

CONCERNING HIGH AND LOW UTILIZERS OF SERVICE IN A MEDICAL CARE PLAN, AND THE PERSISTENCE OF UTILIZATION LEVELS OVER A THREE YEAR PERIOD¹

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INTRODUCTION

THE unequal distribution of episodes of illness and physical and social disability in various population groups has been the subject of intensive investigation for years. These studies have demonstrated repeatedly that small groups account for disproportionately large shares of the adverse events experienced by the population and that there is a tendency for high incidence groups to remain high for extended periods of time.

A distinguishing characteristic of inquiries in more recent years has been the application made of this type of observation to specific medical care, industrial, health and welfare problems. Thus, the uneven distribution of medical costs in the population (1) has spurred much of the interest in the extension of health insurance to all types of physician services. The concentration of the bulk of industrial absenteeism and illnesses in a minority of employees has led to questions of direct concern to management as well as to more general questions regarding the role of the social and interpersonal environment in the occurrence of these episodes. (2) In the public welfare field, the receipt by a relatively few disabled indigent families of most of the expenditures for community health and dependency services has resulted in concerted efforts to find better methods of prevention or control. (3)

Two observations of the utilization experience of members of the Health Insurance Plan of Greater New York (HIP)

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indicate that here, too, there may be a setting for useful investigation of population behavior, this time with respect to the receipt of physician services in a prepaid group practice medical care plan.

1. Each year it is found that 4 per cent of the HIP members account for 25 per cent of the total volume of physician services and that 12 per cent account for 50 per cent of all services. This indicates an extraordinarily high degree of concentration of medical care in a small group of individuals. At the low end of the utilization scale, about 1 in 4 members receive no services in a year and another 1 in four see a doctor once or twice (Table 1, Figure 1).

2. It has also been observed in HIP that when groups of individuals are followed for several years, the average experience of a group that initially has a high utilization decreases somewhat but remains comparatively high; the average experience of an initially low utilization group increases but remains low (Figure 2).³

The preceding suggest that there are people who are *characteristically high utilizers* and that they account for a significant segment of the medical care provided to all persons. Confirmation of this would lead to further inquiry into the nature of the consistent high utilizers and eventually to an examination of

Table 1. Distribution of HIP members by number of physician visits during the year July 1, 1956-June 30, 1957.

NUMBER OF PHYSICIAN VISITS	PER CENT OF ALL HIP MEMBERS
TOTAL	100.0
No Service	25.3
1	12.8
2	10.8
3	9.0
4	7.3
5-6	10.7
7-9	9.3
10-14	7.2
15-19	3.4
20-24	1.8
25-29	0.9
30-39	0.9
40 or More	0.6

NOTE: Data based on a 10 per cent sample of HIP subscribers insured throughout the year and all of their dependents enrolled on June 30, 1957.

³ Based on the results of a longitudinal study of the experience in the first few years of HIP's program, 1948-1951. The study was carried out through grants received from the Rockefeller Foundation and the Commonwealth Fund.

issues of potential value for "medical economics" and the organization of medical practice. Briefly, the questions that would be of interest are of the following variety:

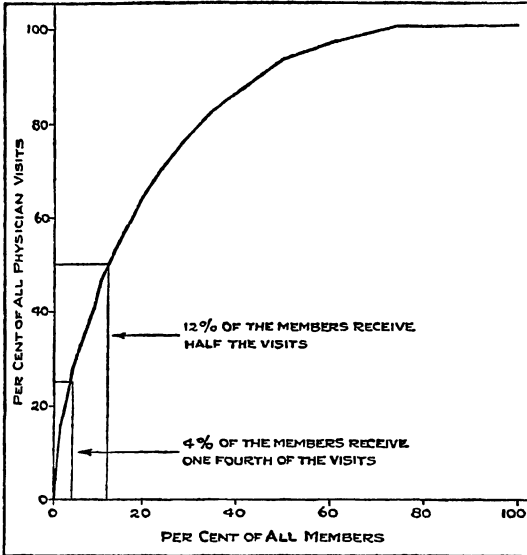


Fig. 1. Distribution of physician visits among HIP members July 1, 1956-June 30, 1957. Data based on a 10 per cent sample of HIP subscribers insured throughout the year and all of their dependents enrolled on June 30, 1957.

a. To what extent does the group of persistent high utilizers consist of the chronically ill, those subject to repeated attacks of minor illnesses, the anxious and dependent?

b. In a group practice setting such as HIP, does the high utilization pattern result, to any important degree, from a carry-over of traditional ways of providing medical care in solo practice? If so, what are the possibilities for experimenting with changes which would benefit the patient and increase efficiency in

providing medical care?

With regard to the non-utilizer group, the findings mentioned above suggest that there is a significant number of individuals who for long intervals of time feel that they do not need medical care. This group is of interest from two standpoints:

a. To what extent does it consist of individuals who ignore symptoms generally agreed upon as requiring medical attention and what does this mean for future medical requirements?⁴

b. To what extent does it consist of individuals who are free

⁴ An essential point to be clarified is the extent to which non-utilizers of HIP physicians receive medical care from physicians outside of HIP. It is believed that this is a relatively small proportion of the total number of "non-utilizers."

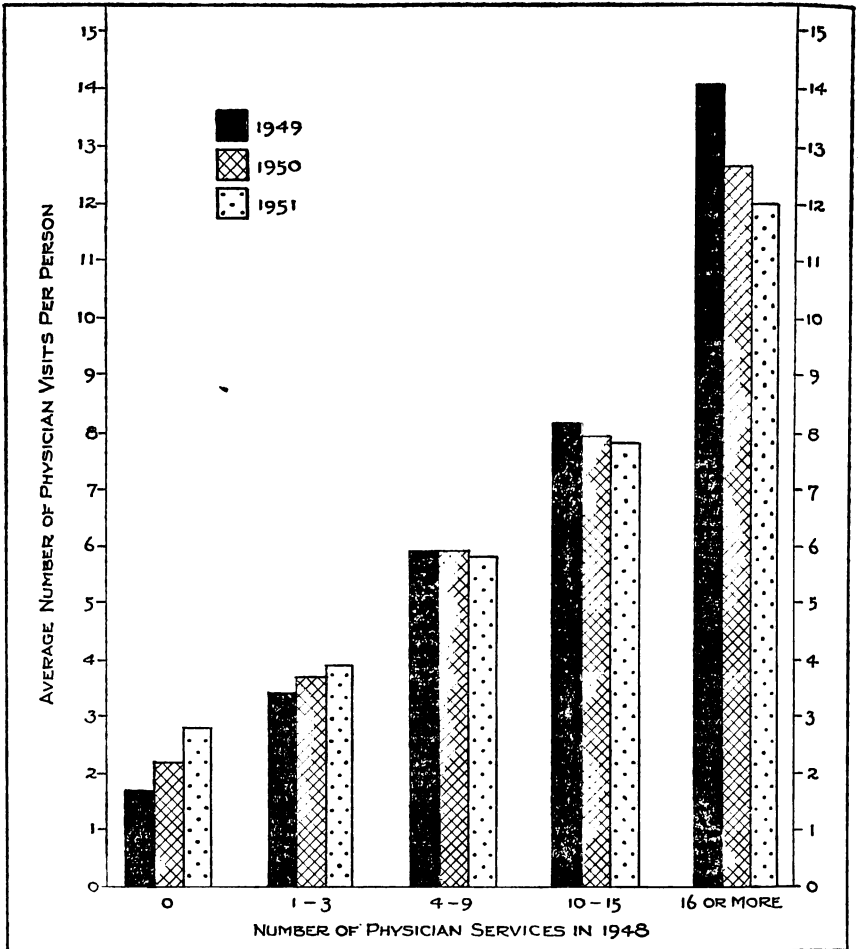


Fig. 2. Average annual utilization rates in 1949, 1950 and 1951 among groups of HIP members classified by utilization in 1948. Data based on a 10 per cent sample of the HIP population enrolled throughout the period January 1, 1948–December 31, 1951.

of malconditions, symptoms, etc., and who would therefore fall in the extreme “healthy” class of a continuum that ranges from “healthy” to “chronically ill?”

The importance of the questions raised is, of course, heavily conditioned by the degree to which persons have a tendency to remain at the same utilization level. The study reported here is concerned with this issue and has as its objectives:

1. To determine the extent to which individuals who are

high utilizers of physician services in one year remain high utilizers in succeeding years; similarly to determine consistency in utilization among low utilizers. Also, to establish whether such characteristics as age, sex or duration in HIP can be used to identify sub-groups that have an unusually high degree of consistency in utilization.

2. To determine whether family units show any greater or lesser consistency in their year to year pattern of utilization than do individuals and whether family size is a factor.

STUDY SETTING

The Health Insurance Plan of Greater New York (HIP) is a prepaid voluntary plan now about 12 years old. It is organized on a group practice basis and provides comprehensive medical care.⁵ Persons covered are entitled to receive medical care from family physicians and specialists in the office, the home and the hospital. Preventive and diagnostic medical services and tests, treatment of illness, as well as physical therapy and services of visiting nurses are included. The only medical services excluded are treatment by a psychiatrist, purely cosmetic surgery, care for drug addiction, anesthesia, and care for chronic illnesses in institutions other than general hospitals.

There are no waiting periods for service in HIP, no exclusions from enrollment because of preexisting conditions, and no limitation on the number of services or duration of medical care. Medical services are provided by physicians associated with 32 medical groups. Each medical group receives an annual capitation payment for each insured person in that group. Members receive no bill for medical services, the premium paying the entire cost. (The only exception is a possible \$2.00 charge for a night call to the home between 10 P.M. and 7 A.M.).

METHODOLOGY

Statistics in this report are derived from an enrollment card

⁵ Initial enrollment is on a group basis only, the usual requirement being that at least 75 per cent of those eligible enroll. Contracts ordinarily provide for coverage of the employee, spouse, and unmarried children under 18 years of age. Members leaving a group may convert to an individual contract.

prepared for each HIP subscriber and from a physician's report form on which the physician records information about each contact with an HIP member. The enrollment card gives the age, sex, and history of all changes in coverage status for each person insured. In general, physician visits refer to face-to-face contacts between the physician and the patient in the office, home, or hospital. Each visit, (including pre-operative, post-operative, prenatal), is counted as a separate physician service.

The group under study consists of 22,809 individuals in a 10 per cent random sample of employees of the City of New York and their dependents enrolled in HIP continuously from January 1, 1954 to June 30, 1957.⁶ This interval was divided into three one-year periods: January–December, 1954, July 1955–June 1956, July 1956–June 1957.⁷ A punch card was prepared for each individual and each family indicating the number of physician services received in each of these time periods. Individuals were classified into one of the following utilization categories for each year.

UTILIZATION DURING 1954

<i>Utilization Level</i>	<i>Per Cent of Persons Enrolled in 1954</i>
Low — 0 Services	25.9
1–2	25.5
Moderate— 3–9	34.9
High —10 or More Services	13.7
(10–16)	(8.2)
(17 or More Services)	(5.5)

In classifying families into one of 4 utilization categories,

⁶ City employees and their dependents represented about 69 per cent of the total enrollment in HIP during this period. The restriction of the study group to those continuously enrolled results in the exclusion of all children born during the period, deaths, and persons who either entered or dropped HIP between January 1954 and June 1957. The excluded groups comprised 29 per cent of the average enrollment of city employees and their dependents.

⁷ Throughout the report the period July 1955–June 1956 is referred to as "1955" and July 1956–June 1957 as "1956."

from low to high, account must be taken of the fact that large families will generally have more physician services than small families if for no other reason than their having more persons. This was done from a detailed frequency distribution of *families* by number of services received by the total family. Separate class intervals were chosen for each size family in such a way that about the same proportion of families fell in each utilization class as is shown above for individuals.

Thus, for 2 person families, the lowest utilization class consisted of families with less than 3 services; for 4 person families it consisted of families with less than 9 services. At the other end of the scale, a 2 person family was classified as a high utilizer if it received 20 or more services. (See Appendix Table F4 for definition of low and high utilization families).

Tabulations were run to determine the utilization experience in succeeding years of individuals (and families of specified size) who were low, moderate and high utilizers in 1954.

Two series of tables have been prepared for this report. One set gives percentages and distributions as observed. The text is based almost entirely on these data. The other set (see appendix tables) presents observed figures in greater detail and percentages that would be expected if utilization in one year did not influence utilization in future years. A discussion of how these expected values were derived and their interpretation is contained in the technical appendix.

FINDINGS

A. Low and High Utilization in a Single Year

Before considering consistency in remaining at the same utilization level from year to year, it is worth examining whether the extremes in utilization (low and high) appear to be concentrated in a particular segment of the HIP population. Variables available for study included age, sex, year of enrollment in HIP, and family size.

1. *Individual Enrollees.* From Table 2, it is apparent that

the likelihood of an enrollee being a low or high utilizer varies moderately with age and sex. Children have especially low percentages at the extremes of the utilization scale (i.e. no physician visits and 17 or more visits). Among adults, the proportion that did not see a physician in a year increased with age and there was a slight increase with age in the per cent that saw a physician at least 10 times. A higher proportion of adult males under 60 than adult females did not visit a physician during the year—but fewer of them received large volumes of service. Differences between adult males and females were present even when women who were delivered by HIP physicians during the study period were excluded.

Adults who joined HIP in 1952–53 had, on the whole, a somewhat similar pattern of utilization as those who became members in the first few years of HIP's program (Table 3).

Table 2. Distribution of HIP members of specified age and sex by number of physician visits in 1954.

AGE AND SEX	TOTAL NUMBER OF PERSONS	PER CENT OF ALL PERSONS BY NUMBER OF PHYSICIAN VISITS					
		Total	None	1–2	3–9	10–16	17 or More
ALL PERSONS	22,809	100.0	25.9	25.5	34.9	8.2	5.5
Children ¹	7,834	100.0	20.4	28.0	40.7	8.0	2.8
Adults	14,975	100.0	28.8	24.1	31.9	8.3	6.9
Under 45	9,178	100.0	27.4	25.8	32.0	8.0	6.7
45–59	4,803	100.0	30.3	21.8	32.2	8.5	7.2
60 or More	706	100.0	36.8	18.1	27.9	10.3	6.8
Adult Males ²	7,508	100.0	31.5	25.1	31.6	6.7	5.1
Under 45	4,266	100.0	31.0	27.3	31.7	5.9	4.1
45–59	2,646	100.0	31.6	23.0	31.5	7.3	6.5
60 or More	455	100.0	35.8	17.4	29.5	10.1	7.3
Adult Females ²	7,467	100.0	26.1	23.1	32.2	9.9	8.6
Under 45	4,912	100.0	24.3	24.6	32.3	9.9	8.9
45–59	2,157	100.0	28.7	20.3	33.1	10.0	8.0
60 or More	251	100.0	38.6	19.5	25.1	10.8	6.0
Adult Females (Excluding Those Delivered by HIP Doctors, 1954–1957)							
Total	6,547	100.0	28.4	23.9	32.7	8.6	6.4
Under 45	3,992	100.0	27.7	26.3	33.0	7.7	5.3

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954–June 30, 1957.

¹ Subscribers' children under 18 years of age excluding those born January 1, 1954–June 30, 1957.

² Includes persons of unknown age.

YEAR OF ENROLLMENT AND SEX	TOTAL NUMBER OF PERSONS	PER CENT OF ALL PERSONS BY NUMBER OF PHYSICIAN VISITS					
		Total	None	1-2	3-9	10-16	17 or More
All Adults	14,975	100.0	28.8	24.1	31.9	8.3	6.9
Enrolled							
1947-1949	8,982	100.0	27.8	23.5	32.8	8.6	7.2
1950-1951	2,560	100.0	30.8	25.5	28.9	8.4	6.5
1952-1953	3,433	100.0	30.1	24.6	31.8	7.3	6.2
Adult Males	7,508	100.0	31.5	25.1	31.6	6.7	5.1
Enrolled							
1947-1949	4,486	100.0	29.6	24.7	32.6	7.1	5.9
1950-1951	1,289	100.0	34.7	25.8	27.7	7.0	4.9
1952-1953	1,733	100.0	33.9	25.5	31.9	5.3	3.4
Adult Females	7,467	100.0	26.1	23.1	32.2	9.9	8.6
Enrolled							
1947-1949	4,496	100.0	25.9	22.3	33.1	10.1	8.6
1950-1951	1,271	100.0	26.8	25.2	30.1	9.8	8.2
1952-1953	1,700	100.0	26.3	23.6	31.7	9.3	9.1

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Table 3. Distribution of adult males and females enrolled in HIP for varying periods of time by volume of physician visits in 1954.

The only group in which there was some relationship between year of enrollment and volume of service was the adult male category for which more recent enrollment appeared to be associated with a relatively low percentage of high utilizers. Although these results concern individuals in a wide variety of employment groups that entered HIP between 1947 and 1953, they suggest that duration in HIP (after the initial years of enrollment) may not exert a strong influence on the patterns of utilization in a single year. To examine this issue further would require presently unavailable data on the utilization pattern of a cohort at various intervals following enrollment.

2. *Size of Family.* Some indication of the relationship between family size and the utilization of physician services by individuals is found in Table 4. Although data are given for only 3 family sizes, i.e. 1-person, 3-person and 4-person, it is clear that there is no association between size of family and the likelihood of an individual being a high utilizer. However, non-utilization decreases as family size increases. Actually, as seen from the following figures, the proportion of non-

NUMBER OF PHYSICIAN VISITS RECEIVED BY A FAMILY MEMBER	PER CENT OF ALL PERSONS IN FAMILIES OF SPECIFIED SIZE		
	Members of One Person Families	Members of Three Person Families	Members of Four Person Families
TOTAL	100.0	100.0	100.0
No Service	37.4	24.5	20.1
1-2 Services	20.6	24.0	28.1
3-9 Services	29.1	35.7	38.7
10 or More Services	12.9	15.8	13.1
Total Number of Persons	2,048	4,848	6,576

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Table 4. Distribution of HIP members in families of specified size by number of physician visits in 1954.

utilizers in one-person families is exceptionally high whether the comparison is with all other enrollees or with only other adults.

*Per Cent of Persons With No
Physician Visits in 1954*

1-Person Families	37.4
2 or More Person Families	
Adults and Children	24.8
Adults Only	27.5

In summary, the utilization patterns by age, sex, year of enrollment in HIP, and family size, show some differences. In a few instances they are fairly large, e.g. children as a group are low in both high utilizers and non-utilizers; one-person families are high in non-utilizers. Nevertheless, the margins that separate categories from one another are not so large that some groups can be viewed on the one hand as being unimportant in a study of utilization patterns or on the other hand as being the focal point for such a study. In other words, *an intensive examination of low and high utilizers should be concerned with all ages, males and females and all family sizes.*

B. Year to Year Consistency in Utilization Level of Individuals

HIP members followed for the 3 year period 1954–1956, were more likely to remain at the same utilization level from year to year than would be expected if one year's experience were independent of the previous year's. This was true for all utilization levels—low, medium, and high. The categories that are of primary interest in this paper are the two extremes of the distribution and the discussion that follows concerns individuals who were high utilizers (10 or more services) in 1954 and those who did not see a physician that year.

Table 5. Per cent of HIP members who were non-utilizers or high utilizers in 1954 who remain at same utilization level in succeeding years, by age, sex and date of enrollment in HIP.

AGE AND SEX, DATE OF ENROLLMENT IN HIP	NON-UTILIZERS IN YEAR 1 (1954)				HIGH UTILIZERS (10 OR MORE SERVICES) IN YEAR 1 (1954)			
	Total Number	Per Cent Who Remain in Same Class in			Total Number	Per Cent Who Remain in Same Class in		
		Year 2	Year 3	Years 2 and 3		Year 2	Year 3	Years 2 and 3
TOTAL	5,914	49.7	46.0	31.0	3,119	36.5	33.2	20.9
Children ¹	1,598	44.0	39.6	26.7	849	33.3	24.5	16.7
Adult Males ²	2,365	50.4	46.6	30.1	888	39.4	35.2	24.7
Under 45	1,323	48.6	43.1	26.5	427	36.5	31.1	21.8
45–59	837	52.1	50.5	33.8	366	42.9	38.5	27.9
60 or More	163	54.6	56.4	41.1	79	41.8	43.0	27.8
Adult Females ²	1,951	53.6	50.4	35.5	1,382	36.5	37.3	21.1
Under 45	1,195	49.0	44.9	30.0	923	33.9	36.0	18.5
45–59	619	59.1	56.4	41.8	387	41.9	40.6	26.6
60 or More	97	72.2	72.2	58.8	42	40.5	42.9	26.2
Adult Females (Excluding Those Delivered by HIP Doctors, 1954–1957)	1,862	55.5	52.3	37.2	977	39.9	38.6	24.0
Under 45	1,106	51.7	47.6	32.3	518	38.8	37.3	22.0
Adults Enrolled in HIP								
1947–1949	2,493	52.0	49.8	33.9	1,426	40.5	37.6	24.3
1950–1951	788	51.4	46.6	30.5	381	33.1	36.2	20.5
1952–1953	1,035	51.7	46.2	31.0	463	32.6	33.5	18.4

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954–June 30, 1957.

Year 1 is 1954; Year 2 is July 1955–June 1956; Year 3 is July 1956–June 1957.

¹ Subscribers' children under 18 years of age excluding those born January 1, 1954–June 30, 1957.

² Includes persons of unknown age.

High Utilizers. Over a third (36.5 per cent) of the high utilizers in 1954 remained high utilizers in 1955 and a fifth (20.9 per cent) were high utilizers in both 1955 and 1956 (Table 5). This suggests a fairly rapid attenuation in the group of high utilizers and the possibility that if extended an additional 2 or 3 years there would be a negligible proportion left. However, receipt of at least 10 physician services year after year is a stringent requirement for classifying an individual as "a characteristically high utilizer."

Movement out of a utilization class one year may be followed by a return to that class in a subsequent year and any such tendency would appear to be an important factor to take into account. As shown below, when the experience of the 1954 high utilizers is examined 2 years later, fully a third are found to be high utilizers again. It is also of considerable interest that about a quarter of them were not seen at all by a doctor in 1956, or had only 1 or 2 physician visits that year. This illustrates the need for finding some way to identify the high utilizer who will continue to be a high utilizer and not treating all high utilizers in a specific year as a homogeneous category. (For more detailed data see Appendix Tables P1-P5).

<i>Utilization Class</i>		<i>Per Cent of 1954 High Utilizers in Specified Class in 1956</i>
Low	—No Physician Visits	8.3
	1-2	16.9
Medium—	3-9	41.6
High	— 10 or More	33.2

Minor variations in these relationships occurred among various subgroups of the HIP population (Table 5). For example, a somewhat higher proportion of adult males than adult females continued as high utilizers from year to year. This difference disappeared entirely when the comparison excluded women who gave birth during the study period, and whose need for large volumes of care was restricted for the most part

to the comparatively short interval covering prenatal and postpartum care.

There is also some indication that adults under 45 were

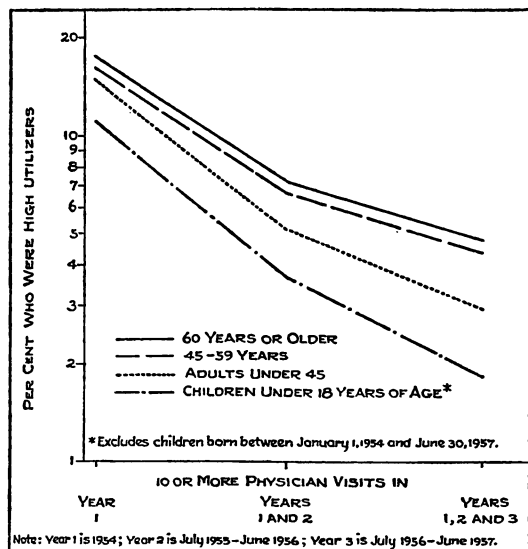


Fig. 3. Per cent of HIP members who were high utilizers, three successive years of experience, 1954-1956. Data based on a 10 per cent sample of persons insured through the City of New York throughout the period January 1, 1954-June 30, 1957.

continue as high utilizers than were more recent enrollees.

When some of the above findings are related to the earlier observations regarding high utilizers in 1954, an interesting pattern emerges. From Figure 3 (plotted on a semi-logarithmic scale), it can be seen that the rate of decline in the proportions that remained high utilizers was lowest among individuals who had the greatest proportions of high utilizers in 1954 (i.e. older adults); the most rapid decline occurred in the group with the lowest proportion of high utilizers in 1954 (i.e. children). (Appendix Table P-6).

Influence of the High Utilizers on Overall Utilization. In assessing the significance of the preceding for an operating medical care program, it is useful to consider how large the groups of high utilizers are and the proportion of the total

adults under 45 were slightly less likely to remain high utilizers than older adults. As regards children, a lower proportion of the 1954 high utilizers continued as high utilizers in succeeding years than was the case for adults.

One other comparison is worth mentioning; this concerns year of enrollment in HIP. Judging from this type of data, persons in the Plan for a comparatively long time were more likely to con-

volume of services they receive. It is apparent from the following figures that only a small segment of the total HIP population can be designated as characteristically high utilizers, i.e. whether the criterion for this designation is 3 consecutive years of high utilization or 2 alternate years. The important point, however, is that this small group accounts for an appreciable portion of the total volume of services. This is seen a little more clearly when estimating the decrease in the utilization rate that would result if it were possible to identify individuals who had a tendency to remain high utilizers and to alter their future pattern.

Under the extreme assumption that the utilization of all of these individuals could be modified so that they had the same utilization as other members, there would be a 17 per cent reduction in the utilization rate during the second year of the program and a 25 per cent reduction in the third year. These proportions are, of course, upper limits of a highly theoretical set of circumstances but they indicate quite impressively the importance of studying the high utilizer more closely.

<i>Year in Which Utilization was High</i>	<i>Per Cent of Total HIP Who Were High Utilizers (10 or More Services in a Year)</i>	<i>Per Cent of Total Services Received by High Utilizers</i>
1954	13.7	52.4
1954, 1955, 1956	2.9	13.3
1954, 1956	4.5	19.7

Non-Utilizers. Half (49.7 per cent) of the non-utilizers in 1954 did not see an HIP physician the following year and 31.0 per cent did not see a doctor in either 1955 or 1956⁸ (Table 5). These proportions are considerably greater than would be expected if the experience after 1954 were independent of the utilization in 1954. It is also clear, however, that if consistency

⁸ As indicated previously, non-utilization refers to HIP medical care and some of the "non-utilizers" may have seen a physician outside of HIP. Any intensive study of "non-utilizers" would have to concern itself with characteristics of two groups; those who did not see any physician and those who saw only a doctor outside HIP.

is defined as non-utilization in several consecutive years, the "consistent" non-utilizer group falls off fairly rapidly as the number of years increases. Thus, 1 in 4 of all HIP members were non-utilizers in 1954; 1 in 12 were non-utilizers in all 3 study years.

As in the case of high utilizers, a somewhat different impression regarding "consistency" is obtained if the definition takes into account movement back into the non-utilization class. The following figures show, for example, that in 1956 almost half of the 1954 non-utilizers did not see a physician. It will also be noted that the proportion (6 per cent) who had many doctor visits two years later was small but far from inconsequential. This demonstrates once again the importance of not treating all persons in a specific utilization class one year as a homogeneous group. Among non-utilizers as among high utilizers there is a need for finding characteristics that distinguish individuals who have a tendency to continue at the same utilization level from those who do not.

<i>Utilization Class</i>	<i>Per Cent of 1954 Non-Utilizers in Specified Class in 1956</i>
Low —No Physician Visits	46.0
1-2	26.8
Medium— 3-9	21.2
High — 10 or More	6.0

At all ages in both sexes, there was greater consistency in year to year non-utilization than could be explained by chance factors.⁹ The patterns, however, differed in a number of respects. Children, the group that had the lowest proportion of non-utilizers in 1954, experienced the sharpest decline in the proportion that remained non-utilizers as additional years came under observation (Table 5, Figure 4, Appendix Table P 6).

With regard to adults, there was a slightly greater tendency for females than males to remain non-utilizers. Also, the older

⁹ See Technical Appendix for discussion of tests of statistical significance.

the adult (in both sexes) the greater the chance that a non-utilizer in one year would continue to be a non-utilizer. This parallels the earlier finding that the per cent of non-utilizers during 1954 increased with age. "Year of enrollment" and consistency in non-utilization showed no association at all.

Probably the most interesting of the above findings is the relationship between age and non-utilization among adults. It may reflect, of course, the fact that utilization refers to medical care from HIP physicians only, and one cannot ignore the possibility that older persons are more apt than others to depend com-

pletely on physicians outside of HIP. It seems unlikely though that this could reverse the picture. Actually, even if the aged followed the same pattern as other age groups, there would be considerable point in learning more about the circumstances that result in a sizable segment of the population highly subject to chronic disease to be consistent non-utilizers over a 3 year period.

C. Size of Family and Year to Year Consistency in Family Utilization

Thus far the discussion has been concerned with the experience of individuals. Some of the variables identify groups that

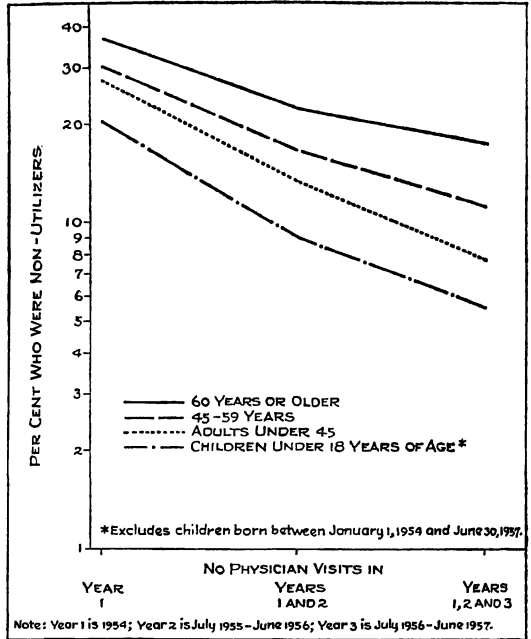


Fig. 4. Per cent of HIP members who were non-utilizers, three successive years of experience, 1954-1956. Data based on a 10 per cent sample of persons insured through the City of New York throughout the period January 1, 1954-June 30, 1957.

FAMILY SIZE	Low ¹ UTILIZERS IN YEAR 1 (1954)				High ¹ UTILIZERS IN YEAR 1 (1954)			
	Number of Families	Per Cent Who Remain in Same Class in			Number of Families	Per Cent Who Remain in Same Class in		
		Year 2	Year 3	Years 2 and 3		Year 2	Year 3	Years 2 and 3
One Person	766	62.0	59.0	44.1	265	42.6	38.9	26.4
Two Persons	702	57.8	51.6	38.6	381	37.3	37.8	21.3
Three Persons	410	51.7	49.5	34.4	193	37.3	31.1	22.3
Four Persons	463	52.1	48.2	31.3	228	37.7	34.6	23.2
Five or More Persons	207	57.5	46.9	35.3	93	36.6	33.3	20.4

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Year 1 is 1954; Year 2 is July 1955-June 1956; Year 3 is July 1956-June 1957.

¹ For definitions of low and high utilizers see Appendix Table F4.

Table 6. Per cent of families in HIP who were low utilizers or high utilizers in 1954, who remain at same utilization level in succeeding years. (Families classified by size.)

have comparatively high proportions remaining high or low utilizers from year to year, but with one or two exceptions, the differentials are not especially large. The question arises whether another axis of classification—the family—would be more efficient in identifying clusters that have particularly large proportions at the same utilization level for a number of years.

Table 6 gives the patterns followed by families of different sizes; utilization being defined as the total number of physician services received by all family members.¹⁰ From these data it would appear that no one family size has a much more consistent pattern than the others. The most deviant group is the 1-person family unit. Here the proportions of 1954 low and high utilizers that remain at these levels in 1955 and 1956 were somewhat greater than was true for larger family units.

Another issue related to family utilization is the possibility that high utilizers tend to concentrate in the same families and similarly for non-utilizers. If this were so and if the number of such instances were sufficiently large then a study of high (or low utilizers) would be more efficient if it were

¹⁰ For discussion of class intervals selected to classify families as low and high utilizers see Technical Appendix.

family centered than if the individual were the primary unit under observation.

Data for 3-person family units strongly suggest that this is not a critical factor (Appendix Table F3). In only 1 per cent of the families were all 3 members high utilizers and these individuals, as shown below, represented a small fraction of the total number of high utilizers. Restriction of a study to families that had all its members in the same utilization class would also exclude a large majority of the non-utilizers. The situation, however, is not as extreme as in the case of high utilizers. With 1 in 5 of the non-utilizers involved, it would be of value to examine the circumstances under which all persons in a family fail to see an HIP physician in the course of a year.

Per Cent of 3-Person Families With All 3 Members	
Non-Utilizers	4.9
High Utilizers (10 or More Physician Visits)	1.1
Per Cent of All Non-Utilizers Found in Families	
Where All Members Were Non-Utilizers	21.1
Per Cent of All High Utilizers Found in Families	
Where All Members Were High Utilizers	7.0

Conclusions. The study of three years of utilization of physician services in HIP reported here, indicates that consistent high utilizers and non-utilizers are found in each age-sex group, and among both seasoned "enrollees" and comparative "newcomers."

Children are the least likely to be either high utilizers or non-utilizers during the year and experience the most rapid decline in the proportions that remain at these utilization levels from year to year. The reverse situation occurs among persons 60 years of age or older. This age group has the highest proportions of high and low utilizers when utilization is measured over a single year or a longer time period. Data by family size identify the 1-person unit as having comparatively more low utilizers than any other type of family and as

having the greatest year to year consistency in low utilization.

While these differences in patterns are important, they are not so large that some categories can be designated as being of no interest and others as holding all of the interest for further inquiries regarding consistent high or low utilizers. Actually, the decision as to whether additional investigation is worthwhile for any group is dependent on the criteria for judging "consistency" and on whether the group so defined has an impact on overall utilization. In the present, early stages of investigation of high and low utilization, it would seem desirable to apply a definition that is not too restrictive, e.g. one that brings under observation individuals who either remain at the same utilization level for several years or have a tendency to keep returning to the same level. The longer the time period the firmer the basis for this type of approach, but even within the limits of the 3 year experience examined, there is strong evidence that "consistent" high utilizers under such a definition have an important influence on total utilization. Similarly, "consistent" non-utilizers form a significantly large group.

The results of the current study give ample justification for inquiring further into the issue of consistency in utilization. The direction and purpose of future investigations would, however, have to be quite different from the one reported here. Their concern would be with the circumstances that result in "consistent" high or low utilization; also, whether any of the important circumstances appear to be amenable to change and if so, to what extent past experience can be used to identify individuals whose future utilization of medical care might be affected by such changes.

In a broad sense, all of these questions are subsidiary to the basic question of whether in a group practice setting such as HIP, traditional methods of providing care can be altered to the benefit of the patient and at a saving in medical costs. This is a long-range issue which may very well require experimental approaches to find the answer. However, before con-

sidering the form of such experiments or for that matter whether there would be any point to them, a great deal of additional information is needed.

With regard to the "consistent" high utilizers, the first requirement would be a clarification of the medical conditions for which care is received and an assessment of the degree to which this care is supportive or directed at somatic conditions. The distinction between the two is, of course, frequently far from clear. Implicit in the problem is the need to define so-called "normal" patterns of medical care in the presence of specified somatic conditions and to isolate deviations from these patterns. The HIP setting offers an unusual opportunity for pursuing this line of inquiry. Favorable circumstances include the availability within the HIP population of well-defined groups that have been enrolled at least 7 or 8 years, from which study and control cases can be obtained; the ability to keep a large majority under observation in the future; and the accessibility of information regarding past illnesses for which medical care was received in HIP.

With regard to the consistent non-utilizers, the primary issues are related to health status, perception of need, reaction to symptoms, social and economic background and past experience with medical care. In short, if the significance of non-utilization for future medical requirements is to be pursued very far, it would be necessary to take a socio-psychological approach and to develop a device for measuring health status or determining existing medical conditions (recognized and unrecognized) in the non-utilizer.

TECHNICAL APPENDIX

CLASSIFICATION OF UTILIZATION LEVELS

Basic considerations in the classification of individuals as low, medium or high utilizers in this study were the uneven distribution of physician visits during the year among HIP members and the desire to have as the two end groups, categories which were potentially of considerable significance to a medical care plan such as HIP. Thus, non-utilizers were designated as a separate class since they represented a substantial proportion (1 in 4) of the total enrollment.

Appendix Table P1. Percentage distribution of HIP members with specified utilization experience in 1954 by utilization in two successive years. (Utilization level refers to number of physician visits.)

UTILIZATION LEVEL IN JULY 1955-JUNE 1956 BY LEVEL IN 1954	UTILIZATION LEVEL IN JULY 1956-JUNE 1957				
	Total	No Service	1-2	3-9	10 or More
<i>All Utilization Levels in 1954</i>					
TOTAL	100.0	24.2	26.2	36.4	13.2
No Service (July 1955-June 1956)	25.4	12.7	6.8	4.9	0.9
1-2	26.0	6.4	8.9	8.9	1.7
3-9	35.4	4.3	8.9	17.3	4.9
10 or More	13.2	0.8	1.6	5.3	5.5
<i>No Service in 1954</i>					
TOTAL	100.0	46.0	26.8	21.2	6.0
No Service (July 1955-June 1956)	49.7	31.0	11.0	6.5	1.2
1-2	26.3	9.5	8.8	6.7	1.3
3-9	19.0	4.8	6.0	6.3	2.0
10 or More	5.0	0.7	1.0	1.7	1.4
<i>1-2 Services in 1954</i>					
TOTAL	100.0	24.9	31.4	35.9	7.9
No Service (July 1955-June 1956)	26.2	10.9	8.6	5.9	0.8
1-2	32.1	8.3	11.2	10.8	1.7
3-9	33.6	4.7	9.8	15.8	3.4
10 or More	8.1	1.0	1.7	3.4	2.0
<i>3-9 Services in 1954</i>					
TOTAL	100.0	13.8	25.7	46.0	14.5
No Service (July 1955-June 1956)	13.5	4.5	4.2	3.9	0.9
1-2	25.9	4.6	8.9	10.4	2.0
3-9	46.7	4.1	10.9	25.2	6.5
10 or More	14.0	0.6	1.7	6.5	5.0
<i>10 or More Services in 1954</i>					
TOTAL	100.0	8.3	16.9	41.6	33.2
No Service (July 1955-June 1956)	8.1	2.6	2.2	2.4	0.9
1-2	14.2	1.8	4.8	5.9	1.6
3-9	41.2	2.9	7.7	20.8	9.8
10 or More	36.5	1.1	2.1	12.4	20.9

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Furthermore, there was special interest in this group because of the particular questions that could be raised about "consistent" non-utilizers.

Persons with 10 or more services during the year were selected as "high utilizers" for several reasons. Although they were a small segment of the HIP population (14 per cent) they accounted for over

Appendix Table P2. Utilization in successive years by HIP members classified by utilization level in 1954, children and adults. (Utilization level refers to number of physician visits.)

AGE AND UTILIZATION LEVEL IN YEAR 1 (1954), AND SEX	NUMBER OF PERSONS IN SPECIFIED CLASS YEAR 1 (1954)	PER CENT OF ALL PERSONS WHO REMAIN IN SAME CLASS IN				
		Year 2		Year 3 ²	Years 2 and 3	
		Observed	Expected ¹		Observed	Expected ¹
<i>All Persons</i>						
Low: No Service	5,914	49.7	25.4	46.0	31.0	12.7
1-2 Services	5,806	32.1	26.0	31.4	11.2	8.9
Medium: 3-9 Services	7,970	46.7	35.4	46.0	25.2	17.3
High: 10 or More Services	3,119	36.5	13.2	33.2	20.9	5.5
(10-16 Services)	(1,868)	(20.0)	(8.0)	(17.0)	(5.9)	(1.7)
(17 or More Services)	(1,251)	(26.5)	(5.2)	(24.4)	(13.9)	(1.6)
<i>Children³</i>						
Low: No Service	1,598	44.0	19.6	39.6	26.7	8.8
1-2 Services	2,196	36.4	29.2	34.6	14.2	11.5
Medium: 3-9 Services	3,191	53.3	41.5	51.4	31.7	23.4
High: 10 or More Services	849	33.3	9.7	24.5	16.7	3.8
<i>Adult Males</i>						
Low: No Service	2,365	50.4	30.5	46.6	30.1	15.4
1-2 Services	1,884	30.6	25.8	30.6	10.1	8.1
Medium: 3-9 Services	2,371	41.4	31.6	42.1	20.9	13.8
High: 10 or More Services	888	39.4	12.1	35.2	24.7	5.4
<i>Adult Females</i>						
Low: No Service	1,951	53.6	26.2	50.4	35.5	14.2
1-2 Services	1,726	28.2	22.8	28.2	8.8	7.0
Medium: 3-9 Services	2,408	43.2	33.0	42.8	20.8	14.5
High: 10 or More Services	1,382	36.5	18.0	37.3	21.1	7.5
<i>Adult Females (Excluding Those Delivered by HIP Doctors, 1954-1957)</i>						
Low: No Service	1,862	55.5	28.3	52.3	37.2	15.8
1-2 Services	1,568	29.7	23.5	29.2	9.6	7.4
Medium: 3-9 Services	2,140	44.8	33.0	44.1	22.0	14.9
High: 10 or More Services	977	39.9	15.2	38.6	24.0	6.6

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Year 1 is 1954; Year 2 is July 1955-June 1956; Year 3 is July 1956-June 1957.

¹ Expected obtained under assumption that utilization in years 2 and 3 is independent of utilization in Year 1.

² Experience observed in Year 3 without regard to utilization in Year 2. "Expected" values are virtually same as for Year 2.

³ Subscribers' children under 18 years of age, excluding those born January 1, 1954-June 30, 1957.

half the services, and as a group they had on the average almost four times the number of physician visits as all HIP members. Consistency in this class, even if only moderate, would have a significant impact on the total volume of medical care received.

A sub-classification of "17 or more services" was provided for very high utilizers. This group accounted for almost a third of all the physician visits, although it represented only 6 per cent of the enrollment. Because of the small number of very high utilizers in the 10 per cent sample used for this study, data regarding year to year consistency at this high a level of utilization are presented only for the total sample.

Two utilization classes were formed for persons who were neither non-utilizers nor high utilizers. One category consisted of individuals with 1 or 2 services during the year and contained almost a fourth of all the enrollees. Despite the comparatively large number in this

Appendix Table P3. Utilization in successive years by HIP members classified by utilization level in 1954, adult males by age. (Utilization level refers to number of physician visits.)

AGE AND UTILIZATION LEVEL IN YEAR 1 (1954)	NUMBER OF PERSONS IN SPECIFIED CLASS YEAR 1 (1954)	PER CENT OF ALL PERSONS WHO REMAIN IN SAME CLASS IN				
		Year 2		Year ² 3	Years 2 and 3	
		Observed	Expected ¹		Observed	Expected ¹
<i>Males Under 45</i>						
Low: No Service	1,323	48.6	29.9	43.1	26.5	13.6
1-2 Services	1,163	33.0	28.3	31.8	10.7	9.2
Medium: 3-9 Services	1,353	40.3	31.4	43.5	21.1	14.4
High: 10 or More Services	427	36.5	10.4	31.1	21.8	4.4
<i>45-59</i>						
Low: No Service	837	52.1	31.1	50.5	33.8	17.4
1-2 Services	609	26.3	22.8	28.9	9.2	6.9
Medium: 3-9 Services	834	42.7	31.9	41.0	20.4	13.0
High: 10 or More Services	366	42.9	14.2	38.5	27.9	6.5
<i>60 or More</i>						
Low: No Service	163	54.6	32.3	56.4	41.1	20.9
1-2 Services	79	26.6	18.9	25.3	7.6	4.6
Medium: 3-9 Services	134	46.3	32.1	36.6	22.4	12.5
High: 10 or More Services	79	41.8	16.7	43.0	27.8	8.8

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Year 1 is 1954; Year 2 is July 1955-June 1956; Year 3 is July 1956-June 1957.

¹ Expected obtained under assumption that utilization in Years 2 and 3 is independent of utilization in Year 1.

² Experience in Year 3 without regard to utilization in Year 2. "Expected" values are virtually same as for Year 2.

low utilization class, the group accounted for only 7 per cent of the total volume of services. The other category, designated "medium" utilizers consisted of persons with 3 to 9 services in a year. About a third of the HIP population were in this class and they received a third of all the physician visits. Also, the overall average number of services per person per year (about 5 physician visits) was contained within this category.

The class intervals described above were used for all subgroups of individuals. Accordingly, absolute rather than relative standards were established for judging low, medium or high utilizers. A high utilizer in a specified age-sex group, for example, was defined as

Appendix Table P4. Utilization in successive years by HIP members classified by utilization level in 1954, adult females by age. (Utilization level refers to number of physician visits.)

AGE AND UTILIZATION LEVEL IN YEAR 1 (1954)	NUMBER OF PERSONS IN SPECIFIED CLASS YEAR 1 (1954)	PER CENT OF ALL PERSONS WHO REMAIN IN SAME CLASS IN				
		Year 2		Year ² 3	Years 2 and 3	
		Observed	Expected ¹		Observed	Expected ¹
<i>All Females Under 45</i>						
Low: No Service	1,195	49.0	24.7	44.9	30.0	12.1
1-2 Services	1,207	26.6	23.6	27.3	8.0	7.2
Medium: 3-9 Services	1,587	41.7	33.1	42.5	20.0	14.7
High: 10 or More Services	923	33.9	18.5	36.0	18.5	7.4
<i>Females Under 45 (Excluding Those Delivered by HIP Doctors, 1954-1957)</i>						
Low: No Service	1,106	51.7	27.8	47.6	32.3	14.2
1-2 Services	1,049	28.7	24.9	28.7	9.1	7.9
Medium: 3-9 Services	1,319	43.9	33.2	44.6	21.8	15.4
High: 10 or More Services	518	38.8	14.0	37.3	22.0	5.8
<i>45-59</i>						
Low: No Service	619	59.1	28.1	56.4	41.8	17.4
1-2 Services	437	31.6	21.5	31.3	10.8	6.7
Medium: 3-9 Services	714	45.9	33.0	43.3	22.1	14.2
High: 10 or More Services	387	41.9	17.4	40.6	26.6	8.0
<i>60 or More</i>						
Low: No Service	97	72.2	38.6	72.2	58.8	29.1
1-2 Services	49	28.6	17.9	24.5	12.2	5.6
Medium: 3-9 Services	63	49.2	30.7	39.7	20.6	12.4
High: 10 or More Services	42	40.5	12.7	42.9	26.2	6.4

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Year 1 is 1954; Year 2 is July 1955-June 1956; Year 3 is July 1956-June 1957.

¹ Expected obtained under assumption that utilization in Years 2 and 3 is independent of utilization in Year 1.

² Experience in Year 3 without regard to utilization in Year 2. "Expected" values are virtually same as for Year 2.

someone who had at least 10 physician visits during the year regardless of the proportion that fell in the category. This approach had advantages over the use of class intervals that varied in accordance with how physician services were distributed in each subgroup. Common intervals made it possible to examine the relationship between utilization and such characteristics as age and sex. Also, categories of enrollees could be expanded or contracted as the analysis required. And, finally, in a medical care program, the point of view regarding who is a high utilizer or a low utilizer is the same whether the individual is in a class that has relatively many or relatively few persons with such utilization.

A different approach had to be taken with regard to family utiliza-

Appendix Table P5. Utilization in successive years by HIP members classified by utilization level in 1954, adults classified by year of enrollment in HIP. (Utilization level refers to number of physician visits.)

YEAR OF ENROLLMENT IN HIP AND UTILIZATION LEVEL IN YEAR 1 (1954)	NUMBER OF PERSONS IN SPECIFIED CLASS YEAR 1 (1954)	PER CENT OF ALL PERSONS WHO REMAIN IN SAME CLASS IN				
		Year 2		Year ² 3	Years 2 and 3	
		Observed	Expected ¹		Observed	Expected ¹
<i>All Adults</i>						
Low: No Service	4,316	51.8	28.4	48.4	32.6	14.8
1-2 Services	3,610	29.4	24.3	29.4	9.5	7.6
Medium: 3-9 Services	4,779	42.3	32.3	42.5	20.8	14.1
High: 10 or More Services	2,270	37.7	15.0	36.5	22.5	6.4
<i>Entry 1947-1949</i>						
Low: No Service	2,493	52.0	27.6	49.8	33.9	14.7
1-2 Services	2,114	30.0	24.1	30.2	10.0	7.8
Medium: 3-9 Services	2,949	43.4	32.8	43.4	21.6	14.4
High: 10 or More Services	1,426	40.5	15.5	37.6	24.3	6.8
<i>Entry 1950-1951</i>						
Low: No Service	788	51.4	30.0	46.6	30.5	15.4
1-2 Services	652	29.8	25.2	27.5	9.0	7.3
Medium: 3-9 Services	739	42.2	31.3	39.5	19.4	13.0
High: 10 or More Services	381	33.1	13.6	36.2	20.5	6.0
<i>Entry 1952-1953</i>						
Low: No Service	1,035	51.7	29.1	46.2	31.0	14.6
1-2 Services	844	27.7	24.3	29.0	8.4	7.2
Medium: 3-9 Services	1,091	39.3	31.8	41.8	19.7	14.2
High: 10 or More Services	463	32.6	14.8	33.5	18.4	5.7

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

Year 1 is 1954; Year 2 is July 1955-June 1956; Year 3 is July 1956-June 1957.

¹ Expected obtained under assumption that utilization in Years 2 and 3 is independent of utilization in Year 1.

² Experience in Year 3 without regard to utilization in Year 2. "Expected" values are virtually same as for Year 2.

tion. The primary function of family data was to provide a basis for determining whether family size influenced consistency in the volume of physicians services received by the total family. A classification of utilization levels for families was required for this purpose and it obviously had to take into account the number of persons exposed, i.e. family size.

The following approach was adopted. First, a detailed frequency distribution of families by number of physician visits was obtained for 1, 2, 3, 4, 5 or more person families. Then dividing points were established for each distribution so that about the same proportion of families fell in each of 4 utilization classes. The criterion used for determining the proportions was the magnitude of the class intervals for individuals. Thus, since the lowest utilization class among in-

Appendix Table P6. Per cent of HIP members who were non-utilizers or high utilizers by age, three successive years of experience. (Utilization level refers to number of physician visits.)

AGE IN YEAR 1 (1954) AND SEX	NUMBER OF HIP MEMBERS	PER CENT OF ALL HIP-MEMBERS WHO WERE NON-UTILIZERS				
		Year 1	Years 1 and 2		Years 1, 2 and 3	
			Observed	Expected ¹	Observed	Expected ¹
TOTAL	22,809	25.9	12.9	6.6	8.0	1.6
Children ²	7,834	20.4	9.0	4.0	5.5	0.7
Adults ³	14,975	28.8	14.9	8.2	9.4	2.3
Under 45	9,178	27.4	13.4	7.5	11.3	1.9
45-59	4,803	30.3	16.7	9.0	17.6	2.7
60 or More	706	36.8	22.5	12.7	5.5	4.7
		PER CENT OF ALL HIP MEMBERS WHO WERE HIGH UTILIZERS (10 OR MORE SERVICES)				
		Year 1	Years 1 and 2		Years 1, 2 and 3	
			Observed	Expected ¹	Observed	Expected ¹
TOTAL	22,809	13.7	5.0	1.8	2.9	0.2
Children ²	7,834	10.8	3.6	1.0	1.8	0.1
Adults ³	14,975	15.2	5.7	2.3	3.4	0.4
Under 45	9,178	14.7	5.1	2.2	2.9	0.3
45-59	4,803	15.7	6.6	2.4	4.3	0.4
60 or More	706	17.1	7.1	2.6	4.7	0.5

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York who were enrolled throughout the period January 1, 1954-June 30, 1957.

¹ Expected obtained under assumption that utilization in a particular year is independent of the utilization in prior years.

² Subscribers' children under 18 years of age excluding those born January 1, 1954-June 30, 1957.

³ Includes persons of unknown age.

dividuals (i.e. non-utilizers) had about a fourth of the total enrollment in HIP, the corresponding class for each family size consisted of approximately the same proportion of families with the lowest utilization. As indicated in Table F4 this procedure could not be followed precisely, but none of the deviations is large enough to affect the analysis.

EXPECTED VALUES FOR TESTS OF INDEPENDENCE BETWEEN 2 YEARS' UTILIZATION

A major interest in this study was to determine whether persons who are low or high utilizers in one year have a greater tendency to repeat this utilization experience in future years than might be expected by chance. To test this hypothesis, expected values were computed under the assumption that a person's utilization level in

Appendix Table F1. Utilization in successive years by HIP families who were low utilizers or high utilizers in 1954. Families of specified size.

SIZE OF FAMILY	PER CENT OF ALL FAMILIES WHO REMAIN IN SAME CLASS IN YEAR 2 ¹					
	Low Utilizers ²			High Utilizers ²		
	Number in Specified Class in Year 1 (1954)	Observed	Expected ³	Number in Specified Class in Year 1 (1954)	Observed	Expected ³
One Person	766	62.0	35.9	265	42.6	13.8
Two Persons	702	57.8	28.7	381	37.3	14.4
Three Persons	410	51.7	25.7	193	37.3	11.9
Four Persons	463	52.1	27.8	228	37.7	12.9
Five or More Persons	207	57.5	27.9	93	36.6	11.2
SIZE OF FAMILY	PER CENT OF ALL FAMILIES WHO REMAIN IN SAME CLASS IN YEARS 2 AND 3 ¹					
One Person	766	44.1	22.7	265	26.4	6.0
Two Persons	702	38.6	16.2	381	21.3	6.2
Three Persons	410	34.4	14.7	193	22.3	4.9
Four Persons	463	31.3	14.7	228	23.2	5.9
Five or More Persons	207	35.3	14.3	93	20.4	4.3

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York, who were enrolled throughout the period January 1, 1954-June 30, 1957.

¹ Year 1 is 1954; Year 2 is July 1955-June 1956; Year 3 is July 1956-June 1957.

² For definition of family utilization level see Appendix Table F4.

³ Expected obtained under assumption that utilization in Years 2 and 3 is independent of utilization in Year 1.

1955, for example, was independent of his utilization in 1954. Thus, among adults who were high utilizers in 1954, the "expected" proportion who would be high utilizers in 1955 was 15.0 per cent, i.e. the proportion of *all* adults who had this volume of service in 1955. The "observed" figure was 37.7 per cent.

Similarly, "expected" values were obtained under the assumption that utilization in the 2 successive years 1955 and 1956 was independent of the level in 1954. Among adults who were high utilizers in 1954, the "expected" proportion who would be high utilizers in 1955 and 1956 was 6.4 per cent, i.e. the proportion of *all* adults who had this volume of service. The "observed" figure was 22.5 per cent.

"Observed" and "expected" percentages are given in Appendix Tables P1-5¹¹ for individuals and in Appendix Tables F1-2 for families.

The hypothesis that high, low or medium utilizers in 1954 have no greater likelihood of being at the same utilization level in succeeding years than might be expected by chance, may be tested as follows:

$$t = \frac{P_o - P_e}{\sqrt{\frac{P_e \times Q_e}{N_o}}}$$

Where P_o = the *observed* value—the per cent of persons of specified age, sex, etc. in a stated utilization class in 1954, who were in the same class in the year (s) under observation.

P_e = the *expected* value—the per cent of *all* persons of specified age, sex, etc. in stated utilization class in year (s) under observation.

N_o = the number of persons of specified age, sex, etc. who were in stated utilization class in 1954.

As "t" increases, the likelihood that a difference between observed and expected values is due to random factors decreases. When $t = 2$, chances are about 1 in 20 and the hypothesis is rejected with a mod-

¹¹ Appendix table P6 gives "observed" and "expected" percentages computed on a different basis than in Appendix tables P1-5. In the latter tables, the percentages refer to the experience in years 2 and 3 among members with specified experience in year 1. In Appendix Table P6, the "observed" percentages refer to the proportions of *all* members who utilize at a specified level in years 1, 1 and 2, or 1, 2 and 3. "Expected" percentages are obtained under the assumption that utilization in one year is independent of the utilization in any other year. Accordingly, the "expected" percentage of members in a particular utilization class in all 3 years (1, 2 and 3) is $P_1 \times P_2 \times P_3$, where P_i is the percentage observed in the i th year.

erate degree of confidence. When $t \geq 2.6$, chances are less than 1 in 100 and the hypothesis is rejected with a high degree of confidence.

Actually, "t" is very large for virtually all of the differences between observed and expected values given in the appendix tables. For example, in the case of adults who were high utilizers in 1954, the "t" value corresponds to a probability of less than .001, when high utilization in 1955 is under question.

$$t = \frac{37.7 - 15.0}{\sqrt{\frac{(15.0)(85.0)}{2270}}} \text{ or a very large number}$$

From the above discussion, it is apparent that persons who are low or high utilizers in one year have a greater tendency to repeat this utilization experience in future years than might be expected by chance. The data given in this report, however, do not provide a ready basis for measuring the strength of this tendency. For this

Appendix Table F2. Utilization in successive years by HIP families who were low utilizers or high utilizers in 1954. Families of specified size excluding those with deliveries by HIP doctors, 1954-1957.

SIZE OF FAMILY	PER CENT OF ALL FAMILIES WHO REMAIN IN SAME CLASS IN YEAR 2 ¹					
	Low Utilizers ²			High Utilizers ²		
	Number in Specified Class in Year 1 (1954)	Observed	Expected ³	Number in Specified Class in Year 1 (1954)	Observed	Expected ³
Two Persons	682	58.7	29.6	328	39.3	13.7
Three Persons	387	53.7	29.4	120	45.0	10.5
Four Persons	428	55.1	30.5	181	39.8	11.8
Five or More Persons	181	59.1	29.6	62	40.3	10.5
SIZE OF FAMILY	PER CENT OF ALL FAMILIES WHO REMAIN IN SAME CLASS IN YEARS 2 AND 3 ¹					
Two Persons	682	39.7	17.3	328	23.2	5.9
Three Persons	387	36.2	17.0	120	28.3	4.5
Four Persons	428	33.6	16.8	181	23.8	5.5
Five or More Persons	181	39.8	17.4	62	19.4	3.9

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York, who were enrolled throughout the period January 1, 1954-June 30, 1957.

¹ Year 1 is 1954; Year 2 is July 1955-June 1956; Year 3 is July 1956-June 1957.

² For definition of family utilization level see Appendix Table F4.

³ Expected obtained under assumption that utilization in Years 2 and 3 is independent of utilization in Year 1.

purpose it would be necessary to determine the probability of movement from one rank order to another.¹² This is a function of the particular class the individual is in during the first year under observation (1954) and the amount of movement required to go from one class to another. The problem is most acute when comparisons of relative stability involve an end-category, such as high utilizers, and medium utilizers (3-9 services). Among the former, the only change that results in a shift in utilization class is a decrease in volume of services below 10; among medium utilizers both an increase and a decrease would produce a change in utilization class. For such comparisons, separate probability functions would have to be defined. This is beyond the scope of the current report. However, one approach for defining the function follows:¹³

The probability that an individual changes his utilization rate in two successive years is expressed as a function of the first year rate, x_1 , the second year rate, x_2 , and a parameter N . The parameter N will be small when there is little tendency to change utilization rate, and it will be large when individuals tend to repeat the same rate from year to year.

A frequency distribution function $F_N(x_1, x_2)$ will describe the above concept, where $F_N(x_1, x_2)$ is the relative frequency of the combination x_1 and x_2 under the circumstance of a "degree of stability," N .

The probability of individuals with an initial rate between a and b having a second year rate in this same interval is given by

$$P_N(a, b) = \frac{1}{b-a} \int_a^b \int_a^b F_N(x_1, x_2) dx_1 dx_2$$

Assuming some convenient distribution function F , which will decrease as the difference between x_1 and x_2 increases and which will decrease with increasing N , values of $P_N(a, b)$ can be calculated for a number of values of N . The degree of consistency, N , of an observed population can be determined from the observed value of $P(a, b)$ by interpolating between these calculated values.

Using the function $F_N(x_1, x_2) = C_{x_1} e^{-N|x_1-x_2|}$, where C_{x_1} is a func-

¹² For a classic discussion of the issues involved in this problem see Reference 4.

¹³ This approach has been suggested and developed by Dr. George B. Hutchison, who has pointed out the need to base comparisons of relative stability in year to year utilization on this type of probability function.

tion dependent on x_1 alone, values for $P_N(0, 25)$ have been calculated as follows:

N	$P_N(0, 25)$
0	.25
2	.45
3	.69
∞	.100

In an observed population .50 of individuals in the lowest quartile (0 to 25 percentile) of utilization in one year remained in this quartile the second year. This observed population would be said to have a degree of consistency, $N = 2.4$ by interpolating in the tabulated values.

EXPECTED VALUES FOR TEST OF INDEPENDENCE OF UTILIZATION BY FAMILY MEMBERS

Another question investigated in the current study was whether low or high utilizers tended to concentrate in the same families; more particularly, was the number of families with all members low or high utilizers greater than would occur by chance. To examine this issue for 3-person families, expected values were computed under the assumption that each family member's utilization was independent of the other. Thus, the expected number of 3-person families in

Appendix Table F3. Proportion of families with all members in the same utilization class, three member families, HIP.

UTILIZATION CLASS OF FAMILY MEMBERS	PER CENT OF FAMILIES WITH ALL 3 MEMBERS IN SAME UTILIZATION CLASS	
	Observed	Expected ¹
<i>Low</i>		
No Services	4.9	1.3
1-2 Services	1.6	1.4
<i>Medium</i>		
3-9 Services	6.8	5.2
<i>High</i>		
10 or More Services	1.1	0.3

NOTE: Data based on a 10 per cent sample of persons insured through the City of New York, who were enrolled throughout the period January 1, 1954-June 30, 1957.

¹ Expected obtained under the assumption that an individual's utilization level is independent of utilization by other members of the same family unit.

which all members are high utilizers was obtained as follows¹⁴ (Appendix Table F-3 gives expected and observed values in percentages):

$$N_e = 1616(.15)^3 = 1616(.0034) = 5.5$$

where .15 is the proportion of persons in a 3-member family who received 10 or more services in a year, and 1616 is the number of 3-person families.

The observed number of 3-person families with all members high utilizers was 17, and

$$\text{Chi-square} > 20 \text{ and } P < .001$$

Similarly, for non-utilizers, the expected number of families with all 3 persons not having seen a doctor during the year is:

$$N_e = 1616(.232)^3 = 20.3$$

The observed value is 79; chi-square is very large; $P < .001$

Accordingly, in the case of 3-person families, there was a greater tendency for families to have all members at the same utilization level than would be expected by chance. As discussed in the text, however, the proportions of families that fall in this category were low and the number of individuals involved represent a small minority of the total number of high or low utilizers.

DEFINITIONS

Data for both individuals and families are based on the experience of a 10 per cent sample of employees of the City of New York, or related agencies,¹⁵ and their insured dependents enrolled in HIP continuously from January 1, 1954 through June 30, 1957. Persons added to the insurance rolls after January 1, 1954 as well as those who dropped HIP coverage during the study period were excluded from the sample.

Subscriber refers to the person in whose name the insurance is written. In this study, the subscriber is an employee of the City of

¹⁴ A more precise way of determining the expected number would be to take into account the fact that a 3-person family unit must consist of either 1 parent and 2 children or 2 parents and 1 child. The latter is by far the more common situation and under this circumstance, $N_e = 1616 P_1 P_2 P_3$ where the P's represent the proportions of adult males, adult females, and children who are in the specified utilization class. However, these values were not available for 3-person family units.

¹⁵ Refers to City Departments, including the Board of Education, County Departments, Transit Authority and Tri-Boro Bridge and Tunnel Authority.

New York. On enrollment in HIP he insures his spouse and all unmarried children under the age of 18 years. No other dependents of the subscriber are eligible for coverage.

Age refers to the individual's age as of January 1, 1954.

Entry Date refers to the year of the subscriber's original enrollment in HIP. Accordingly, husbands and wives of city employees who were added to the HIP insurance rolls before 1954 but after the subscriber's coverage became effective are classified by the subscriber's entry year. For the most part, the insured spouses included in the study sample joined HIP at the time the subscriber enrolled in the plan.

Family Size refers to the number of family members eligible for HIP coverage who were enrolled throughout the period January 1, 1954 to June 30 1957. Thus family size is constant. Members of one person families are subscribers who had no spouse or children under 18 years of age.

Appendix Table F4. Classification of HIP families by utilization level definition and percentage distribution.

UTILIZATION LEVEL	FAMILY SIZE				
	One Person	Two Persons	Three Persons	Four Persons	Five or More Persons
DEFINITION OF UTILIZATION LEVEL: ¹ NUMBER OF PHYSICIAN VISITS RECEIVED BY FAMILY IN YEAR					
Class 1 (Low)	0	0-2	0-5	0-8	0-9
Class 2	1-2	3-6	6-11	9-15	10-17
Class 3	3-9	7-19	12-30	16-33	18-37
Class 4 (High)	10 or More	20 or More	31 or More	34 or More	38 or More
PERCENTAGE DISTRIBUTION OF FAMILIES IN 1954					
Number of Families	2,048	2,483	1,616	1,644	810
<i>Percentage Distribution</i>					
TOTAL	100.0	100.0	100.0	100.0	100.0
Class 1 (Low)	37.4	28.3	25.4	28.2	25.6
Class 2	20.6	21.8	25.2	24.1	27.7
Class 3	29.1	34.6	37.4	33.9	35.3
Class 4 (High)	12.9	15.3	11.9	13.9	11.5

¹ See Technical Appendix for description of the basis of classifying families by utilization level.

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