1969.

_____. "Research... The Past as Prologue," *Hospital Progress,* 46 (July, 1965), 105-107.

McKean, R. N. *Efficiency in Government Through Systems Analysis.* New York: John Wiley and Sons, Inc., 1958.

_____. *Public Spending.* New York: McGraw-Hill, 1968.

McKeown, Thomas. "A Balanced Hospital Community," *Hospitals,* 33 (August 16, 1959), 40-44, 107.

_____. "Medical Education and Medical Care: An Examination of Traditional Concepts and Suggestions for Change," in J. Knowles, ed., *Hospitals, Doctors, and the Public Interest.* Cambridge, Mass.: Harvard University Press, 1965.

_____. *Medicine in Modern Society: Medical Planning Based on Evaluation of Medical Achievement.* New York: Hafner Publishing Co., 1966.

McKinney, Sara. "Hospital Statistics - Are we Asking the Right Questions?" *Inquiry,* III (December, 1966), 28-34.

McNerney, Walter J., and Study Staff. *Hospital and Medical Economics, Vol's. I and II.* Chicago: Hospital Research and Educational Trust, 1962.

Mecklin, John M. "Hospitals Need Management Even More than Money," *Fortune,* LXXXI (January, 1970), 96-99, 150-151.

Meyer, J., and M. Buswell. "Total Medical Treatment: Report of a 5 Year Study," *American Journal of Psychiatry*, 121 (August, 1964), 129-135.

Meyers, Harold B. "The Medical-Industrial Complex," *Fortune*, LXXXI (January, 1970), 90-91, 126.

Millis, J. S. "Manpower for Tommorrow's Health Services," *Journal of Medical Education*, 42 (January, 1967), 73-77.

Mohr, Orpha. "Product and Nursing Time Studies," *Hospital Management*, 84 (July, 1957), 112-114.

Mosher, Frederick. "Limitations and Problems of PPBS in the States," *Public Administration Review*, XXIX (March-April, 1969), 160-167.

_____. *Program Budgeting*. Chicago: Public Administration Service, 1954.

Moss, Arthur B. *Hospital Policy Decisions: Process and Action*. New York: G. P. Putnam and Sons, 1966.

Mushkin, Selma J. "Health as an Investment," *Journal of Political Economy*, LXX, Part 2 (October, 1962), 129-157.

_____. "PPB in Cities," *Public Administration Review*, XXIX (March/April, 1969), 167-177.

_____, and Francis d'A. Collings. "Economic Costs of Disease and Injury," *Public Health Reports*, LXXIV (September, 1959), 795-809.

Myers, Hu C. "The Physician's Assistant in the Community Hospital and in Office Practice," *Annals of the New York Academy of Science*, 166 (December 31, 1969), 911-915.

Nadler, G. "Hospital Management Systems are Different, Part I," *Hospital Management*, 100 (July, 1965a), 43-45.

_____. "Hospital Management Systems are Different, Part II," *Hospital Management*, 100 (August, 1965b), 48-51.

_____. "Hospital Management Systems are Different, Part III," *Hospital Management*, 100 (September, 1965c), 49-52.

National Advisory Commission on Health Facilities. *Report to the President*. Washington, D. C.: U. S. Government Printing Office, December, 1968.

Navarro, Vicente. "A Systems Approach to Health Planning," *Health Services Research*, 4 (Summer, 1969a), 96-111.

_____. "Planning Personal Health Services," *Medical Care*, 7 (May-June, 1969b), 242-249.

Nelson, R. A. "The Hospital and the Continuing Education of the Physician," in Knowles, ed. *Hospitals, Doctors and the Public Interest*. Cambridge, Mass.: Harvard University Press, 1965.

_____. "The Physician and the Hospital," *Hospitals*, 35 (October 16, 1961), 44-47.

Neumann, E. "The Role of Administration in a Teaching Hospital," *Postgraduate Medicine*, 37 (May, 1965), 604-609.

Novick, David. "Long-Range Planning Through Program Budgeting *Business Horizons*, XII (February, 1969), 59-65.

_____. *Origin and History of Program Budgeting*. Santa Monica, Calif.: The RAND Corporation, P-3427, October, 1966.

_____. *Program Budgeting*. Cambridge: Harvard University Press, 1965.

O'Malley, C. D. "Application of Systems Engineering in Nursing," *American Journal of Nursing*, 69 (October, 1969), 2155-2160.

Optner, Stanford L. *Systems Analysis for Business Management*. 2nd edition. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1968.

_____. *Systems Analysis for Business and Industrial Problem Solving*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1965.

Pellagrino, E. D. "Medical Service and Patient Care," *Hospital Progress*, 44 (November, 1963), 79-84.

Pelletier, R. J. "The Future for Programming and Planning Complex Facilities," *Canadian Hospital*, 44 (November, 1967), 66-70.

Pendall, R. J. "Promotion of Health," *Hospital Progress*, 46 (June, 1965), 108-109.

Perrow, Charles. "Hospitals: Technology, Structure and Goals," in James G. March, *Handbook of Organizations*. Chicago: Rand McNally, 1965.

Peterson, Osler, and Ernest K. Barsimian. "A Plan for Dissecting Surgical Performance," in Proceedings, *Conference on Research in Hospital Use*. Public Health Service Publication No. 930-E-2. Washington, D. C.: U. S. Government Printing Office, 1968.

Pierce, William M. "A Patient Care Model," *American Journal of Nursing*, 69 (August, 1969), 1700-1704.

Porterfield, J. D. Foreword to: *Revised Hospital Accreditation Standards*. Chicago: Joint Commission on the Accreditation of Hospitals, October, 1969.

Prest, A. R., and Ralph Turvey. "Cost-Benefit Analysis: A Survey," *Economic Journal*, LXXV (December, 1965), 683-735.

Preston, R. A., K. L. White, E. J. Strachan, and H. B. Wells. "Patient Care Classification as a Basis for Estimating Graded Impatient Facilities," *Journal of Chronic Diseases*, 17 (September, 1964), 761-772.

Prioleau, W. H. "Research in the Community Hospital," *American Surgeon*, 32 (January, 1966), 80.

Quade, E. S., ed. *Analysis for Military Decisions*. Chicago: Rand McNally, 1964.

Quade, E. S. *Cost-Effectiveness: An Introduction and Overview*. Santa Monica, Calif.: The RAND Corporation, P-3134, May, 1965.

_____. *Cost-Effectiveness: Some Trends in Analysis*. Santa Monica, Calif.: The RAND Corporation, P-3529, March, 1967.

_____. *Some Problems Associated with Systems Analysis*. Santa Monica, Calif.: The RAND Corporation, P-3391, June, 1966a.

_____. *Systems Analysis Techniques for Planning-Programming-Budgeting*. Santa Monica, Calif.: The RAND Corporation, P-3322, March, 1966b.

Querido, A. "The Changing Role of the Hospital in a Changing World," *Hospitals*, 36 (January 1, 1962), 31-35.

Rainwater, L. "The Patient's Role in Successful Hospital Care," *Hospital Progress*, 41 (July, 1961), 74+.

Rhodes, A. J. "Clinical Research in the Hospital," *Canadian Hospital*, 39 (August, 1962), 32-33.

Rice, Dorothy P. *Economic Costs of Cardiovascular Diseases and Cancer*. Public Health Publication No. 947-5. Washington, D. C.: U. S. Government Printing Office, 1965.

_____. *Estimating the Cost of Illness*. Public Health Service Publication No. 947-6. Washington,D. C.: U. S. Government Printing Office, 1966.

_____, and B. S. Cooper. "The Economic Value of Human Life," *American Journal of Public Health*, LVII (November, 1967), 1954-1966.

Rice, Robert S. "Analysis of the Hospital as an Economic Organism," *The Modern Hospital*, 106 (April, 1966), 87-91.

Riedel, Donald C., and Thomas B. Fitzpatrick. *Patterns of Patient Care: A Study of Hospital Use in Six Diagnoses*. Ann Arbor, Mich.: Bureau of Hospital Administration, University of Michigan, 1964.

Rinehart, Elma. *Management of Nursing Care*. New York: Macmillan, 1969.

Robbins, Anthony. "Allied Health Manpower," *Inquiry*, VII (March, 1970), 55-61.

Robertson, Robert. "The Market for Hospital Care," *Hospital Administration*, 7 (Winter, 1962), 41-55.

Robinson, Geoffrey A. *Hospital Administration*. London: Butterworths, 1962.

Rosenthal, Melvin. "The Psychologist in the General Hospital," in B. Bandler, ed. *Psychiatry in the General Hospital*. Boston: Little, Brown Co., 1968.

Rutstein, David D. *The Coming Revolution in Medicine*. Cambridge, Mass.: M. I. T. Press, 1967.

Saren, Martin, and Anton Straub, "Nursing Service Effectiveness," *Hospitals*, 44 (January 16, 1970), 45-50.

Schick, Allen. "The Road to PPB: The Stages of Budget Reform," *Public Administration Review*, XXVI (December, 1966), 243-258.

Schneider, J. B. "Planning the Growth of a Metropolitan System of Public Service Facilities: The Case of the Short-Term General Hospital." Ph.D. Dissertation, University of Pennsylvania, 1966.

Schonfeld, H. K. "Health Services for All: Is Health Insurance the Answer?" *American Journal of Public Health*, 59 (January, 1969), Supplement 25-27.

_____. "Standards for the Audit and Planning of Medical Care: A Method for Preparing Audit Standards for Mixtures of Patients," *Medical Care*, 8 (July-August, 1970), 287-298.

_____, I. S. Falk, P. H. Lavietes, J. Landwirth, and L. S. Krassner. "The Development of Standards for the Audit and Planning of Medical Care—Program Content and Method of Estimating Needed Personnel," *American Journal of Public Health*, 58 (November, 1968), 2097-2110.

Schultze, Charles L. *The Politics and Economics of Public Spending*. Washington, D. C.: The Brookings Institution, 1968.

Scoville, James G. "The Development and Relevance of U. S. Occupational Data," *Industrial and Labor Relations Review*, XIV (October, 1965), 70-80.

_____. "The Job Content of the U. S. Economy, 1940-1970: An Attempt at Quantification," Ph.D. Dissertation, Harvard University, 1964.

Schwartz, John. "A Study to Determine the Effect of Certain Factors and Their Relationship in Length of Patient Stay." Master's Thesis, University of Minnesota, 1969.

Shafer, K., J. Sawyer, A. McCluskey, and E. Beck. *Medical-Surgical Nursing*. St. Louis: C. V. Mosby, Co., 1964.

Sheps, C. G., D. A. Clark, and J. W. Gerdes. "Medical Schools and Hospitals - Interdependence for Education and Service," *Journal of Medical Education*, 40 (September, 1965), entire issue.

Sheps, Cecil G., and Eugene E. Taylor. *Needed Research in Health and Medical Care*. Chapel Hill: University of North Carolina Press, 1954.

Sigmond, R. M. "Hospital Effectiveness: A Complex Concept Promises Concrete Results," *Hospitals*, 42 (August, 1968), 50-55.

Silver, G. "New Types of Personnel and Changing Roles of Health Professionals," *Bulletin of the New York Academy of Medicine*, 42 (December, 1966), 1217-1225.

Singer, Sidney. "A Stochastic Model of Variation of Categories of Patients Within a Hospital." Ph.D. Dissertation, Johns Hopkins University, 1961.

Slesinger, R. E., and H. Smalley. "The Economic Apparatus to Determine the Value of Hospital Care," *Hospital Administration*, 8 (Summer, 1963), 30-44.

_____. "The Economics of Patient Care," *Hospital Administration*, 3 (Fall, 1958), 26-31.

Smith, Dorothy, and Claudia Gips. *Care of the Adult Patient: Medical-Surgical Nursing*. Philadelphia: J. B. Lippincott Co., 1963.

Snoke, A. W., M. Carberry, F. T. Hill, J. T. Morrison, C. W. Eisele, and M. J. Knapp. "The Essence of Patient Care: A Symposium," *Hospital Progress*, 42 (January, 1961), 51-54.

"Some Aspects of Patient Flow," *Milbank Memorial Fund Quarterly*, 45 (January, 1966), 156-183.

Somers, Herman, and Anne R. Somers. *Doctors, Patients, and Health Insurance: The Organization and Financing of Medical Care*. Washington, D. C.: The Brookings Institution, 1961.

_____. *A Program for Research in Health Economics*. Health Economics Series No. 7 Public Health Service Publication No. 947-7, January 1967a.

_____. *Medicare and the Hospitals: Issues and Prospects*. Washington, D. C.: The Brookings Institution, 1967b.

Stead, E. A., Jr. "The Physician's Assistant—Job Description and Licensing," *Medical Times*, 97 (August, 1969), 246-247.

Stead, E. A., Jr. "Training and Use of Paramedial Personnel," *New England Journal of Medicine*, 277 (October 12, 1967), 800-801.

Stewart, William A. "The Challenging Need for Assessment," in A. Bergman, ed. *Assessing the Effectiveness of Child Health Services*. Columbus, Ohio: Ross Laboratories, 1967.

Stigler, George J. *The Theory of Price*. 3rd Edition. New York: Macmillan, 1966.

Tapia, F. "The Role of Research in the Development of a Professional," *British Journal of Medical Education*, 2 (December, 1968), 274-277.

Thomas, W. H. "A Model for Predicting Recovery Progress of Coronary Patients," *Health Services Research*, 3 (Fall, 1968), 185-213.

United Hospital Fund of New York. *Techniques of Analyzing A Professional Service Department—A Special Study In Hospital Systems and Procedures*. New York: United Hospital Fund of New York, 1966.

University of California, School of Nursing. *A Functional Analysis of Nursing Service*. San Francisco, California: E. A. Donahue, 1950.

U. S. Bureau of Labor Statistics. *The Economic Status of Registered Professional Nurses, 1946-7*. Bulletin 931. Washington, D. C.: U. S. Government Printing Office, 1947.

U. S. Congress, Senate Committee on Government Operations. *Health Care in America*, Parts 1, 2. 90th Cong., 2d sess., 1969.

U. S. Department of Health, Education, and Welfare. *Conference on Research in Hospital Use*. Public Health Service Publication No. 930-E-2. Washington, D. C.: U. S. Government Printing Office, 1963.

_____. *Elements of Progressive Patient Care*. Public Health Service Publication No. 930-C-1. Washington, D. C.: U. S. Government Printing Office, 1962.

U. S. Public Health Service, National Center for Health Statistics. *Eighth Revision, International Classification of Diseases, Adapted*. Public Health Service Publication No. 1693. Washington, D. C.: U. S. Government Printing Office, 1969.

Van de Moortel, Victor. "The Leading Causes of Admission, PAS Hospitals 1965-67," *PAS Reporter* (July 21, 1969).

Venger, M. J., and J. Yourman. "Modern Management Theory Applied to Nursing Service," *International Nursing Review*, 14 (August, 1967), 23-28.

Vogely, William A. *A Case Study in the Measurement of Government Output*. Paper RM-1934-RC. Santa Monica, Calif.: RAND Corp., July 9, 1957.

Wachs, Melvin. "PPB and Management Information Systems for Mental Health," *American Journal of Public Health*, 59 (February, 1969), 261-266.

Wagner, B. M. "Care Plans, Right, Reasonable and Reachable," *American Journal of Nursing*, 69 (May, 1969), 986-990.

Walker, D. J. "Patterns of Patient Care: A Study of Patient Contact in a Community Hospital." Ph.D. Dissertation, St. Louis University, 1966.

Walton, William W. *Modern Decision Theory Applied to Medical Diagnosis*. Baltimore: Johns Hopkins University, 1964.

Weed, Lawrence L. *Medical Records, Medical Education, and Patient Care*. Cleveland, Ohio: Case Western University Press, 1970.

Weeks, Lewis, and John R. Griffith, eds. *Progressive Patient Care: An Anthology*. Ann Arbor, Mich.: Bureau of Hospital Administration, University of Michigan, 1964.

Weidenbaum, M. "Program Budgeting—Applying Economic Analysis to Government Expenditure Decisions," *Business and Government Review*, 7 (July-August, 1966), 22-31.

Weisbrod, Burton A. *Economics of Public Health*. Philadelphia: University of Pennsylvania Press, 1961.

Weiss, Jeffrey H. "A Job Classification Scheme for Health Manpower," *Health Services Research*, 3 (Spring, 1968), 48-64.

_____. "The Changing Job Structure of Health Manpower," Ph.D. Dissertation, Harvard University, 1966.

White, Kerr L. "Definition and Scope of Problems: Medical Aspects," in A. Bergman, ed. *Assessing the Effectiveness of Child Health Services*. Columbus, Ohio: Ross Laboratories, 1967a.

White, Kerr L. "Medical Care Research and Health Services Systems," *Journal of Medical Education*, 42 (August, 1967b), 729-741.

White, Ruth P. Dana Quade, and Kerr L. White. *Patient Care Classifications: Methods and Applications*. Baltimore, Md.: Johns Hopkins University, 1965.

Wiggins, W. S. "The Objectives of Hospital Medical Education Programs," *Conneticut Medicine*, 24 (May, 1960), 314-315.

Wildavsky, Aaron. "The Political Economy of Efficiency: Cost-Benefit Analysis, Systems Analysis, and Program Budgeting," *Public Administration Review*, XXVI (December, 1966), 292-310.

_____. *The Politics of the Budgetary Process*. Boston: Little, Brown and Co., 1964.

Williams, K. J. "Medical Care Appraisal," *Hospitals*, 40 (April, 1966), 105-108.

Williams, W. J., R. P. Covert, and J. D. Steele. "Simulation Modeling of a Teaching Hospital Outpatient Clinic," *Hospitals*, 21 (November 1, 1967), 71-75.

Wilson, Robert N. "Patient-Practitioner Relationships," in H. E. Freeman, S. Levine, and L. G. Reeder, eds. *Handbook of Medical Sociology*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1963.

W. K. Kellogg Foundation. *The Planning and Operation of an Intensive Care Unit*. Battle Creek, Mich.: Kellogg Foundation, 1962.

Young, J. P. "A Conceptual Framework for Hospital Administration Decision Systems," *Health Service Research*, 3 (Summer, 1968), 79-95.

Zola, I. K. "Problems of Communication, Diagnosis, and Patient Care: The Interplay of Patient, Physician and Clinical Organization," *Journal of Medical Education*, 38 (October, 1963), 829-838.

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Ronald Ervin Beller was born October 4, 1935, in Cincinnati, Ohio. He graduated from Ft. Lauderdale High School, Ft. Lauderdale, Florida, in June, 1953, after which he attended the University of Florida, graduating with a bachelor of Industrial Engineering degree in June, 1957. After graduation from the University, he was employed by the Babcock and Wilcox Company as an industrial engineer, and then by the Shell Oil Company as a technical products marketing representative, and subsequently as a senior market analyst in marketing research in the New York City general offices of the Corporation.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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