A RAND NOTE

THE DEMAND FOR PRESCRIPTION DRUGS AS A FUNCTION OF COST-SHARING

Arleen Leibowitz, Willard G. Manning,
Joseph P. Newhouse

October 1985

N-2278-HHS

Prepared for

The U.S. Department of Health and Human Services

Rand
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PREFACE

This research was performed as part of Rand's Health Insurance Experiment under Grant 016B80 from the U.S. Department of Health and Human Services. It considers the determinants of consumers' purchases of prescription drugs, especially insurance reimbursement.

The text of this Note was presented as a paper at the September 1983 Health Economics International Conference in Lille, France, and will appear in *Social Science and Medicine.* The findings should be of interest to the health research community and to policymakers concerned with the costs of medical care.

SUMMARY

In this Note we estimate how the use of drugs varies when insurance plans alter the coinsurance rate of pharmaceuticals and other medical services. The data for this analysis are derived from the Rand Health Insurance Experiment (HIE), a randomized controlled trial designed to determine the effect of cost-sharing on the demand for health services and the health status of individuals. Participants in the trial were randomly assigned to insurance plans with varying coinsurance rates and deductibles. Therefore, the cost-sharing they faced was independent of their health and demographic characteristics. The HIE contains data on a random sample of the nonaged, noninstitutionalized population in six sites chosen to be representative of urban and rural locations in four census regions of the United States.

HIE data from four sites are used to estimate how drug expenditures vary by insurance plan, and to compare the plan response for drugs with that for all ambulatory expenses. Patients were free to seek care from any fee-for-service physician, and similarly free to fill any prescription the physician might write at any pharmacy. Our findings show that:

- Individuals with more generous insurance buy more pharmaceuticals.
- The cost-sharing response for drugs is similar to the response for all ambulatory medical services except in the Dayton, Ohio site.
- One of the HIE sites, Dayton, Ohio, had significantly greater drug expenditures per capita than the other sites studied.
- In the Dayton, Ohio site a significantly higher proportion of drugs was sold by physicians. This proportion did not vary by insurance plan.
- The proportion of brand-name drugs among all drugs purchased in pharmacies was not a function of insurance plan.

- In the Dayton, Ohio site, as compared with the other sites, a significantly higher proportion of the drugs purchased in pharmacies was brand-name instead of generic.

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I. INTRODUCTION

In the United States, health insurance coverage for pharmaceuticals has typically been less generous than that for other medical care. Recent data show that in 1977, families paid nearly 75 percent of the expenses for drugs for people under 65, private health insurance paid one-eighth, and Medicaid and other public and private programs paid the remaining eighth (1). In contrast, in the same year families paid about 35 percent of the costs of physician care and less than 10 percent of the costs of hospital care (2).

In this Note we present estimates of the amount of ambulatory pharmaceutical use when drugs are covered on the same cost-sharing terms as other medical services. The data for this analysis are derived from the Rand Health Insurance Experiment (HIE), a randomized trial designed to determine the effect of cost-sharing on the demand for health services and the health status of individuals. Participants in the trial were assigned randomly to insurance plans with varying coinsurance and deductibles. Therefore, the cost-sharing they faced was independent of their health and demographic characteristics.

The HIE has several advantages for a study of pharmaceuticals. First, because the HIE assigned health insurance coverage to families, the results will not be confounded by self-selection of insurance coverage. Self-selection could bias results if, for example, more sickly people were more likely to select generous insurance coverage, including generous drug coverage. Using self-selected samples, we might improperly conclude that the high drug use of the sickly people was caused by their generous insurance plan. Instead, their poor health explained their high drug use and their insurance plan.

Secondly, the HIE collected data on all expenditures, even those below the deductible. This is an advantage over analyses using nonexperimentally derived claims data, which may be subject to under-reporting. If the insurance policy does not cover pharmaceuticals, no claims will be filed. Similarly, if the policy includes a deductible, claims may not be filed for those expenses that do not reach the

deductible; and the drug expenditures themselves are not likely to exceed the deductible.

We use HIE data from four sites to estimate how drug expenditures vary by insurance plan, and to compare the plan response for drugs with that for all ambulatory expenses. Our findings show that:

- Individuals with more generous insurance buy more prescription drugs.
- The cost-sharing response for drugs is similar to the response for all ambulatory medical services, except in the Dayton, Ohio, site.
- The Dayton, Ohio, site had significantly greater drug expenditures per capita and a significantly higher proportion of drugs sold by physicians than the other sites studied.
- The proportion of brand-name drugs among all drugs purchased in pharmacies was not a function of plan.
- In the Dayton, Ohio, site a significantly higher proportion of the drugs purchased in pharmacies was brand-name instead of generic.

Below, we describe our hypotheses and methods, and present empirical results. Section II briefly presents hypotheses about how drugs are substituted for other medical services. Section III summarizes the design of the HIE and its insurance plans, the sample, and the covariates used in our analysis. Section IV explains our statistical methods. Section V presents the empirical findings.

II. THEORETICAL BACKGROUND

The demand for prescription drugs can be modeled as a derived demand--determined by the demand for the stock of health. Following Grossman (3) and Phelps (4), we consider that consumers' utility is a function of market goods and healthy days. Because of sickness or accident, an individual's health may fall below his desired level, which is a function of income as well as the relative prices of health and other goods. He will then desire to increase his stock of health by combining health inputs such as prescription drugs, physician and other nondrug inputs, and his own time, according to a health production function.

Using this model and assuming that health and medical care are normal goods, and that constant returns to scale production prevail, it is easy to show that the demand for prescription drugs should rise as their price falls. The demand for drugs will also rise with increases in the prices of inputs that substitute for drugs in producing health. Conversely, the demand for drugs will fall with increases in the price of complements to drugs.

In the HIE the price of all medical care services was experimentally varied by altering the coinsurance rate, deductible, and upper limit on out-of-pocket expenses. When the coinsurance rate is low (e.g., free care), the demand for medical care relative to other goods is higher than when the coinsurance rate is high (5). Thus we expect prescription drug use to be higher when the assigned cost-sharing is low.

We cannot estimate the cross price elasticity between drugs and other medical care inputs, such as doctor visits, because each HIE participant faced the same coinsurance rate for all purchased ambulatory medical inputs. However, the price of drugs did change relative to the price of time inputs to medical care as cost-sharing changed. At higher levels of cost sharing, participants will try to produce investments with greater inputs of time, and fewer purchased inputs whose relative price has risen. If, in producing health investments, drugs are more

complementary to time inputs than other medical inputs are, we might see a smaller decline in drug expenditures than in other medical inputs as coinsurance rises. This could happen, for example, if free-plan participants went to the doctor and got a prescription when they were ill, but participants on the less generous plans refilled an old prescription and stayed home from work when they were sick. We examine whether drugs are more complementary to own time than other medical inputs by testing if drugs and other medical inputs respond similarly to cost-sharing.

Both the quantities of drugs purchased as well as the average price paid may vary with changes in cost-sharing. Participants on the free plan have less incentive to search for lower-cost medical inputs--since they do not bear the cost themselves. Thus we might expect that they will not search for low-cost pharmacies, nor will they have as great an incentive to demand generic drugs in lieu of brand-name products.

The literature contains few controlled trials of the effect on drug use of altering drug prices faced by consumers. Knapp (6) reviews a number of studies using self-selected populations, which provide evidence of a negative relationship between price and drug use. There appears to have been considerable response to eliminating copayment for drugs in the British National Health Service (7). Consumers in Ontario, Canada, who enrolled in a prepaid plan, spent more on drugs when they had no out-of-pocket costs for drugs (8).

Michigan pharmacists were twice as likely to substitute generic drugs when the customer was paying the bill himself as when there was a third-party payor (9). However, generic drug use was low--only 1.5 percent of the drugs prescribed were generic.

The next section describes our statistical methods for testing the above theoretical expectations. In particular, we will perform a variety of analyses:

1. Estimate the demand for drugs as a function of plan, site, and demographics in order to test for negative own price effects, and for evidence of substitution of drugs for other medical inputs, then compare the predictions across plans.
2. Test whether drugs and other medical inputs have the same response to cost-sharing. This reveals whether drugs are more or less

complementary to noninsured health inputs (such as time) than are other medical inputs.

3. Test whether individuals with less generous insurance search for lower-cost sources of drugs (e.g., using pharmacies instead of obtaining drugs from the physician).
4. Test whether individuals with less generous insurance search for lower-cost sources of drugs by using pharmacies that substitute generic for brand-name drugs.

III. THE DESIGN OF THE HEALTH INSURANCE EXPERIMENT, THE SAMPLE, AND THE DATA

THE DESIGN

The HIE is a panel or longitudinal study that tracked the medical expenditures, health, and demographic characteristics of enrollees for a three- or five-year period. It enrolled a representative, random sample of families in six sites: Dayton, Ohio; Seattle, Washington; Fitchburg, Massachusetts; Franklin County, Massachusetts; Charleston, South Carolina; and Georgetown County, South Carolina. Further details are given in (10).

Families included in the sample for this experiment were randomly assigned to insurance plans that varied the amount of cost-sharing they faced. They continued to receive care in the fee-for-service system. Families were enrolled in the insurance plans as a unit, with only eligible members participating. (The principal groups of ineligibles were those who joined the family unit after enrollment or who were over 62 at the time of enrollment.) No choice of plan was offered; the family could either accept the experimental plan or choose not to participate. To prevent refusals, families were given a lump-sum payment equal to their worst-case financial risk associated with the plan; thus, no family was worse off financially for being in the study. Since the amount of the lump-sum payment was independent of health care use, it should not affect the response to cost-sharing.

Families were assigned to plans using the Finite Selection Model (11). This model is designed to achieve as much balance across plans as possible while retaining randomization. About 15 percent of the families contacted refused the enrollment offer (12). However, we have found no unintended differences between the enrolled group and the Dayton population, the only site for which this analysis is complete (5), nor have we found differences in the enrolled adult sample on each plan (13).

About one-third of the sample were assigned to a plan with a zero coinsurance rate; they received free care. Nearly one-fifth faced a 25-percent coinsurance rate for medical services subject to an upper limit on annual out-of-pocket family expenditures of 5, 10, or 15 percent of the previous year's income, or $1000, whichever was less. This limit was called the Maximum Dollar Expenditure (MDE). Just under one-twelfth of the sampled families faced a 50-percent coinsurance rate, subject to the MDE. One-fifth of the sample faced a 95-percent coinsurance rate subject to the MDE. Finally, about one-fifth of the families paid 95 percent[1] of the cost of outpatient medical services, up to an annual limit of $150 per person ($450 per family). In this last plan, all inpatient services were free. We refer to this plan as the Individual Deductible Plan.

All plans covered the same wide variety of services. Prescription drugs were a covered expense on all plans. Over-the-counter drugs were covered if they were prescribed by a physician for a chronic disease.

THE SAMPLE

The sample is a random sample of each site's population. The following groups were excluded from the sampling frame: (1) those who would become eligible for Medicare for the aged during the course of the study; (2) those with incomes in excess of $56,000 (in 1983 dollars); (3) those nonaged individuals eligible for the Medicare program (those with end-stage renal disease or receiving Disability Insurance); (4) those in jails and those institutionalized in long-term hospitals; (5) those in the military or their dependents; and (6) veterans with service-related disabilities.

The sample used in this analysis consists of enrollees who participated for the entire first year of the experiment on the fee-for-service plans in the Dayton, Seattle, and Massachusetts sites. We excluded individuals with a partial period of participation: newborns, adoptees, and participants who left the study before the end of the

[1] In the first year in Dayton the coinsurance rate was 100%. In subsequent sites and all other years in Dayton, the coinsurance rate was 95%.

first year. This is identical to the first year sample used in (5). Table 1 shows the numbers of observations in each site.

INDEPENDENT VARIABLES

We used three groups of independent variables: insurance plan, site, and demographic measures. These variables are described below.

Insurance Plan Variables. We used four dummy variables to represent the insurance plans by level of coinsurance: one each for the plans with family coinsurance rate of 25 percent, 50 percent, and 95 percent, and one for the Individual Deductible Plan. The free plan was the omitted group, against which comparisons were made. In prior work (14) we found the effect of varying the MDE to be small, so all plans with the same coinsurance rate have been combined. The effect of plan on the probability of using drugs varies by site. Interactions of site and plan account for this effect in our equations.

Site. We include indicator variables for the Seattle, Fitchburg, and Franklin sites. Dayton is the omitted group against which comparisons are made.

Demographics. We use a simple specification, with an indicator for children (CHILD = 1 if the individual's age is less than 18). Female adults are defined as women aged 18 and over. Male adults are the reference group against which comparisons are made. The effect of demographic variables differed by site. Our estimates include interactions by site to account for this.

DEPENDENT VARIABLES

Table 2 presents the means for the four different outcome measures used as dependent variables in our analysis: per capita expenditures, the numbers of prescription drugs per capita, the percentage of drugs purchased through physicians, and the percentage of generic drugs purchased at pharmacies.

Drug Expenditures Per Capita. The data on expenditures for drugs are derived from claims filed by HIE participants. Over-the-counter drugs are not included, unless they have been prescribed by a physician for certain chronic conditions (e.g., aspirin for arthritis). The data represent prescriptions filled, rather than prescriptions written.

To account for inflation over time, drug prices were adjusted to reflect January 1983 prices by using the Bureau of Labor Statistics price deflator for drugs (15). We have not attempted to adjust for regional price differences, since no regional price index for drugs was available. Because drugs tend to be marketed nationally, we do not expect large regional differences in drug prices and we believe that the error involved in ignoring them is small.

Number of Prescriptions Per Capita. Each drug prescribed appeared as a line item on a claim form. These line items were aggregated for each individual to obtain a count of drugs prescribed per year. Both drugs obtained from physicians and those obtained from pharmacies are included.

Drugs Supplied by Physicians. For each individual who purchased drugs, we calculated from claims data the proportion of all drugs purchased that were obtained directly from physicians, rather than from pharmacies.

Generic Drugs. For each person who purchased any drugs at a pharmacy, we calculated the percentage that were generic instead of brand-name. In this paper we do not determine whether a generic drug was purchased because the physician prescribed it, or because the pharmacy substituted it for a brand-name drug. A generic substitution law was in effect throughout the first year in our Massachusetts sites, during part of the year in the Seattle site, and not at all during the first year in the Dayton site.

Table 1

SAMPLE FOR DRUG ANALYSES BY SITE AND PLAN
YEAR 1--FULL YEAR FEE-FOR-SERVICE SAMPLE

Insurance Plan	Site				
	Dayton	Seattle	Fitchburg, Massachusetts	Franklin County, Massachusetts	Total
Free	300	425	238	296	1259
25% plan	259	246	123	151	779
50% plan	182	0	56	58	296
95% plan	271	224	106	160	761
Individual deductible plan	98	276	181	210	765
Total	1110	1171	704	875	3860

NOTE: This table excludes individuals who joined eligible families after enrollment (e.g., newborns, adoptees), as well as eligible persons who did not complete the first year.

Table 2

DEPENDENT VARIABLES USED IN THE ANALYSIS
DEFINITIONS, MEANS AND STANDARD DEVIATIONS

Item	Sample Size	Mean	Standard Deviation
Average drug expenditures (in 1983 $)	3860	$46.31	110.84
Number of prescriptions per capita	3860	4.57	9.27
Per capita proportion of all drugs purchased obtained from physician	2369	.063	.200
Per capita proportion of generic drugs among all purchased from pharmacies	2306	.108	.222

NOTE: These standard deviations are unadjusted for intrafamily correlation.

IV. STATISTICAL METHODS

The HIE data come from an experiment whose design kept insurance plan unrelated to important covariates. Therefore, differences in mean values by plan will yield unbiased estimates of differences among plans. This analysis of variance technique, however, yields estimates with relatively large standard errors, because some very large claims can make the sample mean a relatively unreliable estimate of the population mean. Therefore, we have used a two-equation model to estimate the demand for drugs in addition to the more common analysis of variance (ANOVA) and analysis of covariance techniques (ANOCOVA). Our choice is dictated by two characteristics of the distribution of medical expenses. First, a large proportion of the participants purchased no drugs during the year. Second, the distribution of expenses among users is skewed. A model that exploits these two characteristics of the expenditure distribution provides more precise estimates than ANOVA and ANOCOVA (14, 16).

For this analysis we have used a two-part model that partitions the enrolled population into two groups: enrollees who did and did not have ambulatory drug expenses. The first equation is a probit equation for the probability that a person will purchase any drugs during a year. Thus, this equation separates users from nonusers and therefore addresses the first characteristic described above (the many participants who purchased no drugs during the year). The second equation is a linear regression for the logarithm of total annual ambulatory drug expenses. (See 14, 16-18 for a fuller discussion of our estimation methods.)

The log transformation of annual expenses practically eliminates the undesirable skewness in the distribution of expenses among users, and yields nearly symmetric and normal error distributions, for which the least squares estimate is efficient. We therefore expect the estimates from this model to be more precise than those obtained from ANOVA and ANOCOVA. All inference statistics reported below have been corrected for intrafamily correlation, unless otherwise noted (16).

After obtaining the estimated equations, we used them to make the predictions by site and plan. The predictions were made to a standardized population so that they were not influenced by the existing configuration of independent variables on a given plan. The estimated equations are in the Appendix.

Negative binomial regression was used to estimate numbers of prescriptions purchased. The negative binomial is an appropriate technique because it models the skewness of the distribution of discrete count data, such as prescriptions purchased. It is also desirable because it allows for the stochastic nature of drug purchases, while permitting the underlying propensity to purchase drugs to vary with individual characteristics.

V. RESULTS

Table 3 shows that mean per capita drug expenditure (in 1983 dollars) in an ambulatory setting rises steadily as cost-sharing falls. The sample means range from a high of $54 on the free plan to a low of $34 on the family deductible plan. By comparison, national data for people under 65 show per capita expenditures of $35.65 expressed in 1983 dollars (calculated from (1)). The HIE per capita drug expenditure is reasonably consistent with the national figure, when the low rate of insurance for drugs in the general population is taken into account. Expenditure per person on the free plan is about 60 percent higher than in the plan with 95 percent coinsurance. This is about the same relative increase as reported for total per capita outpatient and inpatient expenditures (see 5).

To gain greater precision in the estimates, we used the two-part model described above to estimate the relationship between drug expenditures and plan, site, and demographics. Preliminary analyses uncovered some site-specific effects of plan, age, and sex variables. Interactions account for these effects. The two equations used to make predictions of use for a standardized population are shown in Appendix A. Using these predictions, all the cost-sharing plans show significantly lower drug expenditures than the free plan (Table 4). People on the 95-percent plan spent 57 percent as much as those on the free plan, similar to the effect seen with sample means. The differences among plans are more significant statistically because the regressions control for other characteristics that affect drug use, such as site, that are not balanced over the plans.

The number of prescriptions purchased per capita was significantly higher on the free plan than on any of the cost-sharing plans and varied across plans in roughly the same fashion as dollar expenditure (Table 4). By contrast, average cost per prescription was not significantly related to the plan at the 5-percent level of significance ($F = 1.85$, (DF 4,2359)) (Table 3). Thus, much of the plan difference in drug expenditures appears to be related to the quantity of pharmaceuticals purchased, rather than to price per prescription.

Annual drug expenditures varied significantly by age/sex category (Table 5). Adult women spent twice as much as men. Children, although somewhat more likely than men to have had at least one prescription filled, averaged only half of men's annual expense for drugs. These qualitative differentials are also found in national data (1), which show mean expenditures for women 54 percent above men's, and children's expenditures only half of that of all males. We do not currently have an explanation for the quantitative divergence between HIE and national data.

Although the overall HIE means do not substantially differ from national values, as noted above, the sites differ markedly in drug use (Table 6). Dayton participants had 50 percent greater drug expenditures per capita than Seattle participants, a difference that was significant at better than the one-percent level; this was a remarkable finding, because average drug prices are significantly higher in Seattle than in the other three sites. The Massachusetts participants averaged drug expenditures that were significantly lower than in Seattle--a difference due to higher average costs in Seattle. Once plan is controlled for, there is no statistically signficant difference between the Seattle and Massachusetts sites in number of prescribed drugs purchased. However, the Dayton participants purchased significantly more drugs. For comparison, the national mean number of prescription drugs purchased per capita in 1977 was 3.5 (1).

In Dayton, a significantly greater proportion of all drugs purchased by participants on the free, 50-percent, and 95-percent plans was obtained from physicians. However, this factor alone did not account for the greater use of drugs in Dayton. In fact, the number of prescriptions filled at pharmacies was also significantly greater in Dayton.

We examined generic drugs to determine whether the site price differentials could be attributed to the greater use of generics in the sites with low average costs over all drugs. We found that the proportion of generics among all prescriptions filled was significantly higher in Seattle, the site with highest average drug costs. There was no significant variation by insurance plan in the percent of

prescriptions filled with generic drugs. Thus our results give no support to the proposition that less generous insurance will stimulate patients to search for generic drugs.

We tested to see whether drug expenditures followed the same plan response as all ambulatory medical expenditures. We found that the plan response for drugs was not significantly different from that for total ambulatory care in all sites except Dayton, where the 50-percent plan showed greater plan response and the IDP plan lower plan response than all medical expenditures ($F = 10.13$, (DF 4,914)). This suggests that drug expenditures are used in virtually fixed proportions with physician visits to produce health; there is no evidence that patients with less generous insurance try to substitute drugs for doctor visits in producing health.

The proportion of all expenditures accounted for by drugs is higher in Dayton than in the other sites. This results from relatively high drug expenditures, rather than from low total expenditures, since per capita ambulatory expenditures were not low in Dayton relative to the other sites (5).

Table 3

DRUG UTILIZATION BY PLAN

Plan	Mean Per Capita Expenditure	Cost per Prescription (1983 $)
Free	$54.41	$9.06
	(3.39)	(.18)
P25	49.91	9.43
	(6.53)	(.31)
P50	36.12*	8.18
	(5.56)	(.36)
PFD	33.95*	8.73
	(4.58)	(.25)
IDP	45.53	9.05
	(6.74)	(.28)

*Indicates significantly different from the free plan mean at the one-percent level. Standard errors, corrected for intrafamily correlation, are given in parentheses.

Table 4

PREDICTED PER CAPITA DRUG UTILIZATION BY PLAN

	Expenditure		Prescriptions	
Plan	Mean Per Capita (1983 $)	t-test of Difference From Free Plan	Number Per Capita	t-test of Difference From Free Plan
Free	60.09	-	5.43	-
P25	45.64	-3.28	4.43	-2.77
P50	35.78	-4.47	4.33	-3.25
PFD	34.08	-6.31	3.63	-4.80
IDP	44.07	-3.32	4.30	-1.78

NOTE: The predictions are made for a standardized population with the same distribution of site and demographic characteristics as the entire sample.

Table 5

PREDICTED DRUG EXPENDITURES BY AGE AND SEX ON THE FREE PLAN

Age/Sex Category	Mean Expenditure (1983 $)	t-test of Difference from Male Adults
Male adults	$ 52.91	--
Female adults	105.43	6.57
Children	28.27	3.69

NOTE: The predictions are made for a population on the free plan with the same site characteristics as the entire population.

Table 6

PREDICTED DRUG UTILIZATION BY SITE

Site	Predicted Mean Expenditure (1983 $)	t-test of Difference Relative to Seattle	Predicted Number of Prescriptions	t-test of Difference Relative to Seattle
Seattle	$58.63	--	4.09	--
Dayton	87.80	9.36	6.54	4.70
Fitchburg	46.87	6.98	4.15	0.15
Franklin	37.54	6.11	3.68	-1.07

NOTE: The predictions are made for a standardized population that is on the free plan with the same age/sex distribution as the entire population.

VI. CONCLUSIONS

Our results confirm that expenditures on drugs, like medical care expenditures in general, respond to the cost-sharing faced by consumers. When consumers paid 95 percent of the costs up to a maximum dollar expenditure, drug expenditures were 57 percent of those on a free-care plan. The plan response for drugs was not significantly different from that for total ambulatory medical care in three of the four sites.

Most of the plan response was determined by the number of prescriptions purchased rather than by price per prescription. There was little plan response in factors that might affect average costs, such as the proportion of generic drugs purchased at pharmacies. Although patients on the less generous insurance plans had the incentive to demand generic drugs, they were no more likely to have their prescriptions filled with generic drugs. Thus the plan response of drug expenditures seems to arise mainly as a result of lower exposure to physicians rather than from search for lower prices by participants with less generous insurance.

There were very significant site, age, and sex differences in drug use. Women had greater drug expenditures, and children lower expenditures than men. For most outcome measures, the participants in the Dayton site behaved differently from those in the other three sites. They had greater annual per capita expenditures, used more prescription drugs per capita, were more likely to obtain drugs directly from their physician, and were less likely to purchase generic drugs at the pharmacy. These anomalous findings for Dayton deserve further study.

Appendix Table A-1

DEFINITIONS OF INDEPENDENT VARIABLES

Dummy Variable	For
SEA	Seattle site
FIT	Fitchburg site
FRA	Franklin site
P25	25% coinsurance plans
P50	50% coinsurance plans
PFD	95% coiunsurance plans
IDP	Individual deductible plan
CHILD	Age less than 18
FADULT	Female age 18 or more
SEACH	Child in Seattle
FITCH	Fitchburg
FRACH	Franklin
SEAFAD	Female adult in Seattle
FITFAD	Female adult in Fitchburg
FRAFAD	Female adult in Franklin
SEA25	25% coinsurance in Seattle
SEAFD	95% coinsurance in Seattle
SEAID	IDP in Seattle
FIT25	25% coinsurance in Fitchburg
FIT50	50% coinsurance in Fitchburg
FITFD	95% coinsurance in Fitchburg
FITID	IDP in Fitchburg
FRA25	25% coinsurance in Franklin
FRA50	50% coinsurance in Franklin
FRAFD	95% coinsurnace in Franklin
FRAID	IDP in Franklin

Appendix Table A-2

PROBABILITY OF POSITIVE DRUG EXPENDITURES

	COEF	T-STAT
Intercept	0.4165	4.0674
SEA	-0.2730	-2.1653
FIT	-0.1104	-0.7343
FRA	-0.2769	-1.9758
P25	-0.2515	-3.3112
P50	-0.3063	-2.7836
PFD	-0.4571	-5.9949
IDP	-0.3460	-4.5473
CHILD	0.1682	1.7964
FADULT	0.6188	6.0143
SEACH	-0.0770	-0.4625
FITCH	-0.1965	-1.0211
FRACH	0.0727	0.4016
SEAFAD	0.2943	1.6260
FITFAD	-0.1678	-0.7983
FRAFAD	-0.1371	-0.7047

NOTE: Based on 3860 observations.
All t-statistics corrected for
intrafamily correlation.

Appendix Table A-3

REGRESSION COEFFICIENTS FOR DRUG EXPENDITURE, IF EXPENDITURE > 0
(log of 1983 Dollars)

	COEF	T-STAT
Intercept	4.0647	36.0357
SEA	-0.5346	0.8082
FIT	-0.5156	1.1147
FRA	-0.7379	-0.3826
P25	-0.1238	0.2458
P50	-0.4265	1.4817
PFD	-0.4477	0.9736
IDP	-0.2186	-0.1041
CHILD	-0.6116	-0.4961
FADULT	0.3806	-0.5021
SEACH	0.3233	-1.1287
FITCH	0.1973	-0.8121
FRACH	0.3167	0.1027
SEAFAD	0.2373	-0.6281
FITFAD	-0.0246	0.0974
FRAFAD	-0.0226	0.0815
SEA25	-0.0255	0.0978
SEAFD	0.2640	-1.1536
SEAID	0.2192	-0.7976
FIT25	0.0022	-0.0128
FIT50	-0.0237	0.2007
FITFD	0.0848	-0.5237
FITID	-0.2463	1.2029
FRA25	-0.1586	0.7769
FRA50	0.4026	-3.5933
FRAFD	0.2288	-1.2735
FRAID	0.2997	0.0666

NOTE: Based on 2322 observations. R-squared = .135. All t-statistics have been corrected for intrafamily correlation.

REFERENCES

1. Kasper, Judith A., *Prescribed Medicines: Use, Expenditures, and Sources of Payment,* National Health Care Expenditures Study Data Preview 9, USDHHS, Washington, D.C., 1982.

2. Fisher, Charles R., "Differences by Age Groups in Health Care Spending," *Health Care Financing Rev.*, Spring 1980, pp. 65-90.

3. Grossman, Michael, "The Demand for Health: A Theoretical and Empirical Investigation," Occasional Paper 11, New York, NBER, distributed by Columbia University Press, 1972.

4. Phelps, Charles E., *Demand for Health Insurance: A Theoretical and Empirical Investigation,* The Rand Corporation, R-1054-OEO, 1973.

5. Newhouse, J. P., et al., "Some Interim Results from a Controlled Trial of Cost-Sharing in Health Insurance," *New England J. Med.,* Vol. 305, No. 25, December 17, 1981, pp. 1501-1507; also The Rand Corporation, R-2847-HHS, 1982.

6. Knapp, David A., "Paying for Outpatient Prescription Drugs and Related Services in Third-Party Programs," *Medical Care Rev.*, Vol. 28, No. 8, August 1971, pp. 826-859.

7. U.S. Department of Health, Education, and Welfare, Office of the Secretary, Task Force on Prescription Drugs, *Current American and Foreign Programs, Task Force Background Papers*, Government Printing Office, Washington, D.C., December 1968, pp. 178-179.

8. Greenlick, Merwyn, and Benjamin Darsky, "A Comparison of General Drug Utilization in a Metropolitan Community with Utilization Under a Drug Prepayment Plan," *Am. J. Public Health,* Vol. 58, No. 11, November 1968, pp. 2121-2136.

9. Goldberg, Theodore, et al., "Evaluation of Economic Effects of Drug-Product Selection Legislation," *Medical Care,* Vol. 17, No. 4, April 1979, pp. 411-419.

10. Newhouse, J. P., "A Design for a Health Insurance Experiment," *Inquiry,* Vol. 11, 1974, pp. 5-27.

11. Morris, C. N., "A Finite Selection Model for Experimental Design of the Health Insurance Study," in D. J. Aigner and C. N. Morris (eds.), *Experimental Design in Econometrics, J. Econometrics,* Vol. 11, No. 1, September 1979, pp. 43-62.

12. Morris, C. N., J. P. Newhouse, and R. W. Archibald, "On the Theory and Practice of Obtaining Unbiased and Efficient Samples in Social Surveys and Experiments," in V. L. Smith (ed.), *Experimental Economics,* Vol. 1, JAI Press, Westport, Connecticut, 1979; also in *Evaluation Studies Review Annual,* Vol. 5, Sage Publications, Beverly Hills, California, 1980.

13. Brook, R. H., et al., "Does Free Care Improve Adults' Health?" *New England J. Med.,* Vol. 309, December 8, 1983, pp. 1426-1434.

14. Manning, W. G., Jr., et al., "A Two-Part Model of the Demand for Medical Care: Preliminary Results from the Health Insurance Study," in J. van der Gaag and M. Perlman (eds.), *Health, Economics and Health Economics,* North-Holland Publishing Company, Amsterdam, 1981.

15. *Monthly Labor Review,* Vol. 106, No. 5, May 1983, p. 78; Vol. 101, No. 6, June 1978, p. 89; Vol. 100, No. 12, December 1977, p. 103; Vol. 99, No. 8, August 1976, p. 85.

16. Duan, Naihua, W. G. Manning, Jr., C. N. Morris, and J. P. Newhouse, "A Comparison of Alternative Models for the Demand for Medical Care," *J. Bus. Econ. Stat.,* Vol. 1, April 1983, pp. 115-126.

17. Duan, Naihua, "Correcting for Intracluster Correlation in Probit Regression Models," in N. Duan et al., *A Comparison of Alternative Models for the Demand for Medical Care,* The Rand Corporation, R-2754-HHS, January 1982.

18. Duan, Naihua, "Smearing Estimate: A Nonparametric Retransformation Method," *J. Am. Stat. Assoc.*, Vol. 78, No. 383, September 1983, pp. 605-610; also in N. Duan et al., *A Comparison of Alternative Models for the Demand for Medical Care,* The Rand Corporation, R-2754-HHS, January 1982.