Allocation of Resources for Ambulatory Care —A Staffing Model for Outpatient Clinics

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THE DEVELOPMENT of organized ambulatory health care services in urban America provides an opportunity to adapt existing management techniques, and to create and utilize new techniques, to increase the effectiveness and efficiency of our health care delivery system. "Effectiveness" in this article refers to the achievement of recognized objectives of health care services; namely, the reduction in frequency, severity, and cost of individual and overall morbidity in the population. "Efficiency" refers to the provision of such services with the smallest amount of resources (primarily money, but occasionally scarce manpower, space, and time), preferably in a preventive and ambulatory care setting rather than in the more expensive hospital inpatient care setting.

Traditionally, the primary setting for institutionally based ambulatory care has been the emergency department or the outpatient department of the hospital. Outpatient departments often were composed of diverse, disease-oriented clinics, were underfunded, and were staffed by physicians who donated their time, primarily in exchange for a large patient pool from which to choose interesting patients to further their teaching and professional interests. Within this physician-oriented structure, little emphasis was placed on managing outpatient resources, because funded resources were relatively minimal and management concepts were considered antithetical, or even irrelevant, to the altruistic or teaching motivation of providers. (In 1950, the direct cost of operating 15 New York City municipal hospital outpatient departments was approximately $2.5 million; by 1970 it was about $10.8 million, more than a 300 percent increase.)

In recent years, however, the charity aspect of outpatient service has been greatly altered by *(a)* the growing awareness by the public of the "right to health care," *(b)* the emergence of Federal and third-party funding of ambulatory health care, *(c)* the movement of many physicians away from their neighborhood population bases to hospital or group practice and, most important, *(d)* the provider-stimulated development of ambulatory services as a means of delivering preventive, comprehensive, and cost-effective health care.

Thus, a need for management techniques was created to efficiently plan, allocate, and control the resulting enormous commitment of costly resources. Moreover, such techniques require wide applicability because these newly committed resources are being expended in many new modes of health care delivery. These modes range from health maintenance organizations and OEO-based neighborhood health centers through hospital-based comprehensive care clinics to the traditional hospital outpatient clinics.

Unfortunately, few useful analytical and management techniques have been developed and subsequently applied to the provision of ambulatory care. Indeed, many administrators of ambulatory care services know

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what must be done, but simple and easily implementable tools have not been developed to meet such needs. Patients scheduling systems represent perhaps the only outstanding analytical improvement and, even with these, substantial conceptual and data problems remain, so that such systems have not yet been widely implemented.

This article develops a feasible model for outpatient clinic staffing which potentially provides a major analytical tool for appropriately allocating and monitoring the utilization of the most important and expensive of health resources—professional and nonprofessional clinic personnel. The model is a simplistic and extremely flexible one which can be applied to all modes of delivering ambulatory care. Administrators need only specify preferred decision variables and the model will produce a least-cost staffing configuration to meet the demand for service in accordance with the desired mode and intensity of care.

This model was developed by the Office of Program Analysis of the New York City Health and Hospitals Corporation after substantial analysis of the outpatient clinics of some of its member hospitals. The Health and Hospitals Corporation facilities annually experience approximately 3.3 million outpatient clinic visits at a total cost of $115 million, and the individual hospitals studied account for more than half of these visits. The model has wide applicability in the corporation's budget process by serving as an analytical framework for establishing and monitoring the achievement of specific and acknowledged utilization, fiscal, and clinic performance goals among clinics, programs, and hospitals which compete for the same resources. When the model was applied to both traditional and comprehensive care clinics at one of the Health and Hospitals Corporation's largest member hospitals, substantial cost reductions were indicated. With the identification of newly freed or released funds, resource reallocations to the budgets of other critical or efficient areas of the hospital could take place. Other ambulatory programs could be offered, family practice programs could be begun, or even seed money for development of a health maintenance organization (HMO) could be released through the more efficient use of existing resources.

Model Objectives

The primary objective of the staffing model is to determine the most efficient and equitable allocation of clinic staff among an institution's outpatient clinics, given a specified set of medical and administrative policy constraints. Depending on overall ambulatory care objectives and programs and the resulting technology of delivering care, various mixes of resources (inputs) can be used to produce a measure of clinic service (an output). The model uses the patient visit as the unit of output produced and as the relative measure of equitable resource allocation. The technology employed by the desired health care program is reflected in the productivity and utilization of resources, the staff mix, and the cost of such staff. By combining these aspects of the production process within the model, the production process can be monitored to determine the achievement of desired results.

Thus, the primary purpose for using the model is to increase the efficiency with which care is delivered in the outpatient clinic. It does nothing explicitly about affecting or measuring the quality or effectiveness of such care. Rather, it implicitly assumes that the model parameters selected by the appropriate decisionmakers are sufficient to deliver the desired quality of care which, in turn, will achieve an acceptable effectiveness of care. If, based on actual experience, such achievement is not realized, the responsible model parameters must be revised. Of course, physician concurrence with managerial decisions is critical to insure that utilizing the model maintains the quality of care and effectiveness levels required within the many resource constraints present.

The secondary objective of the staffing model is to provide sufficient flexibility for the model to be easily adapted to any particular hospital or nonhospital outpatient care setting. Because of the inherent impossibility of adequately incorporating all possible variations in medical policy, patient characteristics, and physical and administrative constraints, the model provides an analytical framework which the appropriate decisionmakers can use for their own special policy decisions in accordance with the characteristics of their institution. Such characteristics may include the extensiveness, and therefore the length, of the initial patient visit, the mix of various staff categories, and the desired amount of time providers spend in activities other than examining and treating patients.

Major Assumptions

Following are the major assumptions made in developing the staffing model.

1. The overriding assumption is that for any mode of delivering care and for each staff category, a reasonable but flexible mean time standard can be developed for staff-patient contacts. The time may vary by clinic.
2. In addition to the time standard, a reasonable and flexible desired utilization of capacity can be established for each staff category. Utilization may also vary by clinic, but probably should be relatively uniform among clinics.
3. Patients can be scheduled for each clinic, given seasonal variations and other predictable affects on demand, so that an efficient workflow is established for clinic staff consistent with the desire to minimize patient waiting time.
4. House staff are less preferred in a clinic and their presence must be controlled by an upper limit, relative to the percentage of all physicians, with consideration of their otherwise desirable low-cost characteristic.
5. Economies of scale (with respect to direct staffing)

may occur to a limited extent, but an accurate staff-patient contact time standard and the resulting scheduling of patients and staff in accordance with the model, should negate most economies. However, the model allows the flexibility to schedule staff to serve patients in several clinics during the same session if the number of patients in one clinic is not sufficient to create efficient staffing in accordance with the model. To do so, merely consider the several clinics as one clinic in the model and combine patient workload and staffing characteristics (weighted by number of clinic visits per session or per year).

6. Staff-patient contact time should include all the activities that staff members perform while they are in contact with the patient. If teaching and chart review are done while a physician is examining a patient, then all three functions should be included in establishing a time standard. Thus, standards will vary, depending on the functions performed.

Model Presentation

To develop a method whereby clinic resources can be allocated and managed efficiently, it is necessary to indicate the variables that affect the relationship between resource utilization and the cost of producing a unit of clinic output. The model is concerned with those resources that can be directly controlled by a clinic manager. For the most part, these resources involve staff time spent in patient care and the resulting cost of that time. To some extent, the utilization of ancillary services can also be controlled through a clinic's medical policies, but in this presentation the use of ancillary services and their resulting cost will not be discussed. The control of ancillary services through the PSRO process may offer some assistance in the efficient employment of such resources.

Basically, the model indicates how to staff an outpatient clinic. The model requires that the clinic manager specify clinic demand and certain standards of efficiency which reflect the production process. The model subsequently determines the number of personnel hours, and the resulting salary cost by staff category, to meet the specified demand and standards. The decision variables used in the model were determined by finding those components of clinic resource utilization which correlate with the cost of producing a unit of clinic output, a clinic visit. A linear multiple regression determined that the following variables correlated highly with clinic cost per visit (the relative measure of cost to output): physician-patient contact time, utilization of physician capacity (percentage of physician's total time actually spent treating patients), and the ratio of house-staff hours to total physician hours (both house staff and attending physicians). The R^2 value for this equation was .86, meaning that these three variables expain 86 percent of the variation in cost between clinics. In addition, physician-patient contact time and utilization of physician capacity had an R^2 of .79 when they were regressed on cost per visit. Since these factors appear to explain cost differences, they must be controlled if clinic cost itself is to be controlled and standardized.

The mathematically indicated usage of the variables just mentioned in the model is easily rationalized from a medical and organizational viewpoint. For example, changing the length of physician-patient contact time means that more or fewer patients can be treated during a given period and, therefore, the cost per visit can be expected to change accordingly. In addition, changing the percent of total (paid) time that physicians actually spend treating patients (defined as the percentage utilization of capacity) also allows more or fewer patients to be seen during a given period and also changes cost per visit accordingly. Finally, changing the percent utilization of a lower cost staff category (house staff) also changes cost per visit accordingly. Note that it has been assumed that physicians will be paid for their services and will no longer donate such services.

Once these three key variables were identified, it was necessary to build a model which explicitly hypothesized their relationship. The model is represented by a set of relations which determine the amount of staff time and the resulting cost of that time for a specified clinic and mode of care. In explaining the model, it is necessary to develop the following series of equations, each of which provides useful information in the determination of an efficient staffing configuration.

It is first necessary to determine the number of hours required to treat the expected patient demand, differentiating by required staff category for each specific clinic or type of care desired, or both. Let:

$$[1] \quad T_{pi} = R_i (H_i \times T_{pri} \times D_i + A_i \times T_{pri}) + T_{pfi} \times F_i$$

where T_{pi} is the average amount of time a physician spends treating a patient in clinic i. T_{pi} is a function of the variables defined below. These variables will be explained more fully in the section, Decision Parameters. In addition, examples of the model's application using actual numbers are presented in a subsequent section.

R_i = percentage of revisit patients visiting each session of clinic i.

H_i = desired ratio of house-staff hours to all physician hours for each session of clinic i.

T_{pri} = time standard (in minutes) for physician-patient contact during revisits in clinic i.

D_i = house-staff time differential for revisit patients in clinic i.

A_i = desired ratio of attending hours to total physician hours for each session of clinic i.

T_{pfi} = time standard (in minutes) for physician-patient contact during first visits in clinic i.

F_i = percentage of first visit patients visiting each session of clinic i. Actual experience has shown that if house staff treat patients on the first visit, no time differential is required. Obviously, such a differential can be added if desired.

Thus, [2] $T_{pi} \times Q_i$ = total physician time (in minutes) spent treating patients in each session of clinic i where Q_i is the average number of patients per session expected to visit clinic i. Total physician time can be broken down by house-staff hours and attending physician hours, and this will be done in equations 8 and 9.

Once we determine the total time required to treat the expected number of patients, given specified time standards, physician mix, and patient-visit mix, it is necessary to specify an acceptable utilization of physician capacity.

The definition of utilization of physician capacity is the ratio of hours spent treating patients to total paid hours. Expressed mathematically,

$$[3] \quad U_{pi} = \frac{T_{pi} \times Q_i}{60\ Z_{pi}}$$

where

U_{pi} = utilization of physician capacity for clinic i,
Z_{pi} = total paid physician hours per session for clinic i and
$T_{pi} \times Q_i$ is divided by 60 to express time spent treating patients in terms of hours rather than minutes.

Since we are interested in determining total paid physician hours required (Z_{pi}), utilization of capacity (U_{pi}) becomes a decision variable that we must specify in the model. Equation 3, therefore, must be rewritten to determine Z_{pi}.

$$[4] \quad Z_{pi} = \frac{T_{pi} \times Q_i}{60\ U_{pi}}$$

Equation 4 is the one we are ultimately interested in because it tells how many physician hours must be employed to staff clinic i.

Similarly, we want to determine the total hours required for other staff employed in clinic i. Thus, similar equations can be developed as follows:

$$[5] \quad Z_{ni} = \frac{T_{ni} \times Q_i}{60\ U_{ni}}$$

$$[6] \quad Z_{ci} = \frac{T_{ci} \times Q_i}{60\ U_{ci}}$$

where

Z_{ni} = total paid nursing hours required in clinic i to service Q_i patients.
T_{ni} = time standard (in minutes) for nurse-patient contact in clinic i; this standard is undifferentiated by first or revisit variation. Of course, this standard depends on the appropriate role of the nurse, for example, as a nurse practitioner.
U_{ni} = nurse utilization of capacity in clinic i.
Z_{ci} = total paid clerk hours required in clinic i to serve Q_i patients.
T_{ci} = time standard (in minutes) for clerk-patient contact in clinic i, undifferentiated by first or revisit variations.
U_{ci} = utilization of clerk capacity in clinic i.

Equations 4, 5, and 6 can be used to translate required staff hours into a total cost function by multiplying total paid hours by the appropriate cost per hour.

Hypothetical decision parameter values for four outpatient clinics

Parameters	*Special medicine clinic*	*General medicine clinic*[1]	*Special gynecology clinic*	*General gynecology clinic*
Qi (patients)	25	40	10	75
Fi (percent)	10	20	35	20
Ri (percent)	90	80	65	80
Hi (percent)	10	35	35	20
Ai (percent)	90	65	65	80
Tpri (minutes)	20	20	15	10
Tni (minutes)	12	15	15	15
Tci (minutes)	10	12	12	8
Tpfi (minutes)	35	35	25	25
Di (a multiplier)	1.3	1.3	1.4	1.4
Upi (percent)	80	80	80	80
Uci (percent)	90	90	90	90
Uni (percent)	90	90	90	90
Cpi (dollars)[2]	20	15	15	18
Cci (dollars)	5	6	5	5
Cni (dollars)	9	10	9	9

[1]The general medicine clinic could also be considered an HMO.
[2]C_{pi} is total physician cost per hour and, therefore, must be developed by weighing house staff and attending cost per hour by the relative proportion of time each physician category is scheduled to spend in the clinic.

Thus,

$$[7] \quad C_{ti} = \frac{Q_i}{60}\left(\frac{T_{pi} \times C_{pi}}{U_{pi}} + \frac{T_{ni} \times C_{ni}}{U_{ni}} + \frac{T_{ci} \times C_{ci}}{U_{ci}}\right)$$

$$= C_{pi} Z_{pi} + C_{ni} Z_{ni} + C_{ci} Z_{ci}$$

where C_{ti} equals total cost for clinic i to treat Q_i patients at the expected patient visit mix, the specified staff mix, staff cost per hour, appropriate staff-patient contact time standard, and the appropriate utilization of staff capacity. C_{pi}, C_{ni}, and C_{ci} are average cost per hour figures for physicians, nurses, and clerks, respectively.

In equation 4, total paid physician hours required is derived. However, this total is not useful when different types of physicians are employed, for example, house staff and attending physicians. To develop the number of hours required by each staff type, the following two equations are useful:

$$[8] \quad X_{pi} = Q_i\left(\frac{H_i \times T_{pfi} \times F_i + D_i \times H_i \times R_i \times T_{pri}}{60\ U_{pi}}\right)$$

$$[9] \quad Y_{pi} = Q_i\left(\frac{A_i \times T_{pfi} \times F_i + A_i \times R_i \times T_{pri}}{60\ U_{pi}}\right)$$

$$= Z_{pi} - X_{pi}$$

where X_{pi} equals total paid house-staff physician hours required for each session of clinic i and Y_{pi} equals total paid attending physician hours required for each session of clinic i.

If different types of nursing or clerical personnel are used, similar equations can be developed by specifying the necessary variables in identical fashion.

Some Sample Applications of the Model

In this section, the model is applied to four hypothetical clinics. The applications could easily be modified to approximate nonteaching institutions or health maintenance organizations by modifying the decision parameters, which are discussed more fully in a subsequent section. The decision parameters for each type of outpatient clinic are presented in the table. The model uses such parameters to determine *(a)* the number of hours, by staff category, required to treat the expected number of patients and *(b)* the resulting cost of the number of staff hours specified.

Once the model specifies the staff hours required, the number of actual staff members to be employed must be determined, based on the length of the clinic session. If the relationship between the hours required and the length of the session yields fractions of personnel (for example, 11 hours of physician time divided into 3-hour sessions equals 3 2/3 physicians), several manipulations can be made to utilize personnel fully: *(a)* employ selected hourly (instead of salaried or sessional) personnel, *(b)* cross-train staff to perform flexibly in several functions, *(c)* slightly vary the number of patients, accept (more) walk-ins, or both, *(d)* merge clinics where professional or nonprofessional staff, or both, can be pooled, *(e)* slightly vary utilization of capacity levels where appropriate, and *(f)* if unconstrained by space or by medical requirements, the clinic could meet more often or less often in order to accept the number of patients who will utilize personnel fully.

SPECIAL MEDICINE CLINIC

Equation 1

$$T_{pi} = R_i\left(H_i \times T_{pri} \times D_i \times A_i \times T_{pri}\right) + T_{pfi} \times F_i$$

$$= .90\ (.10 \times 20 \times 1.3 + .90 \times 20) + 35 \times .10$$

$$= 22.04 \text{ minutes}$$

Equation 4

$$Z_{pi} = \frac{T_{pi} \times Q_i}{60\ U_{pi}} = \frac{22.04 \times 25}{60 \times .80}$$

$$= 11.48 \text{ physician hours required}$$

Equation 5

$$Z_{ni} = \frac{T_{ni} \times Q_i}{60\ U_{ni}} = \frac{12 \times 25}{60 \times .90}$$

$$= 5.56 \text{ nurse hours required}$$

Equation 6

$$Z_{ci} = \frac{T_{ci} \times Q_i}{60\ U_{ci}} = \frac{10 \times 26}{60 \times .90}$$

$$= 4.63 \text{ clerk hours required}$$

Equation 7

$$C_{ti} = \frac{Q_i}{60}\left(\frac{T_{pi} \times C_{pi}}{U_{pi}} \times \frac{T_{ni} \times C_{ni}}{U_{ni}} + \frac{T_{ci} \times C_{ci}}{U_{ci}}\right)$$

$$= \frac{25}{60}\left(\frac{2.04 \times 20}{.80} + \frac{12 \times 9}{.90} + \frac{10 \times 5}{.90}\right)$$

$$= \$302.73 \text{ cost for 1 session of clinic serving 25 patients.}$$

$$C_{ti}/Q_i = \frac{302.73}{25} = \$12.11 \text{ cost per visit}$$

GENERAL MEDICINE CLINIC

Equation 1

$$T_{pi} = R_i \left(H_i \times T_{pri} \times D_i + A_i \times T_{pri}\right) + T_{pfi} \times F_i$$
$$= .80\ (.35 \times 20 \times 1.3 + .65 \times 20) + 35 \times .20$$
$$= 24.68 \text{ minutes}$$

Equation 4

$$Z_{pi} = \frac{T_{pi} \times Q_i}{60\ U_{pi}} = \frac{24.68 \times 40}{60 \times .80}$$
$$= 20.57 \text{ physician hours required}$$

Equation 5

$$Z_{ni} = \frac{T_{ni} \times Q_i}{60\ U_{ni}} = \frac{15 \times 40}{60 \times .90}$$
$$= 11.11 \text{ nurse hours required}$$

Equation 6

$$Z_{ci} = \frac{T_{ci} \times Q_i}{60\ U_{ci}} = \frac{12 \times 40}{60 \times .90}$$
$$= 8.89 \text{ clerk hours required}$$

Equation 7

$$C_{ti} = \frac{Q_i}{60}\left(\frac{T_{pi} \times C_{pi}}{U_{pi}} + \frac{T_{ni} \times C_{ni}}{U_{ni}} + \frac{T_{ci} \times C_{ci}}{U_{ci}}\right)$$
$$= \frac{40}{60}\left(\frac{24.68 \times 15}{.80} + \frac{15 \times 10}{.90} + \frac{12 \times 6}{.90}\right)$$
$$= \$475.31$$

$$C_{ti}/Q_i = \frac{475.31}{40} = \$11.88 \text{ cost per visit}$$

SPECIAL GYNECOLOGY CLINIC

Equation 1

$$T_{pi} = R_i \left(H_i \times T_{pri} \times D_i + A_i \times T_{pri}\right) + T_{pfi} \times F_i$$
$$= .65\ (.35 \times 15 \times 1.4 + .65 \times 15) + 25 \times .35$$
$$= 19.87 \text{ minutes}$$

Equation 4

$$Z_{pi} = \frac{T_{pi} \times Q_i}{60\ U_{pi}} = \frac{19.87 \times 10}{60 \times .80}$$
$$= 4.14 \text{ physician hours required}$$

Equation 5

$$Z_{ni} = \frac{T_{ni} \times Q_i}{60\ U_{ni}} = \frac{15 \times 10}{60 \times .90}$$
$$= 2.78 \text{ nurse hours required}$$

Equation 6

$$Z_{ci} = \frac{T_{ci} \times Q_i}{60\ U_{ci}} = \frac{12 \times 10}{60 \times .90}$$
$$= 2.22 \text{ clerk hours required}$$

Equation 7

$$C_{ti} = \frac{Q_i}{60}\left(\frac{T_{pi} \times C_{pi}}{U_{pi}} + \frac{T_{ni} \times C_{ni}}{U_{ni}} + \frac{T_{ci} \times C_{ci}}{U_{ci}}\right)$$
$$= \frac{10}{60}\left(\frac{19.87 \times 15}{.80} + \frac{15 \times 9}{.90} + \frac{12 \times 5}{.90}\right)$$
$$= \$100.17$$

$$C_{ti}/Q_i = \frac{100.17}{10} = \$10.02 \text{ cost per visit}$$

GYNECOLOGY CLINIC

Equation 1

$$T_{pi} = R_i \left(H_i \times T_{pri} \times D_i + A_i \times T_{pri}\right) + T_{pfi} \times F_i$$

$$= .80\ (.20 \times 10 \times 1.4 + .80 \times 10) + 25 \times .20$$

$$= 13.64 \text{ minutes}$$

Equation 4

$$Z_{pi} = \frac{T_{pi} \times Q_i}{60\ U_{pi}} = \frac{13.64 \times 75}{60 \times .80}$$

$$= 21.31 \text{ physician hours required}$$

Equation 5

$$Z_{ni} = \frac{T_{ni} \times Q_i}{60\ U_{ni}} = \frac{15 \times 75}{60 \times .90}$$

$$= 20.83 \text{ nurse hours required}$$

Equation 6

$$Z_{ci} = \frac{T_{ci} \times Q_i}{60\ U_{ci}} = \frac{8 \times 75}{60 \times .90}$$

$$= 11.11 \text{ clerk hours required}$$

Equation 7

$$C_{ti} = \frac{Q_i}{60} \left(\frac{T_{pi} \times C_{pi}}{U_{pi}} + \frac{T_{ni} \times C_{ni}}{U_{ni}} + \frac{T_{ci} \times C_{ci}}{U_{ci}}\right)$$

$$= \frac{75}{60} \left(\frac{13.64 \times 18}{.80} + \frac{15 \times 9}{.90} + \frac{8 \times 5}{.90}\right)$$

$$= \$626.68$$

$$C_{ti}/Q_i = \frac{626.68}{75} = \$8.36 \text{ cost per visit}$$

Decision Parameters

The flexibility of the staffing model is derived from the necessity for program administrators and medical directors to specify indicated model parameters to conform to the policy and program objectives of individual institutions. These model parameters, whose values represent the characteristics of individual programs and technologies of providing care, are called decision parameters. These decision parameters are explained and defined in the following section.

Q_i, patient volume, must be specified, based on the expected demand for service in each session of clinic i. Expected demand can be based on actual clinic experience or on a well functioning patient appointment system. In addition, Q_i is essentially differentiated by F_i (percent of first visits) and R_i (percent of revisits), depending on demand or administrative policies, or both, on accepting new patients and walk-ins.

Expected demand can be treated as either a fixed demand for each session (with appropriate seasonal variations), or it can be treated as a monthly or weekly total demand which can be spread over the number of sessions required to staff a clinic efficiently while meeting whatever space or medical constraints exist (for example, low demand clinics which would be staffed most efficiently on a bimonthly basis may be required to meet weekly because of the nature of the illness and medical care provided).

If expected demand is to be developed from past clinic experience, it is necessary to *(a)* determine the average number of patients who attended the clinic over a representative period (a monthly or seasonal average may be appropriate depending on the clinic), *(b)* determine the variance in the number who show up from session to session, and *(c)* derive a demand that accounts for the average number of patients who show up, plus some slack depending on the size of the variance. All efforts should be made to reduce the variance in order to staff efficiently, and therefore lower the cost per visit. The cost of a large variance can be determined from the model and can be measured against the cost of reducing this variance through the establishment of an effective appointment and appointment-followup system.

Both T_{pfi} (physician-patient contact time for first visits) and T_{pri} (physician-patient contact time for revisits) are time standards for physicians. As with any time standard, the activity that occurs within the designated period must be specified. Such specification relates to *(a)* the type of care to be delivered and *(b)* the functions of various staff members. In the Health and Hospitals Corporation's study, time standards were also differentiated by type of clinic (grouped by medical service) and variations between first visits and revisits because of their widely differing requirements.

Time standards must be developed with the concurrence of the providers who will abide by such standards. Standards can be developed empirically, from the literature, or from discussions with providers. Such standards are a direct reflection of the programs, staff mixes, and functions employed to implement the medical or administrative policies, or both, of the institution. They can be developed in the following manner of observing staff-patient contact time: *(a)* determine average staff-patient time; *(b)* differentiate such time by first visit and revisit; *(c)* establish a standard range of times when a wide distribution in observed contact time makes the use of a mean difficult; *(d)* differentiate by type of provider; *(e)* specify the general type of activities occurring within the contact period (for example, include in a physician-patient contact period, the amount of time physicians spend in chart review, performing examinations, writing prescriptions, and generally treating individual patients, but do not include time when physician is called out of clinic for emergency consultation; if a nurse functions as a physician assistant or nurse practitioner, the time standard might be considerably different from that for nurses with more limited roles); and *(f)* differentiate by type of care and medical department in order to develop a time standard for a homogeneous type of clinic visit (for example, comprehensive medical clinic, specialty surgical clinic, and so forth).

Once an empirical standard is developed, it should be approved for overall reasonableness by providers and administrators. It should be noted that physician contact times are average times and are not meant to indicate that a physician cannot appropriately spend more or less time with an individual patient.

D_i, house staff differential, is related to physician time standards because in the Health and Hospitals Corporation study it was discovered that house staff spend more time than other physicians treating revisit patients; thus the basic physician-patient time standard had to be increased by a factor, D_i, when house staff were employed. Surprisingly, a first-visit differential was not needed because no difference was observed between attending and house staff first-visit treatment times. If such differences do exist, a first-visit differential should be established and added to the model.

H_i, the ratio of house staff hours to total physician hours employed, must be specified as an upper limit. The reason for limiting H_i is that a least-cost physician staffing pattern can be developed by using only house staff because of their lower salary cost, compared to that of attending physicians. Since, generally, one of the basic model assumptions is that house staff are less experienced than attending physicians at delivering high-quality health care, it is desirable to maximize the percentage of the higher quality attending physicians consistent with budget limits, while meeting the demand for patient care and teaching responsibilities. The critical question that relates to specifying the level of H_i is: What percentage of attending physicians can the institution afford? Note that equation 7 can help to answer this question by specifying the cost of alternative feasible house staff proportions. C_{ti} for each clinic or, when summed up for all clinics, for the entire outpatient department, can be specified as a fixed constraint serving as the direct care budget. Then alternative medically acceptable house staff proportions (which affect C_{pi}) can be tried in equation 7 to determine which most closely generates the specified budget cost.

A_i, the ratio of attending hours to total physician hours employed, is the complement of H_i where $A_i + H_i = 100$ percent.

Utilization of capacity (U_{pi}, U_{ni}, U_{ci}) is an important variable because it establishes a means of indicating the desired amount of time spent in activities other than examining, treating, or generally serving patients.

Utilization of capacity has been defined as the ratio of time an employee spends treating patients (the contact time standard multiplied by the number of patients treated) to time for which the employee is paid and available in clinic. Thus, a salaried employee may be paid for vacation or sick time, but since the employee is not available for work during that period, its inclusion as available time is an uncontrollable factor (given union contracts and other conditions of employment), lowering utilization arbitrarily. In the Health and Hospitals Corporation's study, physicians were assigned an 80 percent utilization of capacity. Thus, for 20 percent of their paid time they could provide telephone counseling, take coffee breaks, or perform other activities as may be appropriate. Nurses and clerks were assigned a 90 percent utilization of capacity figure. This 90 percent figure does not include clinic setup time, but includes as available time only that which the employee spends in the clinic while the clinic is scheduled to be open. Thus, nurse activities taking place during clinic operation, such as patient counseling and taking blood pressure, and clerk activities such as appointment making, are included in utilization of capacity figures, while preclinic and postclinic activities are excluded.

Cost-per-hour figures are relatively simple to develop. Each general staff category is paid to work a specified number of hours each week. However, the number of paid hours must be adjusted for sick and vacation time. Once the number of hours worked is determined (also exclusive of overtime), it should be related to the regular weekly salary cost for each staff category to develop a cost per hour. For employees paid on a per hour basis (like sessional physicians), the hourly rate should be used.

Finally, it is strongly suggested, if the resource allocation model is used, that these decision parameter values be reviewed at least annually and preferably quarterly and appropriately updated for changing patient volumes, medical philosophy, budget levels, and input costs.

Model Benefits and Limitations

The major benefit of the model is in providing administrators with a simple and easily implementable tool for efficient and equitable allocation of scarce resources. Second, the general analytical framework and approach allows the model to be expanded to reflect desired programatic characteristics and, thus, the model can be flexibly applied to all processes of delivering ambulatory care whose characteristics can be quantified.

The model has numerous other benefits related to organizational control as well as to resource utilization.

Specifically, as a budget allocation tool, the model can:

- Provide an agreed-upon basis for efficient resource allocation to competing outpatient programs
- Identify efficient production processes and staff mixes in existing programs for duplication or expansion to other programs (that is, determine appropriate model parameters)
- Identify inefficient staff mixes, thus indicating where reallocation may be required
- Test new policy or program alternatives to derive cost and budget implications before allocations are made
- Determine the need for increased or decreased staff when patient demand in the clinic changes.

As a general performance monitoring tool, the model can help to:

- Lower unit cost
- Increase staff productivity
- Increase staff utilization of capacity
- Reveal appropriate trends and comparisons that require immediate management action
- Reveal specific aspects of efficient resource utilization that explain cost variances
- Stimulate the establishment of standards that relate resources used to outputs produced.

As a tool to increase organization accountability, the model can be used to set and monitor the achievement of:

- Fiscal goals
- Efficiency goals
- Equity goals
- Individual, administrative, or staff performance goals.

Such goals provide the basis for an incentive system in which desired performance, both individually and organizationally, is rewarded.

Although some of the benefits mentioned may be somewhat difficult to realize, at least initially, the model should introduce essential management concepts into the consciousness of decision makers who previously may never have been held accountable for, or were never even interested in, such critical responsibilities as efficient resource utilization.

The limitations to the model's uses are significant. For providers to accept the results of the model, they must participate in the establishment of appropriate values of all decision variables (including time standards, utilization of capacity, and others). Development of a desired staff mix is also difficult and must be accomplished before employing the model as a normative tool. The most obvious limitation of the model, however, is that it in no way determines or measures the effectiveness of the health care delivered. Other management or medical tools (such as medical audits and medical care evaluation studies) are required to achieve such determination both at a given point in time and over a period of time.

SYNOPSIS

MANSDORF, BRUCE D. (Booz, Allen & Hamilton Inc., New York City) : *Allocation of resources for ambulatory care—a staffing model for outpatient clinics. Public Health Reports, Vol. 90, September-October 1975, pp. 393-401.*

The enormous commitment of resources to ambulatory health care services requires that flexible and easily implementable management techniques be developed to improve the allocation of health manpower and funds. This article develops a feasible model for staffing outpatient clinics and thereby potentially provides an important analytical tool for allocating and monitoring the utilization of the most critical and expensive of ambulatory care resources—professional and nonprofessional clinic personnel. The model is simplistic, extremely flexible, and can be applied to many modes of delivering ambulatory care—from HMOs to traditional hospital outpatient clinics.

To employ the model, certain decision variables must be specified so that the model can produce a least-cost staffing configuration to meet the demand for service in accordance with the desired mode and intensity of care. The key decision variables that require input from administrators and medical personnel include standards for physician-patient contact time, a desired ratio of staff time actually spent treating patients to total paid staff time, and the desired mix of various staff categories to achieve program objectives.

Specific benefits of using the model include determining staffing for new, expanded, or existing outpatient clinics, determining budget requirements for such staffing needs, and providing quantitative productivity and utilization objectives and measurements.