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BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Health Maintenance Organizations Can Help Control Health Care Costs

GAO's analysis of the economic performance of federally qualified group practice and staff model health maintenance organizations (HMOs) indicated that:

--They were taking into consideration the relative costs of providing services when deciding whether to use medical staffs, ambulatory health centers, and/or hospitals. Because the costs of these services are not affected by third party payments, HMOs should be able to allocate these resources efficiently and help control health care costs.

--There are significant economies of scale in providing comprehensive prepaid care. If the HMOs studied continue to grow, the per unit cost of care will fall. However, sufficient demand and good management are prerequisites for these HMOs to achieve lowest per unit cost.

--With increased time in operation these HMOs, on the average, are experiencing increases in the real cost of providing care.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-197938

To the President of the Senate and the
Speaker of the House of Representatives

This report uses advanced economic analysis to study the performance of health maintenance organizations qualified to receive Federal assistance under the Health Maintenance Organization Act of 1973, as amended. We undertook this analysis to determine if these organizations are performing efficiently in the provision of health care services.

We are sending copies of this report to the Director, Office of Management and Budget, and the Secretary of Health, Education, and Welfare.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

HEALTH MAINTENANCE ORGANIZATIONS CAN HELP CONTROL HEALTH CARE COSTS

D I G E S T

Health maintenance organizations (HMOs) provide comprehensive health care for voluntarily enrolled members in return for a prepaid fixed fee, in contrast to the traditional system which provides care on a fee-for-service basis. The Federal Government has encouraged and assisted the growth and development of qualified HMOs through financial and legal aid.

Proponents of the HMO concept contend that they can provide care more efficiently and control overall health care costs by altering the basic incentive structure affecting providers.

Using new cost analysis methods, GAO analyzed some issues relating to the economic efficiency of these organizations. This study differed from previous studies of HMOs in that it did not involve direct comparisons of costs, rates of use, or other aspects of performance between groups of individuals enrolled in them and those who are not. Instead, it uses information from reports these organizations must file with the Department of Health, Education, and Welfare (HEW).

WHAT GAO DID

Several factors affect the cost of operating an HMO--its size, the number of patients served per quarter, the prices paid for physician and hospital services, how long it has been in operation, etc. GAO has used a complex statistical analysis to study the impact on cost of one variable, while holding the others constant.

WHAT GAO FOUND

GAO's analysis which was restricted to the group practice and staff model types of HMOs due to data limitations, showed that:

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--These federally qualified HMOs were taking into consideration the relative costs of providing services when deciding whether to use the services of medical staffs, ambulatory health centers, and/or hospitals. Because the costs of these services are not affected by third party payments, HMOs should be able to allocate these resources efficiently and help control health care costs.

--If the HMOs analyzed, which ranged in size from 1,131 to 37,087 members, continue to grow, the per unit cost of providing care will fall. GAO could not determine precisely how large an HMO must be to realize all economies of scale since larger HMOs were not represented in the sample. In many areas HMOs may never be able to achieve the minimum size necessary for efficient provision of health care, because of financial and managerial constraints or lack of an adequate demand for their services.

--Given sufficient growth in enrollment, well-managed HMOs eventually will achieve maximum efficiency. But without the discovery and use of new productivity-increasing technology, further reductions in costs are unlikely. There are now some opportunities for these organizations to substitute between capital and labor services in providing ambulatory health care, given existing technology. However, if wages for medical staffs increase substantially, there may soon be little possibility for HMOs to offset increased salary costs by increasing productivity through greater use of capital equipment.

--With increased time in operation, these HMOs, on the average, are experiencing increases in the real cost of providing care. This could lead to some deterioration in the financial positions of many federally qualified HMOs that

are incurring deficits and are not increasing enrollments.

The detailed data on costs, memberships, and utilization levels collected by HEW through the HMO national reporting requirements were instrumental in completing this study. However, many of these reports were either missing entirely from HEW files or had been incompletely or incorrectly submitted by the HMOs.

GAO tried to eliminate all suspect data through a close scrutiny of these reports. The analysis was restricted to the group practice and staff model HMOs because of the limited number of individual practice association HMOs qualified and operating as of December 31, 1977. As more data become available on these organizations, GAO's methodology should be useful in conducting future research on and comparisons of the performance between the different types of HMOs and between HMOs and the traditional system.

TOPICS FOR FURTHER RESEARCH AND ANALYSIS

HEW recently organized an advisory panel to help determine the direction of its HMO research and evaluation activities. GAO commends this effort and recommends that HEW study the following topics:

--Because of data limitations, GAO's economic analysis was restricted to group practice and staff model HMOs. Major differences in organizational structure and incentives exist for the third type-individual practice associations. Since these characteristics may cause differences in performance, further research on and comparison of the performance of different types of HMOs can be performed when more data become available.

--GAO's analysis indicated that group practice and staff model HMOs were taking into consideration the relative costs of providing services unaffected by third party payments when deciding whether to

use the services of medical staffs, ambulatory health centers and/or hospitals. More research on and comparisons of the performance of HMOs and the traditional system are necessary to estimate the magnitude of the resulting cost savings. One approach would be to compare the total annual cost of health care for a representative sample of members of federally qualified HMOs with the total annual cost for a comparable sample of persons receiving care from the traditional system.

--GAO found that HMOs in the range from 1,131 to 37,087 members were experiencing increasing returns to scale in providing comprehensive prepaid health care. Because GAO did not have any information on larger HMOs, it could not determine how large an HMO must be to realize all the available economies of scale. As more data become available on larger HMOs, further research could be directed toward more accurately identifying the minimum efficient size.

--GAO based its analysis on three measures of HMO output: the number of ambulatory encounters with physicians, the number of ambulatory encounters with allied health professionals, and the number of hospital discharges. One can, however, conceptualize the final output of HMOs as the improvement or maintenance of the health status of enrollees. Data on the health status of enrollees will be needed to conduct future research and analysis on the effect of HMOs on the public's health.

RECOMMENDATION TO THE SECRETARY OF HEW

HEW should study the above topics and report its study results to the Congress.

AGENCY COMMENTS

HEW considered our findings generally positive. HEW noted that the Office of Health Maintenance Organizations had recognized the need for timely

reporting of reliable data and had taken steps to decrease the frequency of late reporting and increase the reports' reliability.

HEW agreed with GAO's finding that there might be little possibility for HMOs to offset substantial increases in medical staff salaries by increasing productivity through the greater use of capital equipment and noted that, although these organizations could not control medical staff salaries, they were employing nurse practitioners, physician assistants, and other paramedical personnel at generally half the salaries of physicians. HEW believed this was a positive trend. GAO agrees and encourages HEW to study the extent to which nonphysician services are being substituted for physician services in HMOs and the magnitude of the resulting savings.

HEW concurred in GAO's recommended topics for further studies.

Tear Sheet

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ABBREVIATIONS

GAO	General Accounting Office
GNP	gross national product
HEW	Department of Health, Education, and Welfare
HMO	health maintenance organization
IPA	individual practice association
PGP	prepaid group practice

CHAPTER 1

INTRODUCTION

Health maintenance organizations (HMOs) are legal entities which provide specific comprehensive health care to voluntarily enrolled members in return for a prepaid fixed payment. They are primary alternatives to the traditional health care delivery system, which provides care on a fee-for-service basis. Proponents of the HMO concept contend that HMOs can more efficiently provide care and control overall health care costs by altering the basic incentive structure affecting providers.

LEGISLATIVE BACKGROUND

The Federal Government has encouraged and assisted the growth and development of HMOs through the Health Maintenance Organization Act of 1973 as amended (42 U.S.C. 300e). The act authorizes a program designed to help HMOs by 1/

--providing grants, loans, and loan guarantees;

--requiring certain employers to include in any employees' health benefits plan the option of membership in an HMO that the Secretary of Health, Education, and Welfare has "qualified" as complying with the requirements of the act; and

--preempting State laws and practices which could hinder development and operation of qualified HMOs.

The original act spelled out in considerable detail the definition of and requirements for an HMO qualified to receive Federal assistance. Among other things, the act specified the basic and supplemental health services to be provided to enrollees, the basis for fixing the rate of prepayment, the requirement that HMOs have open enrollment periods for individual members without restrictions (such as on preexisting medical conditions), and the organizational forms of an HMO.

1/For a more detailed discussion of the requirements of the act, as amended, see our earlier report entitled "Can Health Maintenance Organizations Be Successful? An Analysis of 14 Federally Qualified 'HMOs,'" HRD-78-125, June 30, 1978.

The Health Maintenance Organization Amendments of 1976 (90 Stat. 1945) increased the flexibility of HMOs qualified under the act by relaxing the number of required health services, increasing the options for staffing and organization, and providing for waivers and delays of the open enrollment and community rating requirements. These amendments also increased the funding limits for the grant and loan assistance programs and extended the period for which loan funds could be used to cover operating cost deficits from 36 months to 60 months.

The Health Maintenance Organization Amendments of 1978 (92 Stat. 2131) further increased the funding limits for the grant and loan assistance programs, provided for the establishment of a National Health Maintenance Organization Intern Program to train HMO managers, and required greater financial disclosure by federally qualified HMOs.

The original act also placed specific evaluation requirements on us. Section 1314(a) directed us to evaluate HMOs' ability to provide prescribed health services; meet organizational and operational requirements; enroll as members the indigent, the high risk, and the medically underserved; and operate without continued Federal assistance. Section 1314(b) directed us to report on the effects of requiring certain employers to offer their employees the option of enrolling in a qualified HMO. Section 1314(c) required us to (1) evaluate HMOs' effect on the health of the public, (2) evaluate and compare operations of different types of HMOs, and (3) evaluate and compare HMOs with alternative forms of health care delivery.

Section 13 of the HMO Amendments of 1978 further required us to evaluate (1) the adequacy of the amounts of funds available under the grant and loan programs and (2) the adequacy and effectiveness of Department of Health, Education, and Welfare (HEW) policies and procedures for managing these programs.

In compliance with sections 1314(a) and 1314(b) of the act, as amended, we reviewed the activities of 14 HMOs which had obtained Federal financial assistance under the act. 1/ Our findings indicated that with some important exceptions, each was generally providing health services in the manner required by the act and that basically each was organized and operated as the act required.

1/"Can Health Maintenance Organizations Be Successful? An Analysis of 14 Federally Qualified 'HMOs.'"

To determine the effect of the dual choice requirement on employers' costs, we interviewed 247 employers whose establishments were within the targeted membership areas of the 14 HMOs. Most were offering the HMOs as a dual choice. The employers contacted reported no significant effect on their costs from offering the HMO as an option.

In compliance with section 13 of the HMO Amendments of 1978, we evaluated HEW's management of the HMO program and the adequacy of the Federal financial assistance available to HMOs. 1/ Our report concluded that HEW must continue improving program management and that Federal financing was adequate for well-managed HMOs.

Our previous reports on HMOs concentrated primarily on evaluating HEW's management of the HMO program. This study focused on analyzing the operations of federally qualified HMOs. Enough data have recently become available through the HMO national data reporting requirements (see app. II) to allow us to analyze several important economic aspects of HMO performance.

FEDERAL FINANCIAL ASSISTANCE UNDER THE HMO ACT

The act authorized grants to public and private nonprofit organizations for feasibility studies, planning projects, and initial development costs. The act also authorized guarantees of non-Federal loans for the planning and initial development of private for-profit organizations intending to serve medically underserved populations. The act, as amended in 1976, also authorized HEW to help a qualified HMO meet operating deficits incurred during the first 5 years of operation after qualification by (1) loaning up to $2.5 million to each public or nonprofit HMO or (2) guaranteeing non-Federal loans up to $2.5 million to each private HMO operated for profit which served a medically underserved population.

The HMO Amendments of 1978 increased the amount of funds available for initial development and raised the ceiling on loans and loan guarantees from $2.5 million to $4 million, effective October 1, 1979. These amendments also authorized loans and loan guarantees of up to $2.5 million for acquiring and constructing ambulatory health

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1/"Health Maintenance Organizations: Federal Financing Is Adequate But HEW Must Continue Improving Program Management," HRD-79-72, May 1, 1979.

care facilities and grants for providing managerial internships under the National Health Maintenance Organization Intern Program.

Table 1 shows the amounts of grant assistance provided under the act for feasibility studies, planning projects, and initial development for fiscal years 1975-78. Grant assistance over these 4 fiscal years for all purposes totaled $74,558,790. As of February 1979, 58 of the 88 qualified HMOs had also received direct loans totaling $119.3 million. In addition, HEW has guaranteed non-Federal loans to three HMOs totaling about $3.5 million.

SCOPE OF THE ANALYSIS

We used a recently developed advanced method of statistical cost analysis to evaluate the economic performance of 20 federally qualified HMOs. Our methodology, which is summarized in chapter 3 (see pp. 17 to 19) and discussed in detail in appendix I, did not require the prior restrictions and prior assumptions of other statistical designs. (See app. I, pp. 36 to 38.) The necessary data were recently obtained through the HMO national data reporting requirements developed and implemented by HEW.

The data and methodology were sufficient for us to address several important economic aspects of HMO performance. Specifically we were able to analyze whether HMOs could control overall health care costs by (1) responding to relative input costs unaffected by third party payments and substituting among the services of their medical staffs, ambulatory health centers, and hospitals, (2) substituting capital for labor services, and (3) realizing returns to scale in providing health care. Because of limitations in the data, we could not, however, compare the quality of care among HMOs, the quality of care between HMOs and the fee-for-service system, or the cost of providing comparable levels of care between HMOs and the fee-for-service system.

Because of the technical nature of this analysis, a draft of this report was submitted to some outside experts for review. After evaluating their comments, we respecified and reestimated the underlying model. Because the results generally did not change regardless of which specification was used, only the results of the more recent cost analysis are presented here.

Table 1

HMO Act Grants a, b/

FY	Feasibility Number	Feasibility Amount	Planning Number	Planning Amount	Initial development Number	Initial development Amount	Total Number	Total Amount
1978	66	$ 4,543,193	13	$ 2,068,433	21	$10,367,195	100	$16,978,821
1977	5	208,686	15	2,223,133	26	14,515,510	46	16,947,329
1976 (note c)	11	509,370	41	5,080,602	20	12,580,368	72	18,170,340
1975	108	5,196,281	31	3,758,745	33	13,507,274	172	22,462,300
TOTAL	190	$10,457,530	100	$13,130,913	100	$50,970,347	390	$74,558,790

a/Supplemental grants are not counted as separate grants in the "Number" column. Supplemental grant amounts are included in the "Amount" column.

b/Before the HMO Act, planning and development grants for HMOs were awarded under sections 304, 314(e), and 910(c) of the Public Health Service Act.

c/Fifteen month fiscal year.

CHAPTER 2

THE HMO CONCEPT

Expenditures on health care in the United States have increased substantially since 1965. In fiscal year 1977 health spending was estimated to be $163 billion, or 8.8 percent of the gross national product (GNP). The figure was well over double the $69.2 billion spent in 1970 when health expenditures accounted for 7.2 percent of the GNP and more than quadruple the total estimated health expenditure in 1965 of $39 billion, or 5.9 percent of the GNP. In per capita terms, health spending increased from $198 for each person in the United States in 1965 to $334 in 1970 and $737 in fiscal year 1977. 1/

The largest components of health expenditures are for services provided by hospitals and physicians. 2/ In the United States most of these services are provided by the traditional, fee-for-service system of health care delivery. Factors leading to the overall increases in health care costs include inflationary pressures, advances in medical technology, and increases in the overall demand for medical care. Two aspects of the fee-for-service system could have exacerbated the protracted and escalating increases in overall health care costs.

First, payments to providers are made based on the number and complexity of the services. This gives fee-for-service physicians, who have direct control over substantial amounts of health resources, financial incentives to encourage more frequent office visits, order more tests and treatments, and hospitalize patients.

Second, providers are generally paid by various third party financial agents and not by patients' out-of-pocket expenditures. Between fiscal years 1965 and 1977, the growth of private health insurance and public health spending increased the amount of third party payments from 47.5 to 69.7

1/The Health Care Financing Administration's projected estimate of total health care expenditures in fiscal year 1978 was $182.2 billion, which represents 8.9 percent of the GNP and an expenditure of $819 per capita.

2/In fiscal year 1977 hospital services were estimated to account for 40 percent of total health spending and physician services for 20 percent.

percent of personal health expenditures, 36.8 to 61.2 percent of expenditures for physician services, and 81.5 to 94.1 percent of expenditures for hospital services.

This system of third party payments can increase health costs and create inefficiencies since third party payers generally

--have little or no control over how health resources are allocated;

--reimburse providers on the basis of actual costs or fees charged;

--offer more complete coverage for hospital care than for less expensive alternatives, such as ambulatory or home care; and

--reduce the out-of-pocket costs of medical care to patients, which increases their demand for marginally beneficial or unnecessary services.

In contrast to the traditional system, HMOs combine the insurance and financing function with the direct provision of health care. Activities are constrained by a predetermined budget. Consequently, HMOs are thought to have both the incentives and the ability to control overall health care costs by (1) reacting to input costs such as the cost of various physician services and hospital services, unaffected by third party payments, which should lead them to allocate these resources more efficiently, (2) curbing utilization, 1/

1/The HMO's financial incentive to curb utilization is desirable only if it leads to a reduction in services of little or no benefit to patients. HMOs, however, have an incentive to curb services in general, and this may adversely affect the quality of care if medically necessary services are also reduced. To prevent any deterioration in the quality of care, section 1301(c)(8) of the HMO Act requires federally qualified HMOs to have ongoing quality assurance programs established in accordance with regulations of the Secretary of HEW. In addition, three other factors may reduce the probability of any significant declines in the quality of care stemming from a reduction in HMO services. First, HMO members have a countervailing incentive to demand more services since they do not face the same out-of-pocket deductibles and coinsurance payments commonly encountered in traditional health insurance policies. Second, to the extent that HMO members are mobile and able

and (3) emphasizing cost-effective preventive care. 2/ The HMO concept, however, has never been narrowly defined, and differences in organizational forms may affect these incentives.

ORGANIZATIONAL FORMS AND INCENTIVES

The Health Maintenance Organization Act of 1973 distinguishes three separate organizational forms of HMOs. The first form is the group practice, in which physicians (1) are members of closed panel multispecialty group practices, (2) are paid on either a salary or per member basis, and (3) generally share centrally located medical facilities and ancillary personnel. A minor variation of this is the staff model type, in which physicians are salaried employees of the HMO rather than members of an organizationally separate group practice.

Major differences in organizational structure exist for the third type of HMO, the individual practice association (IPA). In this type, participating physicians maintain their own individual office practices and are paid on a fee-for-service basis from a common pool of revenue which is fixed in the short run. 3/ Of the 88 HMOs federally qualified as of February 1979, 24 were group practices, 34 were staff models, and 30 were IPAs.

(Footnote 1 continued)

to perceive changes in the quality of care, competition with traditional fee-for-service providers and other HMOs in the area will discourage HMO behavior leading to declines in quality. Third, even though HMOs have an overall incentive to minimize costs, HMO physicians have little or no direct personal financial incentive to control costs by reducing utilization. This incentive is even diluted in the extreme case of the physician owned, for-profit prepaid group practice (PGP) since the financial benefits of reduced utilization must be shared with others in the group.

2/Of course, similar cost savings may also be attainable by affecting structural changes, such as establishing Professional Standards Review Organizations, in the fee-for-service system.

3/This type has also been referred to as the "medical foundation model."

The method of paying physicians, who have a major role in decisionmaking, affects HMO performance. Specifically the incentive structure for IPA physicians is mixed since their incomes are directly related to the volume and complexity of the services they provide. 1/ The salaried physicians of group practice and staff model HMOs, on the other hand, have no such countervailing incentive to supply any marginal or unnecessary care or overuse other HMO resources to increase their incomes.

HMO DEVELOPMENT

HMO development in the United States began in 1929 when the first two prepaid group practices (PGPs), the Farmers' Union Cooperative Health Association of Elk City, Oklahoma, and the Ross-Loos Medical Group of Los Angeles were established. The prototype Kaiser-Permanente Medical Care Program was organized soon afterward when Kaiser Industries contracted with Dr. Sidney Garfield in 1933 to operate a PGP for Kaiser employees in Washington State. Kaiser plans were extended to northern California, southern California, and Oregon in 1942 and were offered to the public in 1945. In 1947 two additional PGPs, the Group Health Cooperative of Puget Sound and the Health Insurance Plan of Greater New York, were initiated.

Despite the early conception and successful operation of the PGP concept, the initial development and growth of HMOs was hindered by the overt oppostion of organized medicine. Physicians working for PGPs were reprimanded, expelled, or excluded from membership in professional medical societies or denied hospital-admitting privileges. The latter practice led to a suit filed by the U.S. Department of Justice in which the American Medical Association and the Medical Society of the District of Columbia were found guilty of restraint of trade under the Sherman Antitrust Act in a 1943 decision affirmed by the Supreme Court. 2/

Gradually organized medicine lessened its opposition toward HMOs and began to support the establishment of IPAs, which retain the fee-for-service and solo practitioner aspects

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1/Since IPAs are at risk and must operate within a fixed budget, they still have an overall incentive to minimize costs and generally try to curtail overuse by establishing peer review procedures, fee schedules, and financial penalties for any unjustified provision of services by member physicians.

2/American Medical Association v. United States, 317 U.S. 519 (1943).

of the traditional system. In 1954 the first IPA, the San Joaquin Foundation for Medical Care, was organized under the sponsorship of the county medical society. According to a staff report by the Federal Trade Commission, 1/ this IPA and many other IPAs were established as a direct response to the competitive pressures of nearby PGPs or staff model HMOs.

In addition, HMO development has been hampered by restrictive State laws and regulations. These include prohibitions against the corporate practice of medicine and the advertising of services and requirements that HMOs (1) receive medical society approval, (2) meet State insurers' requirements for capitalization and financial reserves, or (3) have physicians constitute all or a controlling percentage of their governing bodies.

Such legal impediments have also diminished over time. Several States have recently enacted laws intended to facilitate HMO development, and section 1311 of the HMO Act of 1973 contained a provision to override restrictive State laws and practices affecting federally qualified HMOs.

Table 2 presents the rate of HMO formation from 1969 to 1978. These data indicate that the number of operational HMOs increased rapidly from 1970 through 1974, declined slightly from 1975 to 1977, and increased 23 percent from 1977 to 1978. Overall, the number of HMOs increased 450 percent during the the 10 years.

Table 3 contains more detailed data on HMO development from 1976 to 1978. It shows that:

--Despite the apparent decline in the number of HMOs from 1976 to 1977, total HMO enrollments increased by over 300,000, or 5 percent, during this period. Total HMO enrollment grew an additional 18 percent from 1977 to 1978.

--A quarter of all HMOs from 1976 to 1977 were IPAs, but these accounted for only 6.5 percent of total HMO enrollment. From 1977 to 1978, the percentage of HMOs that were IPAs and the percentage of total enrollment in IPAs increased substantially.

1/Federal Trade Commission, Bureau of Economics, Staff Report on the Health Maintenance Organization and Its Effects on Competition (Washington, D.C.: July 1977), p. 8.

Table 2

Formation of HMOs, 1969-78 a/

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Estimated number of operational HMOs	37	41	52	79	133	183	181	175	165	203
Percentage change over previous year	-	11	27	52	68	38	-1	-3	-6	23

a/These data are from several sources, and some variation may be due to different survey methods, different response rates, or slightly different definitions of operational HMOs. Data for 1969-74 are from Richard McNeil, Jr. and Robert E. Schlenker, "HMOs, Competition and Government," Health and Society, vol. 53 (Spring, 1975), pp. 195-224; data for 1975 are from Rhona L. Wetherville and Jean M. Nordby, A Census of HMOs (Minneapolis: Interstudy, July 1975), p. 2; and data for 1976-78 are from the National HMO Census Survey (Washington, D.C.: Group Health Association of America, 1977) p. i; U.S. Dept. of Health, Education, and Welfare, Office of Health Maintenance Organizations, National HMO Census of Prepaid Plans, 1978.

Table 3

Detailed Data on HMO Development, 1976-78 a/

Year	Number of operational HMOs	Total enrollments	Percent of HMOs that are IPAs	Percent of enrollments in IPAs	Percent of enrollments in HMOs with 100,000 or more members	H mer
1976	175	6,016,443	23.4	6.5	70	
1977	165	6,330,676	24.2	6.5	71	
1978	203	7,470,963	34.5	14.1	68	

a/The sources of these data are the same as in table 2.

--Large HMOs with 100,000 or more members have accounted for about 70 percent of all HMO enrollees over the entire 3-year period. In 1978 there were only 12 HMOs in this size group. Five of these 12 were Kaiser Foundation Health Plans with a combined enrollment of 3,408,422 members, or 45 percent of total HMO enrollment in 1978.

--The average number of physician encounters per member per year across all HMOs has remained fairly stable, ranging from 3.8 to 3.4. Hospital utilization rates showed greater variation, ranging from 488 hospital days per 1,000 members per year in 1977 to 408 hospital days per 1,000 members per year in 1978.

Geographically HMO development has been widespread, but concentrated in the West. According to the 1978 "National Census of Prepaid Plans," 37 States and Guam have at least 1 HMO, 27 States have 2 or more HMOs, and 6 States have 10 or more HMOs. However, 62.9 percent of total 1978 HMO membership and 31.5 percent of all plans are in the West; California accounts for 47.5 percent of all HMO enrollments.

Table 4 shows the numbers of HMOs qualified under the HMO Act of 1973 from 1974 to 1978. Despite the initially slow progress in qualifying HMOs, there were 81 federally qualified HMOs providing comprehensive prepaid medical care to over 4.7 million enrollees as of December 1978. 1/ The Kaiser Foundation Health Plans, which became qualified in October 1977, had a combined enrollment of over 3.4 million in 1978 and accounted for about 75 percent of total 1978 enrollment in all federally qualified plans.

The percentage of federally qualified HMOs that are IPAs has increased from 22.2 percent in 1975 to 32.1 percent in 1978 and nearly equals the percentage of all HMOs that are IPAs. From January 1 to February 12, 1979, seven more HMOs became qualified, increasing the total number of qualified HMOs to 88 and the percentage of IPAs to 34.1 percent.

1/For a discussion of the factors which hindered the initial progress in qualifying HMOs, see our earlier report entitled "Factors That Impede Progress in Implementing the Health Maintenance Organization Act of 1973," HRD-76-128, September 3,1976.

Table 4 a/

Federally Qualified HMOs, 1974-78

Year	Number of federally qualified HMOs	Percent of qualified HMOs that are IPAs
1974	1	-
1975	9	22.2
1976	27	25.9
1977	51	23.5
1978	81	32.1

a/The Kaiser health plans in the northern California, southern California, and Hawaii regions, which became qualified in October 1977, are counted as one federally qualified HMO. The Family Health Programs of Long Beach, Guam, and Utah, which became qualified in July 1977, are also counted as one HMO.

PREVIOUS STUDIES OF HMO PERFORMANCE

Numerous studies have compared several aspects of HMO performance with that of the traditional system. One recent review article 1/ cited (1) 5 studies which had compared the total annual cost of medical care (including both premiums and out-of-pocket expenditures) for groups of HMO enrollees with the total cost for non-HMO groups, (2) 26 comparisons between HMO and non-HMO use of ambulatory services, and (3) 51 comparisons between HMO and non-HMO use of inpatient services. Other studies have attempted to compare the satisfaction of HMO enrollees and the quality and accessibility of the medical care provided in HMOs with those of the traditional system. A survey of the literature on HMO performance undertaken for HEW

1/Harold S. Luft, "How Do Health Maintenance Organizations Achieve Their 'Savings'?" New England Journal of Medicine, vol. 299 (June 1978), pp. 1336-1343.

by a private consulting firm 1/ summarized the results of previous studies as showing, in general, that:

--Total medical care expenditures were lower for enrollees in PGPs than for people with conventional health insurance coverage who received health care from the traditional system. The percent of estimated total cost savings under PGPs ranged from 6 percent to 46 percent, but no similar cost reductions were documented for enrollees in IPAs.

--Hospital utilization rates were consistently lower for HMO enrollees than for groups receiving care from the traditional system. The percent of hospital utilization reduction varied from 20 percent to 70 percent for PGPs and from 8 percent to 68 percent for IPAs.

--Ambulatory utilization rates were no lower, and were often higher, for HMO enrollees than for non-HMO groups.

--There was no conclusive evidence concerning the relative level of satisfaction of HMO enrollees.

--Medical care in HMOs was of comparable or better quality than traditional care. Important exceptions arose in HMOs primarily enrolling Medicaid recipients.

--HMOs might improve the accessibility to health care, especially for low-income groups.

One could infer from this evidence that HMOs have reacted to their economic incentives and have controlled health care costs by substituting ambulatory services for more expensive inpatient services. However, these findings are not applicable to HMOs in general or to federally qualified HMOs in particular. The findings involve comparisons between selected groups receiving medical care from the traditional system with selected groups receiving medical care from a small number of specific HMOs. These HMOs are generally not representative since they are usually from the set of much larger and more well-established plans, such as the Kaiser Foundation

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1/ICF Incorporated, "Selected Use of Competition by Health Systems Agencies," final report under contract (HEW-HRA-230-75-0071) (Washington, D.C.: Dec. 1976).

Health Plans, the Health Insurance Plan of Greater New York, the Group Health Cooperative of Puget Sound, and Ross-Loos. 1/ Furthermore, variation in utilization rates and costs between groups of HMO and non-HMO enrollees may be greatly affected by differences in the casemix and the age-sex composition of the two groups. Such differences can be particularly significant if HMO memberships have come predominantly from employed populations. Some studies, however, make no adjustments to control for variation in casemix or patientmix between HMOs enrollees and non-HMO groups.

1/For example, four studies of HMO cost savings were reviewed and summarized by the ICF report. Two of these used observations on only Kaiser enrollees, while another used observations on enrollees in Kaiser and Ross-Loos. The fourth used observations on Medicare beneficiaries enrolled in seven HMOs. Three of these HMOs were Kaiser plans, one was the Health Insurance Plan of New York, and another the Group Health Cooperative of Puget Sound.

CHAPTER 3

ANALYSIS OF HMO COST STRUCTURES

METHODOLOGICAL DESIGN

Unlike previous studies, the methodological design of this study did not involve direct comparisons of costs, utilization rates, or other aspects of performance between selected groups of HMO and non-HMO enrollees. Rather, it used the data available on 20 federally qualified HMOs to estimate a multioutput, multiinput statistical cost function for HMOs. 1/

Several factors can be expected to affect an HMO's cost of operation. Among these are:

--Size: If returns to scale are important in providing health care, the size of an HMO will affect cost.

--Output rates: The higher the rates of output in terms of the numbers of ambulatory encounters and hospital admissions per quarter, the greater the input requirements and the higher the cost of operation.

--Level of input prices: An HMO which must pay more for physician services, hospital services, and other inputs will have higher costs. These prices vary over geographical areas and have increased consistently and substantially over time.

--Casemix: An HMO with relatively more complex cases will have higher costs.

--Organizational form: IPA physicians have financial incentives to order more tests and visits than salaried physicians.

--Time in operation: On the one hand, recently formed HMOs may be expected to increase efficiency and lower cost over time through a "learning-by-doing" process. On the other hand, many new medical care techniques and technologies which are introduced over time are cost increasing.

1/For a given technology and a set of input prices, a cost function represents the least cost method of producing various output rates.

Mathematically, we express the relationship as

$$y = f(x_1,\ldots,x_n)$$

where y is the dependent variable, i.e., HMO cost; $(x_1,\ldots,x_n)$ is a set of explanatory variables, such as those discussed above, expected to determine y; and f(.) is the functional form that relates HMO costs to the determining variables. A statistical cost analysis uses actual observations on the values of y and $x_1,\ldots,x_n$ to estimate the relationships between these variables. This methodology allowed us to (1) judge the impact on cost of one of these variables while, in effect, holding the others constant and (2) perform statistical tests of economic hypotheses concerning cost-output relationships and draw broad inferences about the performance of HMOs in general. Specifically, we were able to analyze three principal economic phenomena using this procedure.

First, we analyzed the extent to which size was important for the efficient provision of health services by HMOs. The fact that HMOs of 100,000 or more members currently account for 70 percent of total HMO enrollment while only 6 percent of all HMOs are in this size range makes this an important issue. This predominance of extremely large HMOs could indicate substantial increasing returns to scale in providing prepaid comprehensive care. If so, smaller HMOs would be operating less efficiently, that is, at higher cost per unit of output, until they achieved minimum efficient scale. Policymakers should be alert to any significant overall economies of scale in order not to be continually subsidizing and encouraging the formation and operation of HMOs with little likelihood of becoming large enough to achieve maximum efficiency. However, it is still important to realize that, within a given geographical area, an HMO of less than minimal optimal size may still be producing health care more efficiently than the traditional sector.

Second, we analyzed the extent to which different inputs could be substituted for each other. This phenomenon is measured by the elasticity of substitution and is essential to determining whether HMOs, as is commonly claimed, can respond to differential input costs and substitute ambulatory services for inpatient services. We derived estimates of the elasticities of substitution among four types of inputs: hospital services, medical staff services, ambulatory health center services, and administrative services.

Third, we analyzed whether HMOs were experiencing significant changes over time in the real cost of producing a

constant level of output. 1/ Under the HMO Act many federally qualified HMOs are receiving loan assistance to cover deficits incurred in the first 5 years of operation. If these recently formed HMOs can increase efficiency and lower real costs through a learning-by-doing process, some improvements in their financial positions could occur. To the contrary, many new medical care techniques and technologies which have been introduced over time are cost increasing. Consequently, the net effect of time in operation on HMO costs is uncertain a priori and must be determined by the empirical analysis.

The use of statistical cost analysis has been widespread, well-established, and well-accepted in the economics literature for many years. Most previous empirical studies of cost functions, however, have employed functional forms which ignore the multioutput nature of production processes and imply strong prior assumptions about substituting inputs. To avoid making these restrictions, our cost analysis was based on a recently developed, more generalized functional form, that is, the transcendental logarithmic form, which explicitly recognizes the multiinput, multioutput nature of production. (See app. I, pp. 34 to 38.) Modifications were made in this framework to account for variation in HMO casemix and the fact that variation in the length of time an HMO has been in operation might also affect costs. (See app. I, pp. 38 to 44.)

The data used to perform the statistical cost analysis are discussed below and the findings are summarized in chapter 4. Because of the complexity of the estimation procedure, the technical aspects of the analysis are discussed in detail in appendix I.

THE HMO NATIONAL DATA REPORTING REQUIREMENTS

Under section 1301C(11) of the HMO Act of 1973, each qualified and operational HMO must develop, compile, evaluate, and report to the Secretary of HEW statistics and other information on:

1/The difference between a change in the real cost of production and a change in the nominal cost of production is that the former is computed net of any changes in input prices, while the latter is not. Thus changes in real costs are due to changes in the physical quantities of inputs, such as land, labor, and capital, used up in the production process. Changes in nominal costs may be due to changes in the physical quantities of inputs used, changes in the prices of these inputs, or some combination of both factors.

--its operating costs;

--the patterns of utilization of its services;

--the availability, accessibility, and acceptability of its services;

--to the extent practical, developments in the health status of its members; and

--such other matters as the Secretary may require.

The HMO national data reporting requirements (Office of Management and Budget No. 68R-1496) were developed and implemented by HEW to collect these data on uniform quarterly, semiannual, and annual reports. The data we used to perform this statistical analysis of HMO cost structures were obtained from the unaudited reports submitted by federally qualified HMOs to HEW under the reporting requirements in effect from the start of the HMO program to December 31, 1977. 1/ Copies of these reporting forms appear in appendix II.

The reports contained data on HMO benefit packages, memberships, utilization, and finances. Data on HMO benefit packages were collected annually to monitor the phasein and conversion of the HMO membership to the benefit levels established in the act. HMOs were required to list the range of basic, supplemental, and other health services for each major benefit package offered to members. (See table B-1.) Data on HMO monthly membership were collected quarterly to show the sizes and trends of HMO enrollment. (See table P-1.) HMOs also had to furnish information about the number of contracts and members under various plans, such as the Federal Employees Health Benefit Program, the Civilian Health and Medical Program of the Uniformed Services, Medicaid, and employer plans. (See table P-2.) This information was supplemented by detailed data on the age and sex distribution of HMO membership, which were collected annually. (See table P-3.)

Data on the use of health care services by HMO enrollees were collected on four different forms.

The first required HMOs to report all outpatient or ambulatory care. (See table U-1.) The basic unit of ambulatory output was the "encounter," defined as a face-to-face contact

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1/The reporting requirements were slightly modified after this date.

between a patient and a provider resulting in a service to the patient. The number of ambulatory encounters was reported quarterly by type of service received, type of professional delivering the service, and membership status.

The second form required HMOs to list all total and full-time equivalent professionals and staff semiannually. (See table U-2.) Data on use of inpatient care by total membership were collected on the third form on a quarterly basis. (See table U-3A.) Two measures of inpatient output were used: total hospital discharges and total hospital days. Both output measures were classified by the type of inpatient care received. Separate reports were required for inpatient care given to Medicaid and Medicare members. (See tables U-3B and U-3C.) The fourth form (see table U-4) required HMOs to list the average number of members, the number of ambulatory encounters by type, and the number of days hospitalized for each three prepayment categories: Medicaid, Medicare, and all other prepayment contracts. This form was filled out quarterly, although it contained very little new information regarding HMO utilization.

Financial data were collected on quarterly and annual statements of both budgeted and actual income and expenses. (See table F-1.) Revenues for the period were listed by source, such as group and nongroup premiums, Medicare and Medicaid payments, charges for special services, or grant support. Total expenses were divided into seven major categories. Health plan administration expenses include the costs incurred in such administrative activities as membership enrollment and identification, data collection and processing, accounting, purchasing, and personnel and program managment. Medical group expenses are the costs of the labor services of the health care professionals who provide care to members. Health center expenses include both the capital and operating expenses of ambulatory care facilities, such as rent, depreciation, insurance premiums, maintenance, utilities, and janitorial services. Special services expenses include any additional identifiable costs of providing pharmaceutical, dental, and optical care not reported elsewhere. Hospitalization expenses are the costs of providing inpatient care to enrollees. The last two categories are for reporting the interest of outstanding loans and the cost of special programs.

THE DATA SET

There were 36 qualified and operational HMOs for which data were available through HEW's reporting system as of the fourth quarter of 1977. Of these 36 HMOs, 10 were IPAs, 8

were PGPs, and 18 were staff model HMOs. The major differences in the organizational and incentive structures of the IPAs necessitate a separate analysis of their economic performance. Because the data available as of December 1977 were not sufficient to do this, the present analysis was restricted to the group practice and staff model types of HMOs. As table 5 indicates, the qualification dates for these HMOs ranged from the second quarter of 1975 to the third quarter of 1977. Consequently, the number of quarterly observations on costs and outputs potentially available from HEW's reporting system for a given HMO ranged from 10 to 1.

Our earlier report noted that many federally qualified HMOs did not submit required reports on time and that some concerns had been raised about the data's reliability. 1/ We recommended that the Secretary of HEW assure that reports from qualified HMOs were submitted more promptly and give priority to validating HMO report data. In this analysis we found that many of the required reports were either missing entirely from HEW files or had been incompletely or incorrectly submitted. We attempted to eliminate all suspect data through a close scrutiny of the reports. Specifically, we eliminated all observations for which the data were missing or were inconsistent. These procedures reduced the number of HMOs in the sample from 26 to 20.

The final data set contained 106 pooled time-series cross section observations for the period from the first quarter of 1976 to the fourth quarter of 1977 on 20 group practice and staff model HMOs. These HMOs ranged in size from 1,131 to over 37,000 members as of December 31, 1977. The oldest plan was established in June 1971, while the newest HMO began operating in October 1977. The number of actual observations per HMO ranged from eight to one. 2/ Our statistical cost analysis depended primarily on the HMO quarterly output data in tables U-2 and U-3A, U-3B, U-3C, the HMO quarterly cost data in table F-1, and the membership and age-sex distribution data in tables P-2 and P-3.

1/"Health Maintenance Organizations: Federal Financing Is Adequate But HEW Must Continue Improving Program Management," p. 32.

2/A balanced subset of data, for which the number of observations per HMO equaled four, was also formed. A variance components analysis showed that almost all the variation in the data occurred across HMOs. We chose to use the larger, unbalanced sample to perform the analysis since it contained more information.

Table 5

The HMO Data Set

HMO name and location	Date qualified a/	Date operational	Type of HMO	Membership as of Dec. 31, 1977	Quarters of data
Piedmont Health Care Corp., Greenville, South Carolina	12/75	6/75	Staff	3,936	-
Georgetown University Community Health Plan, Washington, D.C.	5/76	11/72	Staff	37,087	7
Community Health Care Center Plan, Incorporated, New Haven, Connecticut	10/75	10/71	Staff	22,989	8
Health Services Plan of Pennsylvania, Philadelphia, Pennsylvania	4/76	4/74	Group	10,516	7
Genesee Valley Group Health Association, Rochester, New York	1/76	8/73	Group	33,385	8
North Communities Health Plan, Incorporated, Evanston, Illinois	5/75	5/75	Group	10,485	8
Florida Health Care Plan, Daytona Beach, Florida	5/75	8/74	Staff	7,577	8
Sound Health Association, Tacoma, Washington	11/74	4/74	Staff	10,963	8
Rhode Island Group Health Association, North Providence, Rhode Island	10/75	6/71	Staff	23,196	8
Penn Group Health Plan, Inc., Pittsburgh, Pennsylvania	11/75	6/75	Group	16,717	4
Rutgers Community Health Plan, New Brunswick, New Jersey	7/76	7/76	Staff	18,944	5
Prudential Health Care Plan, Houston, Texas	6/76	7/76	Group	10,500	-
Health Care of Louisville, Inc., Louisville, Kentucky	4/76	7/74	Staff	10,863	5
Share Health Plan, St. Paul, Minnesota	6/76	1/74	Staff	17,121	6

Table 5--Cont.

HMO name and location	Date qualified a/	Date operational	Type of HMO	Membership as of Dec. 31, 1977	Quarters of data
Westchester Community Health Plan, White Plains, New York	9/76	10/76	Staff	6,608	4
Prime Health, Kansas City, Missouri	11/76	11/76	Staff	9,067	4
Capital Area Community Health Plan, Latham, New York	12/76	1/77	Staff	8,840	2
Central Essex Health Plan, Orange, New Jersey	12/76	1/77	Staff	1,577	-
Health Alliance of Northern California, Los Gatos, California	11/76	8/72	Group	13,275	3
Metro Health Plan, Indianapolis, Indiana	3/77	11/74	Staff	9,267	4
Connecticut Health Plan, Bridgeport, Connecticut	3/77	3/77	Staff	3,219	3
GEM Health Association, Boise, Idaho	6/77	6/77	Group	3,563	2
Group Health Cooperative of South Central Wisconsin, Madison, Wisconsin	6/77	3/76	Staff	1,131	2
Group Health Association Inc., Washington, D.C.	7/77	1/37	Staff	101,776	-
American Health Plan, Miami, Florida	7/77	9/73	Group	5,901	-
Group Health Plan of New Jersey, Guttenberg, New Jersey	6/77	7/77	Staff	850	-
Total quarters of data					106

a/Regulations governing the administration of section 1310 (dual choice provision) of the HMO Act were not published until October 28, 1975. Before that date HMOs were qualified for financial assistance only--not for using section 1310 as a marketing tool. Such HMOs were qualified for dual choice after the regulations were issued.

EMPIRICAL RESULTS

The statistical cost methodology allowed us to perform three separate tests to determine if returns to scale were important in the provision of prepaid health care by federally qualified HMOs. (See app. I, pp. 44 to 48.) Table 6 indicates whether returns to scale are present. Values less than 1 indicate increasing returns to scale; values greater than 1 indicate decreasing returns to scale; and values equal to 1 indicate constant returns to scale. As table 6 shows, all the measures of overall returns to scale, except for that of the 18th HMO, are less than 1. The mean value of this measure for all 20 HMOs is 0.835. Increasing returns to scale are even more evident for each of the three individual categories of output; i.e. physician output, allied health professional output, and hospital output. All these values for all 20 HMOs are less than 1. Their means across all HMOs are 0.333, 0.187, and 0.345, respectively. These results imply that, everything else remaining the same, per unit production costs will decrease as these HMOs grow larger. Unfortunately, our analysis could not indicate precisely how large an HMO must be to realize all available economies of scale, since the data set did not contain any observations on HMOs with more than 37,087 members.

Table 6

Returns To Scale by HMO

HMO	Overall returns to scale	Returns to scale for physician output	Returns to scale for allied health professional output	Returns to scale for hospital output
1	0.847	0.172	0.256	0.420
2	0.788	0.191	0.276	0.321
3	0.892	0.403	0.064	0.425
4	0.814	0.186	0.291	0.337
5	0.845	0.260	0.191	0.394
6	0.832	0.372	0.181	0.280
7	0.842	0.479	0.228	0.135
8	0.850	0.182	0.254	0.414
9	0.871	0.154	0.195	0.522
10	0.720	0.800	0.218	-0.298
11	0.678	0.331	0.100	0.248
12	0.836	0.231	0.239	0.367
13	0.836	0.436	0.188	0.212
14	0.856	0.290	0.181	0.385
15	0.905	0.240	0.183	0.482
16	0.749	0.260	0.092	0.397
17	0.823	0.309	0.214	0.301
18	1.002	0.344	0.171	0.487
19	0.814	0.399	0.093	0.321
20	0.896	0.626	0.126	0.144
Mean	0.835	0.333	0.187	0.345

The evidence is quite clear, however, that the HMOs in this sample must have membership growth beyond their present levels to achieve maximum efficiency and lowest per unit cost in providing care. 1/

Table 7 gives the estimated elasticities of substitution derived from the cost function. (See app. I, pp. 48 to 49.) Positive values indicate the extent to which four types of inputs--hospital services, medical staff services, ambulatory health center services, and administrative services--can be substituted for each other. Negative values indicate that the inputs are complements to each other and cannot be substituted for each other given the technology available. The estimates show that:

--Administrative services are complements to hospital services, medical staff services, and ambulatory health center services.

--There is substitution between hospital services and medical staff services and between hospital services and ambulatory health center services. Because the relative costs of these services are not affected by third party payments, HMOs should be able to allocate these resources efficiently and help control health care costs.

1/In our earlier report entitled "Health Maintenance Organizations: Federal Financing Is Adequate But HEW Must Continue Improving Program Management," we observed that current costs per member month of HMOs generally had become relatively stable by the time they enrolled 10,000 members. HEW pointed out that our analysis had not considered the effects of inflation and our sample size was small. In response we called for further study of this phenomenon. Although the sample size is still small, the methodology in this report did allow us to control for simultaneous changes in HMO size, input prices, and time in operation and to isolate and estimate their separate and independent effects on HMO costs. The results of this analysis showed quite clearly that, all else remaining constant, an increase in HMO size beyond 10,000 members would indeed lead to reductions in cost per unit of output after considering the effects of inflation. Also there is a separate and independent positive effect of time on HMO cost. Since memberships in federally qualified HMOs are growing over time, our earlier analysis did not let us differentiate between the cost reducing effects of increased HMO size beyond 10,000 members and the cost increasing effects of time and inflation.

Table 7

Estimated Elasticities of Substitution

	Administrative services			Hospital services		Medical staff services
	Hospital services	Medical staff services	Ambulatory health center services	Medical staff services	Ambulatory health center services	Ambulatory health center services
Elasticity of substitution	-0.636	-0.150	-0.138	0.614	0.805	0.638

--There is also evidence of substitution between medical staff services and ambulatory health center services. Since the former are primarily labor services and the latter primarily capital services, there are some opportunities for HMOs to substitute between capital and labor services in providing ambulatory health care. However, if wages for medical staffs increase substantially, there may soon be little possibility for HMOs to offset increased labor costs by increasing productivity through greater use of capital equipment in ambulatory medical care centers.

Our analysis also allowed us to estimate the impact that time in operation had on HMO costs. (See app. I, pp. 40 to 44.) It revealed that the real cost of providing HMO care would increase over time. This could lead to some deterioration in the financial positions of many federally qualified HMOs that are incurring deficits and are not experiencing increases in enrollments over time.

CHAPTER 4

SUMMARY; TOPICS FOR FURTHER RESEARCH AND ANALYSIS; RECOMMENDATION; AGENCY COMMENTS

SUMMARY OF FINDINGS

Federally qualified HMOs are responding to relative input costs and are substituting the services of medical staffs, ambulatory health centers, and hospitals. Because the costs of these services are not affected by third party payments, HMOs should be able to allocate these resources efficiently and help control overall health care costs.

If the HMOs we analyzed, which ranged in size from 1,131 to 37,087 members, continue to grow, the per unit cost of providing care will fall. However, we do not know precisely how large an HMO must be to realize all economies of scale, since the available data set did not contain any observations on larger HMOs. Nevertheless, because of financial and managerial constraints or the lack of an adequate demand for their services, HMOs in many market areas may never be able to achieve the minimum size necessary for efficient provision of care.

Given sufficient enrollment growth, well-managed HMOs will eventually achieve their maximum efficiency. Without the discovery and implementation of new productivity-increasing technology, any further reductions in their costs of operation are unlikely. There are now some opportunities for HMOs to substitute between capital and labor services in providing ambulatory care, given existing technology. However, if wages for medical staffs increase substantially, there may soon be little possibility for HMOs to offset these increased costs by increasing productivity through the greater use of capital equipment in ambulatory medical care centers.

With increased time in operation, HMOs, on the average, are experiencing increases in the real cost of providing care. This could lead to some deterioration in the financial positions of many federally qualified HMOs that are incurring deficits and are not experiencing increases in enrollments over time.

TOPICS FOR FURTHER RESEARCH AND ANALYSIS

HEW recently organized an advisory panel of Federal and non-Federal members to help focus the direction of its HMO

research and evaluation activities. We commend this effort and suggest that HEW study the following topics:

--First, because of data limitations, our economic analysis was restricted to the group practice and staff model types of HMOs. Major differences in organizational structure and incentives exist for the third type of HMO, the individual practice associations. Since these differences may cause differences in performance, further research on and comparison of the performance of different types of HMOs should be done when more data become available through the HMO national data report requirements.

--Second, our analysis indicated that group practice and staff model HMOs were responding to relative input costs unaffected by third party payments and were substituting between the services of their medical staffs, ambulatory health centers, and hospitals. To estimate the magnitude of the resulting cost savings, research on and comparisons of the performance of HMOs and the traditional fee-for-service system of health care delivery are necessary. One approach would be to compare the total annual cost of health care for a representative sample of members of federally qualified HMOs with the total annual cost for a comparable sample of persons receiving health care from the traditional system.

--Third, our analysis indicated that HMOs in the range from 1,131 to 37,087 members were experiencing increasing returns to scale in providing comprehensive prepaid care. Because our data set did not contain any observations on larger HMOs, we do not know exactly how large an HMO must be to realize all the available economies of scale. As more data become available on larger HMOs, further research can be directed toward more accurately identifying the minimum efficient size for HMO operation.

--Fourth, in this analysis we used three measures of HMO output: the number of ambulatory encounters with physicians, the number of ambulatory encounters with allied health professionals, and the number of hospital discharges. One can, however, conceptualize the final output of HMOs as being the improvement or maintenance of health status of enrollees. To conduct future research on and analysis of the effect of HMOs on the public's health, longitudinal

data on the health status of HMO enrollees and a comparable population of non-HMO members are required.

RECOMMENDATION TO THE SECRETARY OF HEW

HEW should undertake the studies of HMOs suggested above. We recommend that HEW study these topics in its HMO research and evaluation activity and report the study results to the Congress.

AGENCY COMMENTS

HEW considered our findings generally positive and made two specific comments. First, HEW noted that the Office of Health Maintenance Organizations had recognized the need for more timely reporting of reliable data through the HMO national data reporting requirements and had implemented procedures to decrease the frequency of late reporting and increase the reliability of the data collected.

HEW's second comment concerned our finding that there might be little possibility for HMOs to offset substantial increases in medical staff salaries by increasing productivity through the greater use of capital equipment. HEW agreed with the validity of this observation and noted that, although HMOs could not control medical staff salaries, they were employing nurse practitioners, physician assistants, and other paramedical personnel at generally half the salaries of physicians. HEW believed this was a positive trend. We agree this may be an important trend and encourage HEW to do research on the extent to which nonphysician services are being substituted for physician services in HMOs and the implications for this on both the cost and the quality of HMO care.

HEW concurred in our recommendation on all of the topics for further research and analysis of HMO performance.

APPENDIX I

STATISTICAL COST ANALYSIS OF FEDERALLY QUALIFIED HMOs

HMOs AS MULTIPRODUCT FIRMS

HMOs provide virtually all services commonly provided by the fee-for-service sector, with the distinguishing characteristic that the services are supplied or contracted for by one organization. Thus it is appropriate to regard them as multiproduct firms producing a vector of outputs from a vector of inputs. They are characterized by "common costs," where these are defined as the costs of common inputs which are used by more than one output. A multiproduct production process can be represented by the product transformation function:

$$F(Y_1,\ldots,Y_m;\ X_1,\ldots,X_n) = 0 \qquad (1)$$

where the Y_i represent the outputs and the X_j represent the inputs.

The theory of duality between cost and production implies that there will exist a dual cost function to the product transformation function (1) if the following assumptions hold true: 1/

i. The firm pursues cost-minimizing behavior. 2/

1/W. Erwin Diewert, "An Application of the Shephard Duality Theorem: A Generalized Leontief Production Function," Journal of Political Economy, vol. 79 (May/June 1971), pp. 481-507.

W. Erwin Diewert, "Applications of Duality Theory," in Michael D. Intriligator and David A. Kendrick, eds., Frontiers of Quantitative Economics, vol. II (Amsterdam: North-Holland, 1974), pp. 106-176.

2/When cost minimizing behavior cannot be assumed, the duality properties will be destroyed, but estimation of a "behavioral" cost function will still be of interest and policy relevance. See, for example, Robert G. Evans, "'Behavorial' Cost Functions for Hospitals," Canadian Journal of Economics, vol. 2 (May 1971), pp. 198-215.

ii. The firm has no control over input prices.

iii. The product-transformation surface satisfies regularity conditions (i.e., convex isoquants).

The dual cost function will have the form

$$C = C(Y_1,\ldots,Y_m;\ P_1,\ldots,P_n) \qquad (2)$$

where the P_j represent the prices of the inputs X_j. The cost function, then, is a complete description of production technology and contains virtually all the information that the product transformation function contains.

The cost function (2) has the properties:

i. C is increasing in Y_i and P_j.

ii. C is linear homogeneous in P_j.

iii. C is concave in P_j.

iv. $\partial C/\partial P_j = X_j$ (Shephard's Lemma).

While the description of the production process embodied in equation (1) is appropriate for HMOs, the existence of a dual cost function depends on the validity of assumptions i. to iii. There is no reason to assume that the production technology of HMOs will be irregular or to assume that they will have control over input prices. Newhouse has suggested, however, that the assumption of cost-minimizing behavior is questionable for nonprofit institutions that receive cost reimbursement payments from third parties. 1/ Although this may be true of conventional hospitals, it is certainly not the case for the HMO, which must compete with conventional providers and insurers as well as other HMOs. 2/ Moreover, some HMOs are for-profit enterprises, while others like the noted Kaiser plans, reinforce their overall cost minimizing incentive by instituting "profit" sharing plans

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1/Joseph P. Newhouse, "Toward a Theory of Non-Profit Institutions: An Economic Model of a Hospital," American Economic Review, vol. 60 (Mar. 1970), pp. 64-74.

2/Evidence of the competitive impact of HMOs has been presented in recent reports by the Federal Trade Commission and InterStudy.

with their physicians. Thus all three of the necessary assumptions appear quite valid for the purposes of this analysis.

THE TRANSLOG JOINT COST FUNCTION

Historically many empirical studies of cost functions have employed functional forms which imply strong restrictions on the type of economic behavior they represent. Duality theory suggests that the form of the cost function has implications for the nature of the underlying production process. 1/ More recently, the transcendental logarithmic (translog) functional form has become increasingly popular as a representation of cost functions because it enables one to model costs without unnecessary prior restrictions on the production process and restrictive prior assumptions about the degree to which inputs can be substituted. The translog function is quadratic in logarithms and is one of the family of second-order Taylor series approximations to an arbitrary cost function. For the multiple-output firm, the translog function takes the form

$$\log C = \alpha_0 + \sum_{i=1}^{m} \alpha_i \log Y_i + \sum_{j=1}^{n} \beta_j \log P_j +$$

$$\tfrac{1}{2} \sum_{i=1}^{m} \sum_{\ell=1}^{m} \delta_{i\ell} \log Y_i \log Y_\ell + \tfrac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \gamma_{jk} \log P_j \log P_k +$$

$$\sum_{i=1}^{m} \sum_{j=1}^{n} \rho_{ij} \log Y_i \log P_j \qquad (3)$$

where the α_i, β_j, $\delta_{i\ell}$, γ_{ij}, and ρ_{ij} are parameters to be estimated. Shephard's Lemma ($\partial C/\partial P_j = X_j$) implies

$$\frac{\partial \log C}{\partial \log P_j} = \frac{P_j X_j}{C} = M_j \qquad (4)$$

1/Robert E. Hall, "The Specification of Technologies With Several Kinds of Outputs," Journal of Political Economy, vol. 81 (July/Aug. 1973), pp. 878-892.

where M_j is the cost share of the j^{th} input. Applying (4) to (3) yields the system of cost share equations

$$M_j = \beta_j + \sum_k \gamma_{jk} \log P_k + \sum_i \rho_{ij} \log Y_i, \quad j = 1, \ldots, n. \tag{5}$$

The system of equations (3), (5) is the cost system to be estimated. For a production process with m outputs and n inputs, there is a total of $m + n + m^2 + n^2 + mn$ parameters. The fact that the function is a second-order approximation implies symmetry of the form $\delta_{i\ell} = \delta_{\ell i}$ and $\gamma_{jk} = \gamma_{kj}$. Further, since the M_j are cost shares, $\sum_{i=1}^{n} M_j = 1$ which implies $\sum_j \beta_j = 1$, $\sum_j \gamma_{jk} = 0$ and $\sum_j \rho_{ij} = 0$.

Finally, the fact that cost functions must exhibit homogeneity of degree + 1 in input prices implies $\sum_k \gamma_{jk} = 0$. This reduces the number of free parameters to $mn + (m+1)(m/2) + (n+1)(n/2)$.

By imposing parameter restrictions on the translog cost function, it is possible to test whether the technology exhibits constant returns to scale and whether the vector of outputs is separable from the vector of inputs. Constant returns to scale imply the restrictions

$$\sum_{i=1}^{m} \alpha_i = 1, \quad \sum_{i=1}^{m} \delta_{i\ell} = 0, \quad \sum_{i=1}^{m} \rho_{ij} = 0 \tag{6}$$

in addition to those already discussed, but only n-1 of the last set of the restrictions are independent since $\sum_j \rho_{ij} = 0$ has already been imposed.

In testing for separability, we considered only strong separability on the translog cost function itself rather than on the underlying cost function which is being approximated. Brown, Caves, and Christensen show that

$$\rho_{ij} = 0, \quad i = 1, \ldots, m, \quad j = 1, \ldots, n, \tag{7}$$

is a sufficient condition for strong separability. 1/

ESTIMATES OF A TRANSLOG JOINT COST FUNCTION FOR HMOs

The Health Maintenance Organization Act was passed in 1973 to provide Federal support for HMO growth and development. HMOs qualified to receive assistance under the act must offer specified, comprehensive services; have community-rated premiums; institute quality assurance and utilization review programs; charge only nominal coinsurance rates; and strictly limit the amount of reinsurance, if any. In addition, each qualified and operational HMO must provide detailed data on costs, membership, services provided, and various other aspects of its operations. The HMO national data reporting requirements were developed and implemented by the Department of Health, Education, and Welfare to collect these data on uniform quarterly, semiannual, and annual reports.

As of the fourth quarter of 1977, there were 36 qualified and operational HMOs for which data were available through this reporting system. Of these 36 HMOs, 10 were IPAs, 8 were group practices, and 18 were staff model HMOs. Because of major differences in organization, incentive structures, and reporting requirements, the IPAs were eliminated from the data set. The study used quarterly observations for the period from the first quarter of 1976 to the fourth quarter of 1977 on the remaining 26 HMOs. Of these 208 time series cross section observations, 102 had missing data of one sort or another, leaving 106 observations on 20 HMOs, in our final sample. 2/

The definition of "output" has always been problematic in empirical studies of the health care industry. Although

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1/Randall S. Brown, Douglas W. Caves, and Laurits R. Christensen, "Modelling the Structure of Production With a Joint Cost Function," Workshop Paper No. 7521, Social Science Research Institute, University of Wisconsin, August 1975.

2/In this sample the number of time-series observations per HMO varied from one to eight as more HMOs qualified over time for Federal assistance.

one can conceptualize final output as improvement or maintenance of the health status of individuals, the lack of suitable indexes of health requires the use of more quantifiable measures of intermediate outputs, such as hospital discharges or the number of physician office visits.

Most cost studies of conventional hospitals and physician office practices use only single measures of intermediate output; employ simple and restrictive functional forms; and, in many cases, omit some inputs and factor prices entirely from the analysis. Thus almost all these studies contain common flaws which could lead to seriously misleading results. For example, numerous cost and production function studies of U.S. hospitals omit any measure of physician input. Thus, if physician input is systematically associated with the size of hospitals, evidence of returns to scale may be illusory.

With regard to studies of physician office practices, Bailey has stressed the importance of the multiproduct model with his contention that economies of scale arise from producing ancillary outputs and not from physician outputs. 1/ If so, empirical studies employing a single output measure are likely to yield misleading evidence of increasing returns to scale in ambulatory care by physicians since larger practices generally offer a wider range of these services.

The use of aggregate indexes of outputs and inputs can be justified only if cost and production functions are separable. To our knowledge, however, this hypothesis has never been explicitly tested with regard to providing health care. Fortunately, sufficiently comprehensive data are available to test for economies of scale and separability directly in a properly specified multiinput, multioutput model. Specifically, in this study we distinguished three outputs: ambulatory encounters with physicians (A1), ambulatory encounters with allied health care professionals (A2), and hospital discharges (DI). Four inputs were distinguished: administrative services (AD), hospital services (HS), medical professional staff services (ME), and health center services (HC). The latter are essentially the capital expenses of maintaining a health center.

To obtain estimates of implicit input prices, we divided the aggregate expenses of these services by ordinal proxies

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1/Richard M. Bailey, "Economies of Scale in Medical Practice," in Herbert Klarman, ed., Empirical Studies in Health Economics (Baltimore: Johns Hopkins Press, 1970), pp. 255-273.

measuring aggregate input usage. Specifically we defined the following input prices:

administrative services price	=	(health plan administration expense) / (member months)
hospital services price	=	(hospitalization expense) / (hospital days)
medical professional staff services price	=	(medical group expense for direct service and outside referrals + special services expense) / (full-time equivalent medical care personnel, including physicians, physician extenders, nurses, optometrists, podiatrists, mental health care providers, dental health care providers, and other direct health care providers)
health center services price	=	(health center expense + interest expense on loans) / (member months)

Two modifications were made in the basic translog framework to account for special characteristics of the data. First, many HMOs sampled became operational during the period we studied in response to the incentives offered by the HMO Act of 1973. Others became qualified for Federal assistance under the act during this period but had been operational before 1973. Length of time in operation may have important, yet opposite, effects on HMO costs. On the one hand, newly formed firms may experience some inefficiencies during the first few quarters of operation which diminish over time through a learning-by-doing process. On the other hand, many new medical care techniques and technologies are cost increasing. 1/ To control for the effects of technical progress on costs, we introduced a variable equal to the number of quarters the HMO was in operation. Because the net effect of technical

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1/See Louise B. Russell, Technology in Hospitals: Medical Advances and Their Diffusion (Washington, D.C.: The Brookings Institution, 1979).

progress could either be cost increasing or cost decreasing, however, we have no a priori expectation concerning the sign of its coefficient.

The second modification is an attempt to control for differences in casemix for hospitalized patients. The importance of differences in casemix to differences in cost for hospitals has been widely documented in the literature. 1/ We would expect specific case types to be more evenly distributed across federally qualified HMOs than across conventional hospitals due to the required uniformity of their benefit packages and a greater degree of homogeneity in their enrolled populations. 2/ However, we attempted to compensate for differences in casemix by including a variable equal to the average length of stay of inpatient admissions for the HMO for each quarter. 3/

The assumed form of the cost function is:

$$C = f\,(T,LOS)\; C^{*}\;(Y_1,\ldots,Y_m;\; P_1,\ldots,P_n) \qquad (8)$$

where T is time in operation, LOS is average length of stay, and C* is the basic cost function. The function f is assumed to be exponential so that T and LOS enter the translog form

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1/For example, see Martin S. Feldstein, Economic Analysis for Health Service Efficiency: Econometric Studies of the British National Health Service (Amsterdam: North-Holland, 1967).

2/Detailed data on the age-sex composition of HMO memberships showed little variation, and alternative specifications which controlled explicitly for differences in the age-sex distribution yielded similar results.

3/It would have been preferable to control for variation in casemix by including as independent variables the proportion of patients in specific diagnostic categories or an index based on such information. Unfortunately the only such data available were for inpatient discharges based on the following very broad categories: medical/surgical, obstetrical (maternity), newborns in hospital, mental health (psychiatry), and all others. (See app. II, tables U-3A, U-3B, and U-3C.) Since these breakdowns were too aggregated to provide any meaningful information about differences in casemix, we used the average length of stay as a controlling variable.

additively. The system of equations estimated includes the modified translog cost function and n-1 of the cost-share equations (5). Classical additive disturbances are assumed for all equations. Since the cost shares must sum to 1, the disturbances to (5) must sum identically to zero. As this would imply a singular covariance matrix for the system of equations, one of the share equations must be eliminated. The share equation corresponding to health center services (HC) was eliminated, and the systems estimation procedure proposed by Zellner was applied iteratively until covergence was achieved. 1/

Table 8 presents estimates of the translog cost function with no restrictions other than those implied by linear homogeneity and the share equations, with parameter restrictions which imply constant returns to scale, and with parameter restrictions which imply separability of the outputs. The subscripts of the parameters represent the two controlling variables, the three outputs, and the four inputs defined earlier.

It is interesting that in the unrestricted form of the translog function, the coefficients of the controlling variables are both positive and significant. Technical progress, represented by μ_T, increases total cost, while the positive sign on length of stay, μ_{LOS}, indicates that HMOs with longer average hospital stays have higher total costs.

1/Arnold Zellner, "An Efficient Method for Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias," Journal of the American Statistical Association, vol. 57 (June 1962), pp. 585-612. It has been demonstrated that iterations of Zellner's estimator will converge to maximum likelihood estimates (if they converge) in Jan Kmenta and Roy F. Gilbert, "Small Sample Prospects of Alternative Estimators of Seemingly Unrelated Regressions," Journal of the American Statistical Association, vol. 63 (Dec. 1968), pp. 1180-1200.

It has also been demonstrated that such parameter estimates are independent of whichever share equation is dropped from the system in A. P. Barten, "Maximum Likelihood Estimation of a Complete System of Demand Equations," European Economic Review, vol. 7 (Fall 1969), pp. 7-78.

Table 8

Estimates of Translog Cost Functions

Variable	Unrestricted		Constant returns to scale		Separable	
	Estimated coefficient	Standard deviation	Estimated coefficient	Standard deviation	Estimated coefficient	Standard deviation
α_0	4.078	2.380	8.237	1.209	7.999	1.056
μ_T	0.012	0.003	0.002	0.003	- 0.003	0.003
μ_{LOS}	0.061	0.012	0.077	0.014	0.081	0.014
α_{A1}	0.337	0.879	- 1.830	0.527	- 1.488	0.534
α_{A2}	- 0.301	0.324	0.370	0.252	0.213	0.242
α_{DI}	1.481	0.817	2.460	0.629	2.275	0.613
β_{AD}	0.778	0.074	0.944	0.062	0.866	0.044
β_{HS}	0.133	0.084	0.151	0.070	0.100	0.044
β_{ME}	- 0.452	0.109	- 0.609	0.102	- 0.531	0.064
β_{HC}	0.541	0.085	0.515	0.076	0.565	0.053
$\delta_{A1,A1}$	0.856	0.183	0.620	0.132	0.588	0.148
$\delta_{A1,DI}$	- 0.199	0.158	- 0.507	0.137	- 0.520	0.147
$\delta_{DI,DI}$	0.252	0.158	0.454	0.172	0.511	0.176
$\delta_{A1,A2}$	0.005	0.063	- 0.113	0.053	- 0.068	0.053
$\delta_{A2,A2}$	0.060	0.026	0.060	0.030	0.058	0.030
$\delta_{A2,DI}$	- 0.16	0.065	0.053	0.070	0.009	0.071
$\gamma_{AD,AD}$	0.174	0.006	0.159	0.004	0.171	0.005
$\gamma_{AD,HS}$	- 0.060	0.004	- 0.065	0.004	- 0.064	0.004
$\gamma_{AD,ME}$	- 0.062	0.006	- 0.049	0.005	- 0.058	0.006
$\gamma_{AD,HC}$	- 0.052	0.006	- 0.045	0.004	- 0.049	0.005
$\gamma_{HS,HS}$	0.113	0.009	0.124	0.009	0.104	0.009
$\gamma_{HS,ME}$	- 0.022	0.008	- 0.029	0.007	- 0.008	0.007
$\gamma_{HS,HC}$	- 0.031	0.006	- 0.031	0.006	- 0.032	0.006
$\gamma_{ME,ME}$	0.121	0.011	0.106	0.009	0.098	0.010
$\gamma_{ME,HC}$	- 0.037	0.006	- 0.028	0.006	- 0.032	0.006
$\gamma_{HC,HC}$	0.119	0.010	0.104	0.010	0.113	0.009
$\rho_{A1,AD}$	- 0.004	0.012	- 0.023	0.010		
					$\bar{R}^2$ = .98	
$\rho_{A1,HS}$	- 0.026	0.015	- 0.027	0.013		
$\rho_{A1,ME}$	0.035	0.019	0.060	0.017		
$\rho_{A1,HC}$	- 0.005	0.012	- 0.010	0.011		
$\rho_{DI,AD}$	0.040	0.012	0.025	0.012		
$\rho_{DI,HS}$	0.043	0.016	0.044	0.015		
$\rho_{DI,ME}$	- 0.093	0.021	- 0.074	0.020		
$\rho_{DI,HC}$	0.010	0.013	0.004	0.013		
$\rho_{A2,AD}$	- 0.004	0.005	- 0.002	0.005		
$\rho_{A2,HS}$	- 0.016	0.007	- 0.017	0.006		
$\rho_{A2,ME}$	0.016	0.009	0.014	0.008		
$\rho_{A2,HC}$	0.004	0.006	0.006	0.005		
	$\bar{R}^2$ = .99		$\bar{R}^2$ = .98			

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To test the hypotheses of constant returns to scale and separability, we compute the likelihood ratio statistic

$$-2 \ln \lambda = n(\ln|\hat{\Sigma}_{\gamma}| - \ln|\hat{\Sigma}_{u}|) \qquad (9)$$

where $|\hat{\Sigma}_{\gamma}|$ is the determinant of the estimated covariance matrix with the restrictions imposed and $|\hat{\Sigma}_{u}|$ is the determinant of the covariance matrix of the unrestricted system. This statistic is distributed asymptotically as chi-square with degrees of freedom equal to the number of restrictions being imposed. The values of the test statistics are presented in table 9. Both hypotheses are soundly rejected, and so the unrestricted translog form must be used. Having rejected the possibility of constant returns to scale, we turn to the problem of measuring returns to scale for HMOs.

ECONOMIES OF SCALE

The measurement of returns to scale is more complex for firms which produce multiple outputs because it is necessary to distinguish between returns to scale in some overall sense where all outputs are expanded and returns to scale with respect to a particular output. Hanoch suggests that it is most appropriate to measure overall returns to scale along an expansion path where all outputs are increased proportionately. 1/

If we assume that all outputs are increased in proportion

$$\frac{dY_i}{Y_i} = d \log Y_i = \lambda . \qquad (10)$$

1/Giora Hanoch, "The Elasticity of Scale and the Shape of Average Costs," American Economic Review, vol. 65 (June 1975), pp. 492-497.

Table 9

Tests for Constant Returns to Scale and Separability

	$-2\ell n\ \lambda$	Number of restrictions	Critical χ^2_γ at .05 level
Constant returns to scale	38.859	7	14.067
Separable	57.146	9	16.919

then the measure of scale economies (SE) is

$$SE = \frac{d \log C}{\lambda} = \sum_{i=1}^{m} \frac{\partial \log C}{\partial \log Y_i}. \qquad (11)$$

If SE>1 there are overall decreasing returns to scale; if SE = 1, the technology exhibits constant returns to scale (which has been ruled out by the test presented in the previous section); and if SE<1, there are overall increasing returns to scale.

For a single output we can consider the elasticity of cost with respect to a single output, all other outputs held constant:

$$SE(i) = \frac{\partial \log C}{\partial \log Y_i} \Big| \ Y_j, \quad j \neq i, \text{ constant} = \frac{\partial \log C}{\partial \log Y_i} \qquad (12)$$

If SE(i) >1, there are decreasing returns to scale with respect to the ith output; if SE(i)<1, there are increasing returns to scale; and if SE(i) = 1, there are constant returns to scale. Clearly it is possible to have the overall measure of returns to scale, SE, indicate decreasing returns to scale while each of the individual returns to scale indicates increasing returns to scale.

An alternative indicator of returns to scale with respect to a single output is the change in incremental costs

$$\frac{\partial^2 C}{\partial Y_i^2} \Big| \ Y_j, \ j \neq i, \text{ constant.}$$

Decreasing marginal cost $(\partial^2 C/\partial Y_i^2 < 0)$ should be indicative of increasing returns to scale with respect to the ith output; but, of course, it is possible to observe decreasing marginal cost with respect to each output and at the same time have overall decreasing returns to scale (SE>1). For the translog function "marginal costs" are defined as

$$\frac{\partial C}{\partial Y_j} = \frac{\partial \log C}{\partial \log Y_j} \cdot \frac{\hat{C}}{Y_j} = \left(\alpha_j + \sum_{j=1}^{m} \delta_{ij} \log Y_j + \sum_{i=1}^{m} \rho_{ij} \log P_j\right) \cdot \frac{\hat{C}}{Y_j} \qquad (13)$$

where $\hat{C}$ is the fitted value of total costs. It can also be shown that

$$\frac{\partial^2 C}{\partial Y_i^2} = \frac{\hat{C}}{Y_i^2}\left[\frac{\partial^2 \log C}{\partial \log Y_i^2} + \frac{\partial \log C}{\partial \log Y_i}\left(\frac{\partial \log C}{\partial \log Y_i} - 1\right)\right] \qquad (14)$$

Table 10 presents estimates of overall economies of scale (SE), the output cost elasticities (SEA1, SEA2, SEDI) for each output, the marginal costs (MCA1, MCA2, MCDI) for each output, and the derivatives of marginal costs (DMCA1, DMCA2, DMCDI) for each output by HMO.

The measure of overall returns to scale and the measures of returns to scale for individual outputs give quite consistent and unambiguous evidence of increasing returns to scale. The overall measures are less than one for 19 of the 20 HMOs, indicating that total costs are increasing at a decreasing rate along the expansion paths of these firms. For all 20 HMOs, the individual cost elasticities are substantially less than one, giving a clear indication that these HMOs are operating well within the region of increasing returns to scale with respect to all three outputs individually. The marginal costs of ambulatory encounters with physicians are decreasing for all HMOs in the sample, and the marginal costs of ambulatory encounters with allied health professionals are decreasing for 18 of the 20 HMOs, giving even further evidence of increasing returns to scale for these two outputs. The marginal costs of hospital discharges are increasing for all HMOs, but, of course, this is not inconsistent with increasing returns.

For all 20 HMOs, the marginal cost of a hospital stay is substantially higher than the marginal cost of either type of ambulatory encounter. Somewhat more surprising is the fact that for only 4 of the 20 HMOs is the estimated marginal cost of an ambulatory encounter with a physician higher than the marginal cost of an ambulatory encounter

Table 10

Scale Economies and Marginal Costs by HMO

HMO	SE	SEA1	SEA2	SEDI	MCA1	MCA2	MCDI	DMCA1	DMCA2	DMCDI
1	0.847	0.172	0.256	0.420	28.41	52.59	2240.00	-0.001	-0.004	0.612
2	0.788	0.191	0.276	0.321	26.26	62.06	1672.29	-0.001	-0.003	0.480
3	0.892	0.403	0.064	0.425	117.12	81.07	5047.42	-0.049	2.892	7.625
4	0.814	0.186	0.291	0.337	22.00	43.12	1690.84	-0.000	-0.001	0.434
5	0.845	0.260	0.191	0.394	48.80	69.53	1972.47	-0.005	-0.016	0.558
6	0.832	0.372	0.181	0.280	38.79	48.01	1520.06	-0.004	-0.014	3.930
7	0.842	0.479	0.228	0.135	47.08	48.19	1924.02	-0.007	-0.008	0.115
8	0.850	0.182	0.254	0.414	21.08	40.78	1853.03	-0.001	-0.002	0.268
9	0.871	0.154	0.195	0.522	24.27	53.56	1675.36	-0.001	-0.008	0.094
10	0.720	0.800	0.218	-0.298	51.63	59.70	601.62	-0.005	-0.039	144.392
11	0.678	0.331	0.100	0.248	35.35	187.01	1146.66	-0.002	-0.132	2.120
12	0.836	0.231	0.239	0.367	33.65	44.51	1468.72	-0.002	-0.005	0.448
13	0.836	0.436	0.188	0.212	115.77	105.55	3028.55	-0.014	-0.035	41.385
14	0.856	0.290	0.181	0.385	37.39	48.34	1705.72	-0.004	-0.012	1.252
15	0.905	0.240	0.183	0.482	37.45	48.83	2180.46	-0.003	-0.008	0.058
16	0.749	0.260	0.092	0.397	23.15	104.62	1490.11	-0.001	-0.022	0.760
17	0.823	0.309	0.214	0.301	46.71	51.35	1659.57	-0.004	-0.008	1.779
18	1.002	0.344	0.171	0.487	134.57	38.90	3673.39	-0.076	-0.012	0.748
19	0.814	0.399	0.093	0.321	64.60	78.50	2600.88	-0.010	0.196	4.562
20	0.896	0.626	0.126	0.144	178.45	87.59	3621.80	-0.039	-0.079	261.112
Mean	0.835	0.333	0.187	0.345	56.63	67.69	2138.65	-0.012	0.134	23.637

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with a nonphysician health professional. The other HMOs show lower although in most cases not substantially lower, marginal costs of physician encounters. This could be the result of HMOs using allied health professionals for more capital intensive procedures previously performed by physicians, such as administering diagnostic tests or routine therapeutic treatments. The mean values for the marginal costs of the three outputs are $56.63, $67.69, and $2,138.65, respectively. 1/ The extent to which HMOs can achieve greater cost efficiency in producing a given level of outputs by substituting inputs in response to changes in relative prices is considered in the next section.

ELASTICITIES OF SUBSTITUTION

Uzawa has demonstrated that elasticities of substitution can be computed from the cost function as 2/

$$\sigma_{ij} = C\frac{\partial^2 C/\partial P_i \partial P_j}{\partial C/\partial P_i \cdot \partial C/\partial P_j} . \qquad (15)$$

In the translog cost function these become

$$\hat{\sigma}_{ij} = \frac{\hat{\gamma}_{ij} + \hat{M}_i\hat{M}_j}{\hat{M}_i\hat{M}_j} , \; i \neq j , \quad \hat{\sigma}_{ii} = \frac{\hat{\gamma}_{ii} + \hat{M}_i(\hat{M}_i - 1)}{\hat{M}_i^2} , \qquad (16)$$

1/A few of the individual marginal costs seem implausibly large, but these generally are for HMOs which have just started operation and have had relatively few patients. These costs are also all inclusive and consequently contain several items which are not included in the costs or charges of traditional health care providers. In addition, HMOs may be admitting only the more severe and complex cases for in-hospital care and deferring marginal ambulatory visits through a telephone screening process. Differences in casemix and severity of illnesses may, therefore, be causing some of the difference in costs between HMO and non-HMO settings.

2/Hirofumi Uzawa, "Production Functions With Constant Elasticities of Substitution," Review of Economics and Statistics, vol. 44 (Oct. 1962), pp. 291-299.

where the M are the fitted values of the cost share equations. Berndt and Wood have shown that the own price elasticities of demand can be computed as 1/

$$\hat{\eta}_{ii} = \hat{M}_i \hat{\sigma}_{ii} = \frac{\hat{\gamma}_{ii} + \hat{M}_i(\hat{M}_i - 1)}{\hat{M}_i} \qquad (17)$$

Concavity of the cost function in input prices requires that for each factor input. A sufficient condition for concavity is that the bordered Hessian be negative semidefinite. In our sample, two firms failed to satisfy either the necessary or the sufficient condition.

Table 11 presents estimates of the own price elasticities and the elasticities of substitution. These are the averages for all firms in all time periods which satisfy the concavity condition. As expected, the own price elasticities reveal that demands for all inputs are inelastic; the demand for administrative services is the least elastic. The elasticities of substitution reveal that administrative services are complements to all other inputs, but that there is substitution between hospital services and medical staff services, between hospital services and health center services, and between medical staff services and health center services.

CONCLUSIONS

The results of the cost analysis support the belief that HMOs can achieve efficiency in providing health care by responding to relative input costs unaffected by third party payments and substituting between the services of their medical staffs, ambulatory health centers, and hospitals. Also, substitution is possible between health center and staff inputs, and administrative services are complements to all of the other factors of production. Because of the substitution between outpatient and inpatient services, the reduced hospitalization rates and lower total costs of care for HMO enrollees noted in other studies (see p. 14 to 16) can be attributed, in part, to the fact that HMO decisionmakers do not face a price system affected by a system of third-party cost-based

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1/Ernst R. Berndt and D. O. Wood, "Technology, Prices, and the Derived Demand for Energy," Review of Economics and Statistics, vol. 57 (Aug. 1975), pp. 259-268.

Table 11

Estimated Elasticities of Demand and Substitution

	Administrative services			Hospital services		Medical staff services
	Hospital services	Medical staff services	Health center services	Medical staff services	Health center services	Health center services
Elasticity of substitution	-0.636	-0.150	-0.138	0.614	0.805	0.638

	Administrative services	Hospital services	Medical staff services	Health center services
Own price elasticity of demand	-0.104	-0.287	-0.283	-0.253

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payments. Also HMOs may be experiencing cost-increasing technical progress over time.

In addition, positive economies of scale are exhibited by the HMOs studied, both overall and with regard to ambulatory care by physicians, ambulatory care by allied health professionals, and in-hospital care. This implies that these HMOs must experience some growth in size before they can produce at the lowest per unit cost of care.

APPENDIX II

COPIES OF THE HMO NATIONAL DATA REPORTING REQUIREMENTS IN EFFECT THROUGH DECEMBER 31, 1977

Form Approved:
OMB No. 68-R-1496
HSA-51

Complete this form for each of the major benefit packages offered to HMO members. Write in the name of each major package in the title.

HMO REPORTING SYSTEM

TABLE B-1: SELECTED HEALTH SERVICES PROVIDED UNDER _____ BENEFIT PACKAGE

Organization Name:			Case Number:
Date Benefit Effective:			
Health Services Provided	Check If Benefit Is Provided (a)	Amount of Copayment (b)	Limitation on Amount of Service Provided (c)
A. Basic Health Services			
1. Physician Services--Nonhospital			
2. Hospital Inpatient			
3. Hospital Outpatient			
4. Medically Necessary Emergency Health			
5. Short-Term Outpatient Evaluative and Crisis Intervention Mental Health			
6. Medical Treatment and Referral for the Abuse of, or Addiction to, Alcohol and Drugs			
7. Diagnostic Laboratory			
8. Diagnostic and Therapeutic Radiologic			
9. Home Health			
10. Preventive Health			
A. Voluntary Family Planning			
B. Infertility			
C. Preventive Dental Care for Children			
D. Eye Examinations for Children			
E. Pediatric and Adult Immunization			
B. Supplemental Health Services			
1. Skilled Nursing and Long-Term Care Facilities			
2. Vision Care (not included above)			
3. Dental Care (not included above)			
4. Mental Health (not included above)			
5. Long-Term Physical Medicine and Rehabilitation			
6. Prescription Drug			
C. Other Health Services (Specify services not listed)			
1. Medical Social			
2. Health Education			
3. Nutritional Counseling			
4.			
5.			
6.			

Frequency: Annually

APPENDIX II

Form Approved:
OMB No. 08-R-1496
HSA-91

HMO REPORTING SYSTEM

TABLE P-1: MEMBERSHIP STATUS BY MONTH

Organization Name:	Case Number:
For Reporting Period: From:	To:

Month	Total Members at End of Month	New Members Added During Month	Members Dropped During Month	Cumulative Member Months
	(a)	(b)	(c)	(d)
1. January				
2. February				
3. March				
4. April				
5. May				
6. June				
7. July				
8. August				
9. September				
10. October				
11. November				
12. December				

Frequency: Prepared Monthly; Submitted Quarterly

HMO REPORTING SYSTEM

OMB No. 68-R-1496
HSA-51

TABLE P-2: CONTRACTS AND MEMBERSHIP BY TYPE OF PREPAYMENT

Organization Name:	Case Number:
For Reporting Period: From:	To:

Type of Prepayment	Contracts at End of Quarter		Total Members at End of Quarter	
	Total Number	Average Members Per Contract	Projected	Actual
	(a)	(b)	(c)	(d)
1. Total for All Types of Prepayment				
A. Group Contracts				
1. Trust Funds				
2. Employer Plans				
B. Government Plans				
1. FEHBP				
2. Title 19--Medicaid				
3. Title 18--Medicare*				
4. CHAMPUS				
5. State/Local				
C. Nongroup Contracts				
D. Other				

Frequency: Quarterly

Note: * Category relates only to members enrolled in complementary programs to Title XVIII, or under direct cost contracts or risk contracts with the Social Security Administration. It excludes Medicare-eligibles in other categories.

APPENDIX II

HMO REPORTING SYSTEM

Form Approved:
OMB No. 68-R-1496
HSA-51

TABLE P-3: MEMBERSHIP BY AGE AND SEX

Organization Name:

Case Number:

For Reporting Period: Year Ending

Age Group	Sex		
	Total Persons	Males	Females
	(a)	(b)	(c)
1. Total for All Ages			
A. Under 1			
B. 1 - 4			
C. 5 - 14			
D. 15 - 19			
E. 20 - 24			
F. 25 - 44			
G. 45 - 64			
H. 65 and Over			
I. Not Reported			

Frequency: Annually

APPENDIX II

HMO REPORTING SYSTEM

OMB No. 68-R-1496
HSA-51

TABLE U-1: AMBULATORY ENCOUNTERS BY TYPE AND MEMBERSHIP STATUS

Organization Name:	Case Number:
For Reporting Period: From:	To:

Type of Ambulatory Encounter	Number of Encounters By Members and Nonmembers		
	Total	Members	Nonmembers
	(a)	(b)	(c)
1. Medical Care			
A. Physicians (excluding Psychiatrists)			
B. Other Health Professionals			
2. Mental Health Services			
3. Dental Health Services			
4. Other Direct Health Care Services			
A. Alcohol Abuse Referral and Treatment			
B. Drug Abuse Referral and Treatment			
C. Hospital Emergency Room (in-area)			
D.			
E.			
TOTAL			

Frequency: Quarterly

APPENDIX II

OMB No. 68-R-1496
HSA-51

HMO REPORTING SYSTEM

TABLE U-2: PARTICIPATING PROFESSIONALS AND STAFF
(FULL-TIME EQUIVALENTS)

Organization Name:	Case Number:
For Reporting Period: From:	To:

Patient Care Personnel	Professionals and Staff				
	Total Staff	Total FTE Staff	Number Board-Certified or Board-Eligible	Ambulatory Care Man-Hours Per Week	
				March	September
	(a)	(b)	(c)	(d)	(e)
1. Medical Care Personnel (excluding Psychiatrists)--Total					
A. All Physicians--Total					
(1) General and Family Practitioners					
(2) Internists					
(3) Obstetricians and Gynecologists					
(4) Pediatricians					
(5) Surgeons					
(6) Other Physician Specialties (not included above)					
B. Physician Extenders (list by type)--Total					
C. Nurses (list by type)--Total					
D. Optometrists					
E. Podiatrists					
2. Mental Health Providers--Total					
A. Psychiatrists					
B. Psychologists					
C. Nurses					
D. Social Workers					
E. Other					
3. Dental Care Providers--Total					
A. Dentists					
B. Dental Hygienists					
C. Dental Assistants					
D. Other					
4. Other Direct Health Care Providers (list by type)--Total					
5. Other Technical and Admin. Support (list by type)--Total					

Frequency: Semiannually

APPENDIX II

HMO REPORTING SYSTEM

Form Approved:
OMB No. 68-R-1496

TABLE U-3A: UTILIZATION OF INPATIENT SERVICES BY TOTAL MEMBERSHIP

HSA-51

Organization Name:	Case Number:
For Reporting Period: From:	To:

Type of Inpatient Service	Total Discharges (a)	Total Days Hospitalized (b)
1. Hospital Total		
A. Medical/Surgical		
B. Obstetrical (Maternity)		
C. Newborns In Hospital		
D. Mental Health (Psychiatry)*		
E. All Other		
2. Skilled Nursing Facility Total*		
3. Intermediate Care Facility Total*		

Frequency: Quarterly

Note: * Where covered as a supplemental benefit

APPENDIX II

HMO REPORTING SYSTEM

Form Approved:
OMB No. 68-R-1496
HSA-51

TABLE U-3B: UTILIZATION OF INPATIENT SERVICES BY MEDICAID MEMBERS

Organization Name:	Case Number:
For Reporting Period: From:	To:

Type of Inpatient Service	Total Discharges (a)	Total Days Hospitalized (b)
1. Hospital Total		
A. Medical/Surgical		
B. Obstetrical (Maternity)		
C. Newborns In Hospital		
D. Mental Health (Psychiatry)*		
E. All Other		
2. Skilled Nursing Facility Total*		
3. Intermediate Care Facility Total*		

Frequency: Quarterly

Note: * Where covered as a supplemental benefit

APPENDIX II

HMO REPORTING SYSTEM

Form Approved:
OMB No. 68-R-1496
HSA-51

TABLE U-3C: UTILIZATION OF INPATIENT SERVICES BY MEDICARE MEMBERS

Organization Name:

Case Number:

For Reporting Period: From: To:

Type of Inpatient Service	Total Discharges (a)	Total Days Hospitalized (b)
1. Hospital Total		
A. Medical/Surgical		
B. Obstetrical (Maternity)		
C. Newborns In Hospital		
D. Mental Health (Psychiatry)*		
E. All Other		
2. Skilled Nursing Facility Total*		
3. Intermediate Care Facility Total*		

Frequency: Quarterly

Note: * Where covered as a supplemental benefit

HMO REPORTING SYSTEM

Form Approved:
OMB No. 68-R-1496

HSA-51

TABLE U-4: MEMBER AMBULATORY ENCOUNTERS AND INPATIENT UTILIZATION BY TYPE OF PREPAYMENT

Organization Name:	Case Number:
For Reporting Period: From:	To:

Type of Prepayment	Average Number of Members for Period	Number of Ambulatory Encounters				Days Hospitalized	
		Medical Care	Mental Health	Dental Health	Other Direct Health Care	Total	Number Per 1,000 Members (Annualized)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
1. Total for All Prepayment							
A. Medicaid							
B. Medicare							
C. All Other Prepayment Contracts							

Frequency: Quarterly

APPENDIX II

HMO REPORTING SYSTEM

Form A

TABLE F-1: STATEMENT OF INCOME AND EXPENSE

Organization Name:					Case Numbe	
Detail	Quarter Ended:				Year-to-Date:	
	Total Amount		Per Member Per Month		Total Amount	
	Budgeted	Actual	Budgeted	Actual	Budgeted	Act
Membership (Number of)						
Member Months (Number of)						
Income						
Fremium:						
Group and Nongroup						
Title XVIII						
Title XIX						
Copayments						
Nonmember						
Special Services:						
Pharmacy						
Dental						
Optical						
Grants/Foundation Support						
Other						
Total Income						
Expense						
Health Plan Administration						
Medical Group: Direct Service						
Outside Referral						
Health Center						
Special Services:						
Pharmacy						
Dental						
Optical						
Hospitalization						
Interest on Loans						
Special Programs						
Total Expenses						

APPENDIX III

FEDERALLY QUALIFIED HMOs AS OF FEBRUARY 22, 1979

Name and location	Type	Date qualified
Sound Health Association, Tacoma, Washington	Staff	11/74
Florida Health Care Plan, Inc., Daytona Beach, Florida	Staff	5/75
North Communities Health Plan, Evanston, Illinois	Group	5/75
Piedmont Health Care Corporation, Greenville, South Carolina	Staff	12/75
Portland Metro Health, Inc., Portland, Oregon	IPA	7/75
Rhode Island Group Health Association, Providence, Rhode Island	Staff	10/75
Community Health Care Center Plan, Inc., New Haven, Connecticut	Staff	10/75
Penn Group Health Plan, Pittsburgh, Pennsylvania	Group	11/75
Rocky Mountain HMO, Grand Junction, Colorado	IPA	12/75
Genesee Valley Group Health Association, Rochester, New York	Group	1/76
MAXI-CARE, Hawthorne, California	IPA	3/76
Health Care of Louisville, Inc., Louisville, Kentucky	Staff	4/76
Health Services Plan of Pennsylvania, Philadelphia, Pennsylvania	Group	4/76
Georgetown University Community Health Plan, Inc., Washington, D.C.	Staff	5/76

APPENDIX III

Name and location	Type	Date qualified
Health Care Plan of New Jersey, Cherry Hill, New Jersey	Staff	5/76
Prudential Health Care, Inc., Houston, Texas	Group	6/76
Share Health Plan, St. Paul, Minnesota	Staff	6/76
Rutgers Community Health Plan, New Brunswick, New Jersey	Staff	7/76
ChoiceCare Health Services, Fort Collins, Colorado	IPA	8/76
CompreCare, Inc., Denver, Colorado	IPA	8/76
Westchester Community Health Plan, White Plains, New York	Staff	9/76
Prime Health Plan, Kansas City, Missouri	Staff	11/76
Health Alliance of Northern California/dba Community Care, Los Gatos, California	Group	11/76
Marion Health Foundation, Marion, Ohio	IPA	11/76
Capital Area Community Health Plan, Latham, New York	Staff	12/76
Family Health Services, Inc., Pomona, California	IPA	12/76
Central Essex Health Plan, Orange, New Jersey	Staff	12/76
Metro Health Plan, Indianapolis, Indiana	Staff	3/77
Connecticut Health Plan, Bridgeport, Connecticut	Staff	3/77

APPENDIX III

Name and location	Type	Date qualified
Intergroup Prepaid Health Services, Chicago, Illinois	IPA	4/77
HMO Illinois, Inc., Chicago, Illinois	IPA	6/77
HMO of Pennsylvania, Willow Grove, Pennsylvania	IPA	6/77
Group Health Plan of New Jersey, Guttenberg, New Jersey	Staff	6/77
Group Health Cooperative of South Central Wisconsin, Madison, Wisconsin	Staff	6/77
Gem Health Association, Inc., Boise, Idaho	Group	6/77
Group Health Association, Inc., Washington, D.C.	Staff	7/77
California Medical Group Health Plan, Los Angeles, California	Staff	7/77
American Health Plan, North Miami Beach, Florida	Group	7/77
Family Health Program, Long Beach, California	Staff	7/77
Cooperative Health Plan of Greater Spokane, Spokane, Washington	Group	8/77
Group Health Plan of Southeast Michigan, Warren, Michigan	Staff	9/77
Harvard Community Health Plan, Allston, Massachusetts	Staff	9/77
Av-Med Health Plan, Inc., Miami, Florida	IPA	9/77

Name and location	Type	Date qualified
Kaiser Foundation Health Plan, Inc., Oakland, California Northern California Region Southern California Region Hawaii Region	Group	10/77
Kaiser Foundation Health Plan, of Oregon, Oakland, California	Group	10/77
Kaiser Community Health Foundation (Ohio), Oakland, California	Group	10/77
Kaiser Foundation Health Plan of Colorado, Inc., Oakland, California	Group	10/77
Manhattan Health Plan, Inc., New York, New York	Staff	10/77
Health Central, Inc., Lansing, Michigan	Staff	12/77
Anchor Organization for Health Maintenance, Chicago, Illinois	Staff	12/77
Foundation Health Plan, Inc., Sacramento, California	IPA	12/77
South Los Angeles Community Health Plan/CompreCare, Los Angeles, California	IPA	02/78
Group Health of El Paso, Inc., El Paso, Texas	Group	2/78
Capitol Health Care, Inc., Salem, Oregon	IPA	3/78
Health Maintenance Organization of Baton Rouge, Inc., Baton Rouge, Louisiana	Group	3/78
Crossroads Health Plan, East Orange, New Jersey	IPA	3/78

APPENDIX III

Name and location	Type	Date qualified
HMO Concepts, Inc., Orange, California	IPA	3/78
The Northern California Institute for Medical Services, Inc., Oakland, California	IPA	3/78
Metropolitan Baltimore Health Care, Inc., Baltimore, Maryland	Staff	4/78
Michigan Health Maintenance Organization Plan, Inc., Detroit, Michigan	IPA	4/78
Micheal Reese Health Plan, Inc., Chicago, Illinois	Staff	4/78
Valley Health Plan, Amherst, Massachusetts	Group	5/78
Health Maintenance of Oregon, Inc., Portland, Oregon	IPA	6/78
Prepaid Health Care, Inc., Clearwater, Florida	Staff	8/78
ABC-HMO, Inc., Phoenix, Arizona	Group	8/78
Matthew Thornton Health Plan, Inc., Nashua, New Hampshire	Staff	8/78
Arizona Health Plan, Inc., Phoenix, Arizona	Group	8/78
The Health Care Plan, Inc., Buffalo, New York	Staff	8/78
Los Padres Group Health, San Luis Obispo, California	IPA	9/78
Community Health Plan of Suffolk, Inc., Hauppauge, New York	Staff	10/78
CoMed, Inc., Cedar Knolls, New Jersey	IPA	10/78

APPENDIX III

Name and location	Type	Date qualified
Metro Health Plan, Inc., Detroit, Michigan	Group	10/78
Greater Delaware Valley Health Care, Inc., Radnor, Pennsylvania	IPA	10/78
The Toledo Plan/Health Plus, Toledo, Ohio	Staff	10/78
Fallon Community Health Plan, Worcester, Massachusetts	Group	11/78
Southwest Medical Plan, Inc., San Antonio, Texas	Group	12/78
Pacificare, Incorporated, Los Angeles, California	IPA	12/78
San Luis Valley HMO, Inc., Alamosa, Colorado	IPA	12/78
HealthPlus, Inc., Riverdale, Maryland	IPA	12/78
Protective Health Providers, San Diego, California	Group	12/78
Southshore Health Plan, Inc., Northfield, New Jersey	IPA	12/78
Health Maintenance Network of Southern California, Van Nuys, California	IPA	1/79
Health Central, Lincoln, Nebraska	Staff	1/79
MetroCare, Arlington, Texas	IPA	1/79
Eastern Pennsylvania HMO, Inc., Allentown, Pennsylvania	IPA	2/79
Lifeguard, Inc., San Jose, California	IPA	2/79

APPENDIX III

Name and location	Type	Date qualified
Health Alliance Plan of Michigan, Detroit, Michigan	Group	2/79
Family Health Plan Cooperative, Greendale, Wisconsin	Staff	2/79

BIBLIOGRAPHY

Bailey, Richard M. "Economies of Scale in Medical Practice," in Klarman, Herbert, ed., Empirical Studies in Health Economics. Baltimore: Johns Hopkins Press, 1970, pp. 255-273.

Barten, A. P. "Maximum Likelihood Estimation of a Complete System of Demand Equations," European Economic Review, vol. 1, (Fall 1969), pp. 7-78.

Berki, Sylvester E. Hospital Economics. Lexington: Lexington Books, 1972.

Berndt, Ernest R., and Wood, D. O. "Technology, Prices, and the Derived Demand for Energy." Review of Economics and Statistics, vol. 57 (Aug. 1975), pp. 259-268.

Bothwell, James L. and Cooley, Thomas F. "Efficiency in the Provision of Health Care: An Economic Analysis of Health Maintenance Organizations." Technical Papers in Economics, no. 1, U.S. General Accounting Office (Apr. 1979).

Brown, Randall S., Caves, Douglas W., and Christensen, Lauritis R. "Modelling the Structure of Production With a Joint Cost Function." Workshop Paper No. 7521, Social Science Research Institute, University of Wisconsin, August 1975.

"Can Health Maintenance Organizations Be Successful? An Analysis of 14 Federally Qualified 'HMOs.'" U.S. General Accounting Office. HRD-78-125, June 30, 1978.

Christensen, Laurits R., Jorgenson, Dale W., Lau, Lawrence J. "Conjugate Duality and the Transcendental Logarithmic Production Function." Econometrica, vol. 39 (July 1971), pp. 225-256.

Christensen, Laurits R. "Transcendental Logarithmic Production Frontiers." Review of Economics and Statistics, (Feb. 1973), pp. 208-245.

Diewert, W. Erwin. "An Application of the Shephard Duality Theorem: A Generalized Leontief Production Function." Journal of Political Economy, vol. 79 (May/June 1971), pp. 481-507.

Diewert, W. Erwin. "Applications of Duality Theory," in Michael D. Intriligator and David A. Kendrick, eds., Frontiers of Quantitative Economics. Amsterdam: North-Holland Publishing Company, 1974.

Donabedian, Avedis. "An Evaluation of Prepaid Group Practice." Inquiry, vol. 6 (Sept. 1969), pp. 3-27.

Ellwood, Paul M. et al. "Health Maintenance Strategy." Medical Care, vol. 3 (June 1971), pp. 291-298.

Evans, Robert G. "'Behavioral' Cost Functions for Hospitals." Canadian Journal of Economics, vol. 2 (May 1971), pp. 198-215.

"Factors That Impede Progress in Implementing the Health Maintenance Organization Act of 1973." U.S. General Accounting Office. HRD-76-128, September 3, 1976.

Federal Trade Commission, Bureau of Economics. Staff Report on the Health Maintenance Organization and Its Effects on Competition. Washington: July 1977.

Feldstein, Martin S. Economic Analysis for Health Service Efficiency: Econometric Studies of the British National Health Service. Amsterdam: North-Holland Publishing Company, 1967.

Frech H. E., III, and Ginsburg, Paul B. Public Insurance in Private Medical Markets. Washington, D.C.: American Enterprise Institute, 1978.

Gaus, Clifton R., Cooper, Barbara S., and Hirschman, Constance G. "Contrasts in HMO and Fee-for-Service Performance." Social Security Bulletin, vol. 39 (May 1976), pp. 3-14.

Greenberg, Ira G., and Rodburg, Michael L. "The Role of Prepaid Group Practice in Relieving the Medical Crisis." Harvard Law Review, vol. 84 (Feb. 1971), pp. 887-1001.

Hall, Robert E. "The Specification of Technologies with Several Kinds of Outputs." Journal of Political Economy, vol. 81 (July/Aug. 1973), pp. 878-892.

Hanoch, Giora. "The Elasticity of Scale and the Shape of Average Costs." American Economic Review, vol. 65 (June 1975), pp. 492-497.

"Health Maintenance Organizations: Federal Financing is Adequate But HEW Must Continue Improving Program Management." U.S. General Accounting Office. HRD-79-72, May 1, 1979.

ICF Incorporated. Selected Use of Competition by Health Systems Agencies, final report under contract HEW-HRA-230-75-0071. Washington, D.C.: December 1976.

InterStudy. HMO Growth: 1977 to 1978. Excelsior 1978.

InterStudy. The Competitive Impact of Health Maintenance Organizations: Minneapolis-St. Paul. Excelsior, Minn: 1978.

Johnston, James J. Statistical Cost Analysis, New York: McGraw-Hill, 1960.

Klarman, Herbert E. "Analysis of the HMO Proposal - Its Assumptions Implications and Prospects," in Health Maintenance Organizations: A Reconfiguration of the Health Services System. Chicago: Center for Health Administration Studies, University of Chicago, 1971, pp. 24-38.

Kmenta, Jan, and Gilbert, Roy F. "Small Sample Prospects of Alternative Estimators of Seemingly Unrelated Regressions." Journal of the American Statistical Association, vol. 69 (Dec. 1968) pp. 1180-1200.

Luft, Harold S. "How Do Health Maintenance Organizations Achieve Their 'Savings'?" New England Journal of Medicine, vol. 299 (June 1978), pp. 1336-1343.

Lewis, Charles E., Fein, Rashi, and Mechanic, David. A Right to Health. New York: 1977.

Mann, Judith and Yett, Donald D. "The Analysis of Hospital Costs: A Review Article." Journal of Business, vol. 41 (Apr. 1968), pp. 191-202.

McNeil, Richard and Schlenker, Robert E. "HMOs, Competition and Government." Health and Society, (Spring 1976), pp. 195-224.

Newhouse, Joseph P. "Toward A Theory of Non-Profit Institutions: An Economic Model of a Hospital." American Economic Review, vol. 60 (Mar. 1970), pp. 64-74.

Newhouse, Joseph P. "The Economics of Group Practice." Journal of Human Resources, vol. 8 (Winter 1973), pp. 27-56.

Nixon, Richard M. Message From the President of the United States Relative To Building a National Health Strategy, H. Doc. 92-49, February 1971.

Pauly, Mark. "Medical Staff Characteristics and Hospital Costs." Journal of Human Resources, vol. 13 (1978), Supplement, pp. 77-111.

Roemer, Milton I, and Shonick, William. "HMO Performance: The Recent Evidence." Health and Society, vol. 51, (Summer 1973), pp. 271-317.

Russell, Louis B. Technology in Hospitals: Medical Advances and Their Diffusion. Washington, D.C,: The Brookings Institute, 1979.

Shephard, Ronald W. Cost and Production Functions. Princeton, N.J.: 1953.

U.S. Department of Health, Education, and Welfare. "Health Maintenance Organizations." Federal Register, vol. 39 (Oct. 1974), pp. 37308-37323.

Uzawa, Hirofumi. "Production Functions with Constant Elasticities of Substitution." Review of Economics and Statistics, vol. 44 (Oct. 1962), pp. 291-299.

Zellner, Arnold. "An Efficient Method for Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias." Journal of the American Statistical Association, vol. 57 (June 1962), pp. 585-612.

Nixon, Richard M. Message From the President of the United States Relative To Building a National Health Strategy, H. Doc. 92-49, February 1971.

Pauly, Mark. "Medical Staff Characteristics and Hospital Costs." Journal of Human Resources, vol. 13 (1978), Supplement, pp. 77-111.

Roemer, Milton I, and Shonick, William. "HMO Performance: The Recent Evidence." Health and Society, vol. 51, The Brookings Institute: Summer 1973, pp. 271-317.

Russell, Louis B. Technology in Hospitals: Medical Advances and Their Diffusion. Washington, D.C,: 1979.

Shephard, Ronald W. Cost and Production Functions. Princeton, N.J.: 1953.

U.S. Department of Health, Education, and Welfare. "Health Maintenance Organizations." Federal Register, vol. 39 (Oct. 1974), pp. 37308-37323.

Uzawa, Hirofumi. "Production Functions with Constant Elasticities of Substitution." Review of Economics and Statistics, vol. 44 (Oct. 1962), pp. 291-299.

Zellner Arnold. "An Efficient Method for Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias." Journal of the American Statistical Association, vol. 57 (June 1962), pp. 585-612.

APPENDIX V

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

REFER TO: OFFICE OF THE INSPECTOR GENERAL

DEC 12 1979

Mr. Gregory J. Ahart
Director, Human
Resources Division
United States General
Accounting Office
Washington, D.C. 20548

Dear Mr. Ahart:

The Secretary asked that I respond to your request for our comments on your draft report entitled, "An Economic Analysis of the Operation of Federally Qualified Health Maintenance Organizations." The enclosed comments represent the tentative position of the Department and are subject to reevaluation when the final version of this report is received.

We appreciate the opportunity to comment on this draft report before its publication.

Sincerely yours,

Richard B. Lowe III
Acting Inspector General

Enclosure

APPENDIX V

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE ON THE GENERAL ACCOUNTING OFFICE'S DRAFT REPORT ENTITLED: "AN ECONOMIC ANALYSIS OF THE OPERATION OF FEDERALLY QUALIFIED HEALTH MAINTENANCE ORGANIZATIONS."

GENERAL COMMENTS

The Department was pleased to find that the report was generally positive and concluded that HMOs are responding to economic incentives. However, there are two specific findings that we will address: (1) the national data reporting requirements, and (2) the potential impact on HMO costs, if there is a substantial increase in medical staff wages.

(1) The National Data Reporting Requirements: The report findings indicated that HMOs did not submit the required reports to the Office of Health Maintenance Organizations (OHMO) on time. The reliability of the data was also in question. OHMO has been aware of the need for reliable and timely data. During the past months, timely reporting has been given priority. The "tickler" system which identifies those HMOs whose reports are overdue, has been an effective tool. Late reporting has been reduced significantly. In the third quarter of FY '79, 62% of the plans sent their reports in on time compared to 12% in FY '78. Also, a number of editing and logical checks on the data are built into the computerized data system. Plans for future modification in the system to improve the reliability of the data are also being developed. Through a series of analyses of the data, OHMO developed indicators (early warning signs) which help them to determine if the plan is progressing on schedule or if it is in difficulty and requires immediate attention. These efforts to refine the data so it is usable and meaningful will be continued by the users.

(2) The Potential Impact on HMO Costs, if there is a substantial increase in medical staff salaries: The report indicated that if salaries for medical staff increase substantially, there may be little possibility for HMOs to offset these increased costs by an increase in productivity owing to technology. We agree that this observation is valid and the OHMO needs to be aware of the possible implications as a plan increases in size. Medical staff salaries cannot be controlled by HMOs because they are dictated by supply and demand and other factors. Nevertheless, many HMOs are employing nurse practitioners, midwives and physician assistants. Their salaries are generally one-half that of physicians. We believe this is an encouraging trend.

GAO RECOMMENDATION

We believe that HEW could usefully undertake studies of HMOs such as those suggested above. We recommend that HEW consider the above topics in its HMO research and evaluation strategy and report the results of their studies to the Congress.

DEPARTMENT COMMENT

The Department concurs with this recommendation. The OHMO is currently in the process of evaluating potential HMO research and evaluation projects for inclusion in an HMO evaluation plan. As suggested in the GAO report, the OHMO will consider the following topics for further research and analysis as more data becomes available: the relative performance of different types of HMOs; a more accurate identification of the minimum efficient size for an HMO operation; the effects of the HMOs on the public's health which requires data on the status of HMO enrollees; and the comparative performance of HMOs and traditional fee-for-service system. As research and evaluation studies are accomplished, the results of these studies will be reported to Congress as recommended in the GAO report.

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