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Research in Resource Allocation in a Prepaid Group Practice

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HEALTH MAINTENANCE ORGANIZATIONS (HMOs) have long been proposed as one mechanism for controlling health care costs and encouraging a more rational allocation of resources to health care needs. Although a wealth of literature has been published on the concepts of HMOs, the theory of their operation, and their performance in gross terms, very little information has been available on the details of how they function, and especially on the analytic tools used to make internal decisions on how to allocate staff and capital. The Southern California Region of the Kaiser-Permanente Medical Care Program (K-P) has made a major commitment over the last four years to a program of applied research directed toward improving the analytic capabilities available for short-term staffing, budgeting and rate setting decisions, and for long-term member and facility expansion policies. This paper provides an overview of the types of projects undertaken, and includes brief summaries of some of the more significant findings.

The paper's intent is twofold. First, it supplies some specific insights into the surprising diversity that exists among local areas of a large-scale HMO. This diversity makes simplistic approaches to resource allocation questions infeasible in the long term. Second, the paper offers a perspective on the prospects and problems in health services research somewhat different from that recently presented by Mechanic (1978). He has argued for an isolation of health services

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research for immediate policy implementation, in tones reminiscent of the supporters of basic research in the hard sciences:

> The most serious problem affecting the future of health services research is the expectation that a modest research investment will provide solutions to the political dilemmas of health care. It is both naive and counterproductive to anticipate any direct relationship between such research and policy implementation. The demand that health services research questions be formulated in terms of immediate political issues, moreover, debases the processes of problem formulation, compromises adequate data acquisition, and inevitably leads to disappointment and frustration. (Mechanic, 1978: 129–130)

Yet in an era of increasing scarcity of health resources neither society, through its government, nor operational organizations through their internal staffs, can afford the luxury of long-term commitments to researchers who, as a whole, have not inspired much confidence in their ability to select or carry out research projects that will lay strong foundations for later practical applications. Perhaps one approach to building this confidence is to redirect some attention away from the ever-changing and faceless policy makers and toward the managers of major large-scale delivery systems.

As has been illustrated by the work described in this paper, the issues surrounding the ongoing allocation of resources within such institutions provide a rich set of opportunities for research that challenges the researcher, advances the state of the profession, and results in significant organizational change. Although institutional settings are by no means insulated from the political pressures and constraints that Mechanic describes, they are reduced enough to make unnecessarily pessimistic his assessment that "health services research will (and, indeed, should) always be in the background in the formulation of important policy decisions unless the decisions are purely technical ones. But few important health services issues are simply matters of knowledge or technical expertise" (Mechanic, 1978: 130).

The institutional setting for the work described in this paper was the Kaiser-Permanente Medical Care Program, which provides high-quality, comprehensive medical services to over 1.4 million members in southern California. The medical care is delivered through seven relatively autonomous medical centers distributed over a 20,000-square-mile service area. The resources available to the program include 1,400 full-time salaried physicians, 140 nurse

practitioners, and 1,826 staffed acute-care beds. The operating costs for these resources, which are primarily supported by revenue from the dues paid by the program's membership, were $540 million for fiscal 1978. Because of the autonomy that has evolved for each of the seven medical centers, K-P presents an unparalleled natural experiment in which seven sets of group practices are functioning with identical benefits for members and incentives to providers. The decisions that determine what resources will be available, and when and where, are made at many levels throughout the organization, including senior regional management, the area administrators responsible for each medical center, and the department heads, chiefs of service, and supervisors responsible for the day-to-day delivery of care (Somers, 1971). Each medical center uses administrative structures and staffing patterns that are unique, influenced only by broad regional guidelines on either total dollars spent, or total staffing levels per thousand members. But the principal actors who shape these structures and patterns are the physicians in each medical center, especially the chiefs of service and local medical directors.

One indication of the great diversity among the areas is shown by their different approaches to providing primary care services. Some areas have developed independent departments of family practice, utilizing a combination of family practitioners and nurse practitioners, supported by a carefully structured network of linkages to specialists in the departments of internal medicine, pediatrics, and obstetrics and gynecology. Other medical centers rely, instead, on a single department of internal medicine, using primarily physicians as the provider, with a small number of nurse specialists who function in restricted roles. A similar diversity is evident in the behavior of the medical centers over time. K-P has been in existence for more than twenty-five years, and significant differences in the long-term trends in key parameters such as inpatient utilization rates remain unexplained. For example, two medical centers that ten years ago had essentially the same inpatient utilization, as measured by patient days per thousand members, have experienced opposite long-term trends, one increasing while the other has decreased, so that today the inpatient utilization rates, adjusted for age and sex, differ by 55 percent.

A key question for management in such a setting is how to determine what changes in resource allocations would result in better

performance, and how to provide incentives to the area directors for making such changes. Formal analysis of alternatives can play a role in some issues. However, given the nature of the management of medicine, there are major constraints on the impact that analysis can have in such decisions. K-P provides an almost ideal setting for analysis: a large-scale prepaid health program in which the decision makers have direct control over and responsibility for all major resources, and the managers have demonstrated an enlightened attitude toward supporting the analytic staffs and the data collection required to conduct meaningful studies. During the last four years, a large number of applied research projects have been completed, which provide good insight into the limitations of analysis even in such a favorable environment. The next section of this paper will review a selected set of cases from the work completed in four subject areas and the final section will summarize some of the lessons to be learned from our experience. It should be emphasized that not all the points made in this paper can be generalized to all HMOs. The opportunities, needs, and constraints faced by prepaid health care vary with each setting.

Applied Research in Resource Allocation

The analyses described below were carried out in an unusual setting, and it is important to understand some of the characteristics of the environment before the substance of the work is reviewed. During the four-year period under review (1974–1978), the staff directly involved in the projects originally envisioned for the Applied Research Unit expanded approximately tenfold, from four analysts to slightly over forty. Even a program the size of K-P could not make a commitment of this magnitude to "research." The principal reason for such growth was the steady expansion of the ongoing responsibilities, primarily staff support to both regional management and the area administrators in the twice-a-year operating and capital budget cycles. Approximately three-fourths of the applied research efforts during the four years were spent on developing the forecasting and analysis tools necessary for the short-range and long-range planning cycles described elsewhere (Richter, 1978; Rubenstein, Hester, and Brannin, 1978), and on producing those forecasts twice a year. The research projects have encompassed all aspects of the analysis, including membership forecasting, inpatient and outpatient utiliza-

tion, and selection of sites for new facilities. As both the tools and the institutional framework for the planning analysis have stabilized, the character of these projects has shifted from applied research to a greater emphasis on routine production and continuing development. The formalization of these responsibilities has resulted in the spin-off of two operating groups, one for short-range planning support, the other for long-range planning support, with the result that the regional applied research staff is again at the original size of four analysts.

A twice-a-year budgeting cycle implies that the staff responsible is continuously in production of a major set of operating forecasts: data collection and preparation, analysis of initial projections, review with administrators, and a seemingly never-ending cycle of updates and modifications. Because of the way in which staff were assigned, almost every individual involved in the applied research projects outlined below was also responsible for some aspect of this routine planning support. The continuing exposure to the blunt pragmatic probing by seasoned line administrators and regional managers inevitably shaped both the scope and the execution of the applied research projects. Much of the work represents attempts to apply simple quantitative tools to large, previously unanalyzed data bases in order to answer fundamental questions about the characteristics of K-P's membership and their use of medical care services. There has been no pretense of generating either highly refined causal models or finely tuned optimizations, for reasons discussed in the concluding section. Instead, the theme of the work has been twofold: first, the development of simple new tools for budgeting staff and facilities, and second, descriptive analyses in support of specific major issues of management.

The originators of the topics chosen included the research staff itself, line managers in the K-P facilities, regional managers in the southern California central office, and corporate staff for the K-P program as a whole in Oakland. The realities of organizational dynamics shaped both the topics selected (e.g., note the absence of a major evaluation of nurse practitioners) and the pace of completing the work. Some indication of the interaction between organizational dynamics and research issues will be given, but a full discussion of this theme is beyond the scope of this paper.

The efforts described here divide naturally into four categories of analysis: 1) membership, 2) ambulatory care, 3) inpatient utiliza-

tion, and 4) special projects. Selected major projects in each category are discussed in order to give an indication of the nature of the projects and their consequences. Each piece of work summarized is substantial enough to merit a separate paper to do full justice to the analysis; each analysis has been documented in internal K-P reports. Formal papers on several of the projects are now being prepared for publication.

Membership Studies

Outpatient Membership Project. In a prepaid group practice with multiple locations, a precise understanding of the size and composition of the membership being served at each location is essential to the functioning of the program. In the short term, the allocation of staff and total operating budget to each location must be based upon the membership served by each location. Even errors as small as 3 to 5 percent in this allocation can result in significant inequities in the physician staffing and other resources available at each location to service the needs of its members. In addition, long-range (three to ten years) planning for the allocation of capital for facility expansion must be based upon forecasts of the geographic distribution of the total growth in membership, and the draw-off of membership from existing facilities that is caused by the addition of new medical centers. This is not a simple problem, since the location of new facilities in an area can, and usually does, stimulate additional growth in membership. However, the effects of this stimulus can be analyzed separately. Finally, both cross-sectional and longitudinal analyses of utilization rates at each location require a consistent definition of the population at risk at each location.

Since the allocation of resources based on the size of the membership is such an important issue, K-P initiated a major review of its allocation methodology. The outpatient membership project examined the extent to which the members of each of the seven medical centers identified with that center and used it to obtain most of their medical care. Given a network of facilities located close enough to each other to offer each member a choice among two or more possible service locations within a reasonable driving time, it is not obvious that a well-defined membership exists for each medical center. It is quite conceivable that members might switch back and forth among several facilities, according to the availability of ser-

vices, so that no meaningful distinct membership could be identified. The project analyzed the utilization records of a 1 percent sample (13,000 members) of the program's membership over a one-year period. The results demonstrated that a well-defined membership does in fact exist for each area, and that a member-oriented allocation was feasible. The key findings were:

1. Almost 90 percent of the members who used outpatient services in the eleven-month period obtained 100 percent of their care from a single medical center; i.e., they did not split *any* of their utilization with another source of care (Table 1).

TABLE 1
Use of One of Six Medical Centers by a 1-Percent Sample (13,000) of the Members (1976)

	Number of Centers Used					
	1	2	3	4	5	6
*Percent of sample using center	89.20	9.90	0.74	0.14	0.02	0

*Based on records of visits to doctors' offices.

2. Consequently, each medical center in the region was found to be providing the overwhelming majority (typically 95 percent) of its outpatient services to health plan members affiliated principally with that medical center.

3. The age-sex profiles of the membership for the several medical centers did vary significantly (Table 2) and needed to be accounted for in analyzing utilization, especially of inpatient services.

TABLE 2
Age Composition of Members of Seven Medical Centers (1978)

Age (years)	Medical Center							Entire Region
	A	B	C	D	E	F	G	
0-14	23%	27%	23%	25%	22%	24%	24%	24%
15-44	49	49	51	49	49	51	52	50
45-64	21	20	20	19	23	19	19	20
65+	7	4	6	7	6	6	5	6
Total	100%	100%	100%	100%	100%	100%	100%	100%

These findings imply that it is possible to identify the membership served by each medical center, and to compare the differences in characteristics that should significantly influence the amount and composition of the utilization of medical care.

On the basis of these results, a proposal was made to the regional medical group management to use these data to produce a new member-based allocation. Even though the initial response to the proposal was favorable, almost eighteen months passed before the change was implemented. Since the proposed change implied significant shifts in the official allocation of members and thus of resources among the seven medical centers, a number of detailed studies were made to explain exactly why the changes occurred. The departure of the key managers who had approved the change required starting almost from scratch with a new review committee. Finally, the desire to produce more reliable estimates of the size of the over-65 population required waiting for the expansion of the sampling fraction in the data system that supported the allocation.

Membership Termination Study. This study documented for the first time the turnover of membership that results both from involuntary disenrollment due to job change, moving, etc., and from voluntary disenrollment. Because of the myriad possibilities for change in the status of membership, for example, those due to changes in benefit coverage, conversions to individual coverage, and transfers between different employer groups, it had previously been impossible to determine the true level of membership terminations. A precise set of definitions was used, along with a 10 percent sample (140,000 members) drawn from a special membership file that linked enrollment histories, to analyze both the overall termination rate and how it is affected by such matters as age, geographic location, and coverage.

The results of the study had a major effect on the conceptual framework underlying the analysis of membership growth in the program. In the past, attention had focused exclusively on the net increase in membership, which tended to be in the range of 5 to 7 percent per year. With a turnover rate of approximately 17 percent per year, it became clear that the net growth was the residual of two major gross flows: an inflow of 23 percent new members and an outflow of 17 percent due to terminations, both voluntary and involuntary. Since small shifts in either of the gross flows could have a major im-

pact upon their difference, i.e., the net growth, it was easier to understand the volatility of the fluctuations in net growth of members experienced during the 1970s. In addition, concern over the effect of the large volume of new members identified here, approximately 260,000 in 1978, led to the special project on new member entry described below.

Ambulatory Care Analysis

Early in the development of our research priorities, the decision was made to have an ongoing series of projects exploring the delivery of outpatient services. The consensus among both the support staff and the administrators was that ambulatory care offered long-term potential for changes that would result in greater satisfaction to members and providers, and greater efficiency.

Urgent Care Study. The largest single study in this group was a 2.5-year analysis of the delivery of urgent care services to a sample of 7,000 adults (over 14 years of age) at a medical center and its affiliated satellite clinics. Patients were supplied with questionnaires and their written answers used to develop a profile of the members who visited outpatient clinics and requested general medical and surgical care on an urgent basis, i.e., within forty-eight hours of initial contact. Two surveys were conducted approximately nine months apart in order 1) to develop a broad-based description of the magnitude of the demand for urgent care, the characteristics of the members who asked for urgent care, and the respective roles of different departments in handling these patients; and 2) to assess the impacts of several significant operational changes in key outpatient clinic areas. Specifically, the surveys sought to answer the following questions:

1. What are the characteristics of the members who utilize these clinics? In particular, what proportion of them perceive themselves as having "regular physicians"?

2. Are characteristics such as the member's age, sex, and length of time in the health plan significant determinants of the likelihood that users of medical short-appointment clinics will have a regular physician?

3. What are the characteristics of the physicians identified as being the members' regular physicians? For example, where are they located, and what is their specialty?

4. Why do patients with regular physicians visit short-appointment or walk-in clinics, instead of their own physicians?

5. Do patients come to these clinics with new or with old medical problems? Have they seen a physician previously for the same complaint?

The second survey, which included 5,000 patients, showed that those adults who used urgent care represented all age groups (Fig. 1), were relatively long-time members of the health plan, and tended to be habitual users of same-day or walk-in clinics. In addition, approximately one-half of the patients surveyed reported having a regular or family physician. The findings indicated that members who had regular physicians were in fact "splitting" their utilization of outpatient services. This was confirmed by the patients' response to the question on why they were using the medical short-appointment clinic and walk-in clinics instead of their regular physicians. Although many patients mentioned the difficulty in getting to see their physicians, almost one-quarter (23.8%) of the

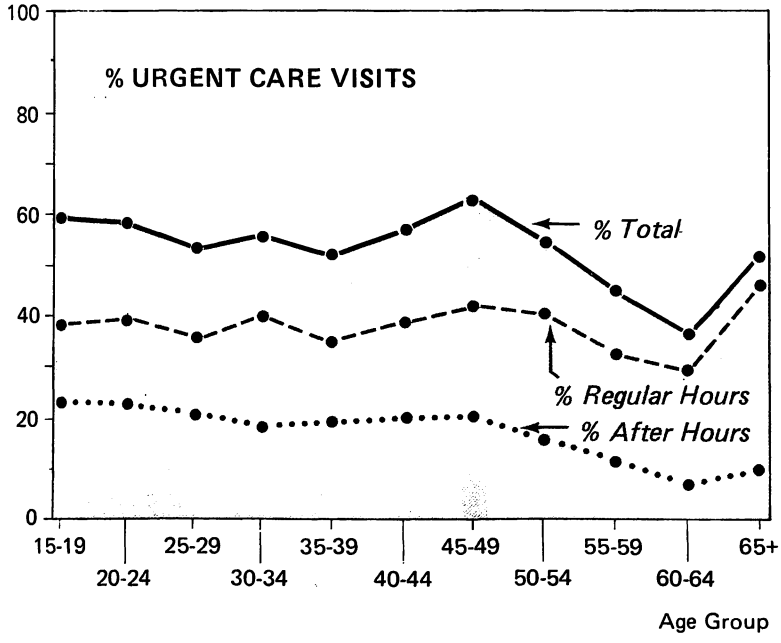

FIG. 1. Estimated proportion of 5,000 outpatient visits for urgent care to the departments of internal medicine, family practice, obstetrics and gynecology, and surgery, plotted by age groups.

ple entry points in the health care system generate special problems. False economies in one department, for example in the evening after-hours clinics, can result in lack of definitive care, so that the patient soon reappears at some other point in the system.

Dealing with this issue requires accurate, reproducible coding of medical problem and diagnosis. This has been achieved in research and smaller operational settings (Barnett, 1973; Greenfield et al., 1978), but not at the scale (six million provider contacts per year) involved in K-P. Since research applications by themselves cannot justify the costs involved, the program is currently reviewing whether its management analyses will require such data.

Inpatient Utilization

Estimates of inpatient utilization rates at specific medical centers are an essential component of both long- and short-range planning in the program. In the short term, forecasts of patient days are the measure of workload volume, which drives the budgets for hospital staffing. In the long-range analyses, the timing and size of major additions to the number of beds are linked directly to projected utilization by members. The use of inpatient services within the program shows a degree of variation that has yet to be explained. If we compare utilization rates in the seven medical centers, we find a 55 percent variation even after adjusting for age and sex differences (Table 3). If we look at region-wide trends over time, we find that raw utilization (not adjusted for age/sex changes in membership) has declined an average of 1 percent per year over the last eight years, and age-specific utilization has decreased almost twice that fast.

TABLE 3
Comparison of Annual Inpatient Utilization Rates at Seven Medical Centers (1976)

Inpatient Utilization (Days/1000 Members)	Medical Center							Entire Region
	A	B	C	D	E	F	G	
Actual	480	399	426	528	430	493	309	441
Age/sex adjusted	448	437	424	519	411	504	333	441

Inpatient Utilization Study. This study utilizes the computerized 100 percent sample of discharge abstracts, which has been main-

tained in the program since 1969, as a resource in explaining the behavior described above. The utilization data have been combined with age- and sex-specific membership data to allow a population-based analysis. The analysis first computes the utilization rate expected for each area if it followed regional average patterns. The variation from expected is then explained by three types of factors: age-sex composition of membership, admission rates, and lengths of stay. Case mix is adjusted by using either the diagnosis categories of the Professional Activity Study (PAS) or the diagnosis-related groups (DRGs) developed by Fetter and Mills (1976). The analysis is carried out for each of the five major services (obstetrics, gynecology, pediatrics, medicine, general surgery) at each medical center, as well as for the medical center as a whole.

The study has not been completed as yet, so that its final results and impact cannot be described. First indications are that variations in morbidity patterns from area to area, as well as differences in physician patterns of practice, will be important in explaining the data in Table 3. Preliminary results of the analysis by service have already been incorporated into the short-term forecasts prepared for setting hospital budgets.

Inpatient Case-Mix Analysis. In a related effort, the case mix of each of the K-P hospitals has been compared both with each other and with a sample from community hospitals. This study is not population-based like the previous one. It looks only at the patient load admitted to each hospital and estimates the relative complexity of the case mix it represents and the impact of that case mix on the average length of stay and average cost.

The K-P data for one year (1976) were obtained from the 100 percent sample of discharges already described. Data on clusters of community hospitals, for the same year, were purchased from a discharge abstract service. The first step was to construct the detailed profile of the case mix served by each institution by allocating each discharge into one of 383 DRGs. The DRGs are more appropriate than the traditional categories of the International Classification of Diseases, Adapted (ICDA) or the PAS categories for analyzing the impact of case mix on resource use, because they take into account the effect of secondary diagnoses, operations, and complications (Fetter and Thompson, 1975). The distributions were consolidated into case-mix indices by using total length of stay by DRG as a

weighting factor. The analysis separated out the relative importance of two types of effects—differences in the mix of patients hospitalized, i.e., case mix, versus differences in the manner in which patients with the same medical problem were managed, i.e., performance.

Interpretation of the distributions and indices is now under way. However, preliminary results agree with the early findings of the inpatient utilization study and reveal a significant variation in case mix among the K-P medical centers. Both of these studies began because of a concern over how differences in inpatient utilization affect resource allocation. Inpatient days are a fair measure of resource use in planning future facilities, but they are a poor measure of costs per case in estimating the impact of case mix on operating costs. Carrying out the case-mix analysis disclosed one of the disadvantages of prepaid medical care: since no hospital bill is prepared for each patient, there was no record on a case-by-case basis of the services used. This meant that it was impossible to determine the average cost per case for the different types of cases. Surrogate cost data from fee-for-service hospitals can be, and have been, used to make approximate calculations. However, a full analysis of the effects of case mix on *costs* will not be possible until the equivalent of a patient billing system is installed. As was the situation in the problem of missing data on medical problems for outpatient services, such a data system could not be justified if they were to be used only in an analysis. It appears that an automated admit, discharge, and transfer system, combined with portions of automated order-entry systems, can be justified by their impact on hospital operations. If so, they will provide the core of the required cost data system. In summary, although prepaid health plans do not require detailed resource-tracking systems for external billing, such systems may be quite useful for the internal management of medical center budgets and rates.

Special Projects

The project described here is representative of the short-term interdepartmental efforts requested by senior regional management to resolve pressing, immediate questions. Since the analysis phase typically lasts only two to three months, any new efforts to collect significant source data are precluded.

New Member Entry Project. The manner in which approximately 260,000 new members each year enter the Southern California Region of the Kaiser-Permanente Medical Care Program was reviewed by a special regional committee. The objective was to develop recommendations that would improve the entry system in three ways:

1. More appropriate matching of services to the needs of new adult members, especially for those with immediate medical problems.

2. Improved control over entry, to reduce the peaked workload that now results from the concentration of new enrollments effective in the first month of the year.

3. Improved orientation of new members, to make them more familiar with proper utilization of services, and to encourage them routinely to use one particular medical center and provider as a source of care.

The committee's findings and recommendations covered all aspects of the region's response to new members: processing of applications and issuing of membership cards, providing initial acute and routine medical services, orienting and educating the members, and linking new members to a particular location of care and a regular provider. It was not possible to single out one or a few functions that could be concentrated on, to the exclusion of the rest.

The report relied heavily upon the experience of the committee members and of other individuals in the program who were interviewed during the course of its work. This expertise was supplemented by statistical analysis, which usually confirmed the first impressions of the committee but from time to time provided some surprising insights. The data for this analysis came from a combination of the special files of membership status developed from the termination study described previously, the 1 percent member-oriented sample of outpatient utilization based upon encounter data, and special surveys conducted at two medical centers. Such statistics were useful; however, the most important information came from the lengthy candid exchanges among the committee members during their working sessions. After distribution of the preliminary report of the committee, these discussions were expanded to include all senior managers.

Two of the principal findings that shaped the recommendations were:

1. The number of new members entering the program each year is substantial in all medical centers, but varies widely from area to area. Even with the closing of new group enrollment in 1978, 260,000 new members should be added, representing 103,000 new families. For a typical medical center (200,000 members), this represents 160 new members each working day, 110 being adults over 15. The percentage of members who were new in 1976 averaged 18 percent region-wide, but varied from 31 percent in one medical center to 14 percent in two other medical centers (Table 4).

TABLE 4
Number and Age Distribution of New Members in Seven Medical Centers (1976)

Members	Medical Center							Entire Region
	A	B	C	D	E	F	G	
Number new members	43,700	45,200	19,600	27,400	50,600	28,200	19,500	234,200
Percent new members	17%	20%	14%	15%	31%	14%	17%	18%
Total members	257,000	220,000	138,000	185,000	164,000	199,000	116,000	1,279,000

2. New members seek and obtain their first medical services much more quickly than was anticipated. They account for a significant fraction of outpatient services. In 1976, approximately 45 percent of new members had an initial contact for care within their first three months of membership. This rate is comparable to that of the health plan membership as a whole, and appears to represent needs for specific acute or chronic care as opposed to physical examinations. Overall, new members account for about one-fifth of the outpatient services provided.

The recommendations are expected to be incorporated as specific objectives for each department involved. They encompass a broad scope of program operations, including the first health assessments after the member joins the roll of the regular physician, the distribution and content of membership cards and orientation literature, and the timing of new admissions to membership.

Some Observations

In assembling the above summary of applied research projects, it has been impossible to resist the temptation to reflect on the current limitations to the effective application of analysis to questions of resource allocation faced by providers in general and by health maintenance organizations in particular. This is admittedly a significantly restricted subset of possible applications, yet the topics involved are essential ones for the translation of broader policy analyses into changes in how people actually obtain medical care. These particular applications also face the most demanding requirements from the decision makers involved. If these analyses turn out to be in error, to have neglected a key factor or misestimated a response, the manager involved has to live with the consequences of those mistakes, often for a long time. Also, since resource reallocations usually imply that some medical centers will get a smaller staff and fewer facilities, the intensity of the probing of staff analysts by the "losing" manager is something that must be experienced to be appreciated. This interaction over time, in fact, represented an ultimate quality-control system upon much of the work presented here. As such, it had some obvious limitations; for example, emotions occasionally overruled logic, and the critic's lack of formal analytic background sometimes hindered the unraveling of the critical comments and using them to make adjustments in the methodology. However, in comparing these experiences with the more traditional reference system for papers, I believe that the sustained interaction over time with an interested group of critics was more effective in revealing flaws in logic, alternative approaches, and basic inconsistencies or errors in source data. For the reasons detailed below, much of the extensive body of analytical work published to date is not very helpful in such a setting. This is not meant as a condemnation of the work, but rather to emphasize that the requirements are different.

Health Maintenance Organizations: Uniform Concept, Diverse Reality

Health maintenance organizations have received steadily increasing attention as an alternative form of organizing, providing, and reimbursing health care services. For the most part, HMOs are classified into two primary types, prepaid group practices with physicians

organized into multispecialty groups and paid an annual salary, and groups of independent practitioners, which are looser affiliations of physicians who are reimbursed on a fee-for-service basis. Although some awareness appears to be developing of the great diversity that exists among existing HMOs, even among those that fall into the prepaid group practice model, this understanding is not widely shared. The prepaid group practice form of HMOs is an extremely complex organization involving numerous formal contractual arrangements among health plan administrators, medical care providers, and the administrators of clinic and inpatient facilities. The resulting institutional relations, financial incentives, and administrative practices vary widely and often influence the performance of the HMO as measured by any number of key standards: cost, accessibility, quality of services, member satisfaction, etc. In addition, as was emphasized in the introduction to this paper, multiple service locations, even when restricted to just a single HMO, usually imply the likelihood of significant variations in administrative practices and the local organization of care, which can readily confound analyses that do not take them into account.

In short, the conceptual model of an HMO that is often employed in comparative analyses between the prepaid and fee-for-service sectors, or is used in analyzing policy options for HMOs in general, is usually greatly oversimplified. It neglects key characteristics of the internal structure of those institutions, and uses aggregate measures of both inputs and outputs that often blur essential differences in performance. Some of the difficulties include the following:

1. The importance of the dynamic nature of both the membership and provider staffing is often underestimated. In our work we have found numerous examples were the 15–20 percent turnover in membership per year, and the slightly lower rates of turnover of physicians per year, affect the development of member-physician relations, member behavior in seeking care, and demands upon marketing and enrollment staff.

2. The incentives felt by individual salaried physicians on the staff are complex, and the role of economic incentives, such as the bonus offered by the Southern California Region of the Kaiser-Permanente program, may be greatly overestimated. Similarly, the economic benefits of the practice of preventive medicine are questionable in the eyes of the average staff physician (Luft, 1978).

3. The per capita amount and mix of both inpatient and outpatient services utilized by HMO members varies widely and cannot be explained by simple age-sex adjustments. Utilization rates appear to be influenced not only by internal factors such as member characteristics, provider attitudes, accessibility to care, and out-of-pocket costs, but also by external factors such as geographic setting and community provider standards.

Tools for Analysis

One of the principal reasons for the confusion outlined above and for the major limitations on analysis at the current time is the lack of adequate tools for describing the behavior of a HMO at a detailed, as opposed to gross, level. In order to make valid cross-sectional comparisons, or to anticipate "what happens if . . . ," the following tools are needed:

1. Reasonable models of behavior of members and providers, to predict the impact of differences in structural variables and other changes.
2. Accurate, reproducible measures of key inputs and outputs for both inpatient and outpatient services.
3. Routine collection of key data on mix of services, costs, and accessibility as part of an ongoing management information system that provides both summary reports to regional management and regular operating reports to line supervisors.
4. Techniques for combining impacts when the organization has multiple objectives.

In spite of the extensive research in health care delivery during the last three decades, the tools available in these areas fall short of the need. The understanding of key incentives and the factors motivating behavior, which is incorporated in many of the formal models that attempt to explain the behavior of users and providers, is often somewhat naive and idealistic. For example, models are needed that can estimate outpatient utilization while taking into account the effect of member characteristics, economic incentives, and characteristics of the delivery system within an HMO framework. Does a more definitive handling of a medical problem during the patient's first visit reduce the need for follow-up visits and thus result in lower total cost per episode? What is the impact of significant im-

provements in access upon utilization in a setting where out-of-pocket costs are negligible? How does the time required for a task change when a more skilled (or less skilled) provider is used?

The measures of output for inpatient utilization that allow analysis of case complexity have steadily improved during the past several years. We have been satisfied with the preliminary results of such classification systems as the diagnosis-related groupings (DRGs) mentioned before. This is unfortunately not true for outpatient utilization. The difficulties of obtaining reproducible coding of outpatient utilization are substantial because of the need to combine the formal diagnoses with the more general presenting symptoms in order to capture the full range of cases. The revised classification scheme developed for the National Ambulatory Care Survey is currently being assessed. Also, it is highly desirable to be able to describe outpatient utilization in terms of the total services associated with the episode of care for a given medical problem. Even within a prepaid group practice, which theoretically provides all outpatient services, the difficulty of linking discrete services spread out over a period of many months, and provided at multiple locations, is great.

A final difficulty has been the basic one of obtaining a consistent interpretation of even simple sets of definitions and complete reporting on services in a system where literally hundreds of persons are involved in collecting the source data. Even within the same organization, ensuring consistent reporting of outpatient utilization by discrete categories turned into a major one-year project. As for measures of input, although measuring total costs and the amount of mix of staff time would seem to be relatively straightforward, stubbornly persistent problems have been encountered in obtaining sets of cost centers that reflect the actual structure of the delivery system, accurate accounting of direct costs to those cost centers, and meaningful allocations of indirect costs.

Many of the data used in these analyses came from a set of special computerized reporting systems, which collected data on an ongoing basis. These included a 100 percent sample of hospital discharge abstracts, a 1 percent sample of all outpatient utilization, and a 10 percent sample of members and their membership transactions. A substantial support staff (twelve clerks and five analysts) was assigned to these systems to enter the source data, ensure data quality, and program both routine and special reports. While many

new HMOs have comparable or even better systems of collecting source data, very few of them have reached the stage of organizational maturity where they have the resources required to collate and interpret these data in special studies of the type described here. An additional problem for many of the new HMOs is their size; for example, with 30,000 members the number of inpatient episodes is too small to analyze case mix in a meaningful way.

It is not at all unusual in the history of the evolution of quantitative techniques, both within the health care field and outside, to find premature pressure to make analysis relevant by linking basic research to immediate prescriptions for improvement. Short-sighted responses to these forces can lead, and have led, to measurement for measurement's sake and to the neglect of the sound foundations necessary for long-term credibility. It is to be hoped that the basic tools needed to extend the range of potential applied-analysis projects chosen by large institutional providers will be forthcoming. In the meantime, the following are two of the guidelines governing the selection of applied research projects at Kaiser-Permanente:

1. Keep the research issues simple and clearly framed with an emphasis on descriptive profiles of what exists now, or on historical trends. The only two Kaiser-Permanente projects that have ventured beyond descriptive analyses are the travel-time models used in facility-location analysis, and a probable-length-of-stay model incorporated in an optimal scheduling system for elective admissions. Otherwise, recommendations for change have been tentative, and stressed the use of pilot projects. Both the conceptual and operational designs of the pilots have relied heavily upon nonanalytic inputs from line staff and managers.
2. Concentrate on areas where significant differences appear to exist, so that the uncertainties introduced by less than desirable measuring rods are not critical. For the most part, this has led to a de-emphasis of such areas as outpatient provider manpower, quality of care, and health status outcomes.

For the foreseeable future, formal analysis within K-P will play a secondary, supporting role, and the judgment of intangibles will remain a key aspect of most major decisions. The decision makers within the program know the limits of the tools available, even if from time to time the analysts forget them. Any efforts to revise the current organization and practice of medicine must be led by the

physicians immediately responsible and directly involved. Even within a formally structured group such as the medical group of K-P, policy can rarely be imposed from above and the hierarchical structure is somewhat of an illusion. This is rightfully so. Repeatedly, we have found that the autonomy of the seven medical centers in K-P has led to the evolution of differences in structure and administrative practice that are often the result of an understanding of special local conditions. However, as in any institution, lags can occur both in responding to changes in local circumstances, and in accepting innovations developed elsewhere. The issue in such circumstances is how to provide accountability in terms of broad measures of performance so that the autonomy is not abused, and equitable allocation of resources can be made. K-P is currently implementing two different performance-budgeting systems, one for its hospital operations and the other for the medical group, in an effort to improve the basic management controls to enhance local accountability. Many of the applied research projects described above have contributed to these systems, which are intended to lead to a more appropriate incentive structure for the local chiefs of service, department heads, and area administrators. This environment, combined with the ongoing natural experiments in administrative practice and operational structure, promises to make K-P an even more fruitful setting for applied research in the future.

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