Use of Medical Care in the Rand Health Insurance Experiment

Diagnosis- and Service-specific Analyses in a Randomized Controlled Trial

Kathleen N. Lohr, Robert H. Brook, Caren J. Kamberg, George A. Goldberg, Arleen Leibowitz, Joan Keesey, David Reboussin, Joseph P. Newhouse

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RAND

Preface

This monograph presents studies from the Rand Health Insurance Experiment (HIE) concerning the effect of cost-sharing on the use of outpatient medical care for specific diagnoses. The HIE was a large-scale randomized controlled trial of alternative forms of health care financing sponsored by the Department of Health and Human Services (formerly Department of Health, Education, and Welfare). The study took place between November 1974 and January 1982 in six sites around the country and enrolled more than 7,700 nonaged persons in one of several experimental health insurance plans that differed either in the amount of cost-sharing borne by the families or in the organization through which they received their care.

These analyses highlight two important topics not previously reported by the HIE in any detail: (1) the effect of cost-sharing on the probability of using medical care for specific diagnoses or problems; and (2) the content of medical practice ("disease profile") for specific conditions or reasons for seeking care.

This work extends our understanding of whether the effects of cost-sharing apply more or less indiscriminantly across many diagnoses or whether they are concentrated mainly on particular types of problems or reasons for seeking care. We can also begin to draw some inferences about whether cost-sharing in public or private health insurance programs might alter care-seeking behaviors differently for different population groups or have special implications for any high-risk groups, such as poor children. Finally, these studies help to clarify whether certain types of services, such as routine laboratory tests or common prescription drugs, are being overused in ordinary ambulatory practice.

Chapter 8, an executive summary, discusses the implications of our findings for health services research and health policy. Some readers may wish to focus on that chapter alone. Chapter 1 briefly describes the purpose and content of this research, and Chapter 2 describes important aspects of the HIE, for readers unfamiliar with the experiment. In Chapter 3, the methods common to all analyses presented are described and lengthy overview of the way we built the diagnosis-specific "episodes of care" is provided; the latter is one hallmark of these studies. Chapters 4–7 provide study-specific methods and results of the four sets of investigations reported; brief discussions related to the chapter topic also can be found in the individual chapters.

Acknowledgments

The authors wish to express their appreciation to RAND colleagues M. Susan Marquis and Patricia Camp for encouragement and assistance at various stages of this work. Other individuals who contributed to particular substudies are acknowledged in the text.

They also acknowledge the following persons for their unique contributions to the Health Insurance Experiment: Carolyn André, Rae Archibald, Marie Brown, Maureen Carney, and Ken Krug (administration); Darlene Blake, Carole Edwards, Bryant Mori, Suzanne Polich, Martin Seda, David Stewart, and Beatrice Yormark (data processing); James Schuttinga and Larry Orr for support and guidance in their capacities as project officers from the Office of the Assistant Secretary for Planning and Evaluation, Department of Health and Human Services; and their superiors through the years, whose support made this endeavor possible.

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CONTENTS

Chapter 1

Introduction

Analyses from the Rand Health Insurance Experiment (HIE) concerning the effect of cost-sharing on the use of outpatient medical care for specific diagnoses are presented in this monograph. The HIE was a large-scale randomized controlled trial of alternative forms of health care financing done between November 1974 and January 1982. There were six study sites around the country, and more than 7,700 persons (in more than 2,700 families) were enrolled in one of several experimental health insurance plans that differed either in the amount of cost-sharing borne by the families or in the system within which enrollees received care.

These analyses highlight two important topics not previously reported in any detail: (1) use of medical care for specific diagnoses or problems, and (2) the content of medical practice for specific conditions or reasons for seeking care. In all analyses, we studied diagnosis-specific "episodes of care," which included all visits, procedures, tests, and prescribed and injected medications given in one year for more than 100 different diagnostic categories.

For the utilization analyses, we describe for the first time the impact of cost-sharing on the probability that an HIE participant would have at least one episode of care in a year for a variety of separate chronic and acute conditions and several categories of preventive care. Hence we can extend our understanding of whether the effects of cost-sharing apply more or less indiscriminantly across many diagnoses or whether they are concentrated mainly on particular types of problems or reasons for seeking care.

Further, we explore more fully than before whether cost-sharing affected children more than adults and low-income individuals more than persons of average or above-average income. Therefore, we can begin to draw some inferences about whether cost-sharing in public or private health insurance programs might alter care-seeking behaviors differently for different population groups or have implications for any groups of special interest to public health insurance programs, such as poor children.

In addition, from a set of independent studies we can now provide the first comprehensive descriptions of the content of medical practice as experienced by a general population representative of the main U.S. census regions. Persons who participated in the fee-for-service portion of the HIE could obtain care from physicians of their own choosing, so our results can be seen as reflecting medical practices common in the late 1970s and early 1980s. These studies help to clarify whether certain types of services, such as routine laboratory tests or common prescription drugs, are being overused in ordinary ambulatory practice.

The rationale for doing disaggregated disease-specific analyses and examining cost-sharing effects for specific groups rests on two related uncertainties. First, earlier HIE analyses strongly documented the overall impacts of cost-sharing on use of medical services, but they did not fully address the issue of whether cost-sharing had differential effects on certain subgroups defined, for instance, by age or income. Second, our health status findings, based mainly on 3 years of

follow-up study, hinted that for the poor sick, cost-sharing may have had deleterious effects. Although sample size and length of follow-up study prevented examination of those health status measures with any greater precision, looking at how cost-sharing influenced care-seeking for specific conditions may help us to ascertain whether it induced changes in the use of services that might have produced other health status effects undetected by earlier analyses.

Background

The genesis of this work lies in earlier HIE findings about how cost-sharing affected use and expenditures.[1-4] The previous studies were done at a high level of aggregation, such as all expenditures, all outpatient care, or probability of any hospital admission. They all documented the considerable effect of cost-sharing on obtaining medical care and the related reduction in expenditures: on the average, persons who faced copayments had about one-third fewer ambulatory visits than persons whose care was entirely free.

The earlier analyses also showed that about two-thirds of the decrease in expenditures caused by cost-sharing occurred because some additional people obtained no care at all.[1] Subanalyses have been done on use of mental health services,[5] emergency room use,[6] and care-seeking for serious and minor symptoms.[7] However, by and large the earlier work sheds little light on the specific disorders for which people did or did not seek care when they had to share in the costs of that care.

Additional impetus for these diagnosis-specific analyses came from the complex findings regarding the relationship between having free care and health status at the end of the experiment. Four publications have reported on the association between generosity of health insurance and health status for adults[8,9] and for children,[10,11] addressing the question of whether the additional services consumed by persons with free care resulted in better health status by the end of the HIE.* Judging by several measures of self-assessed health status and by changes in physiologic measures related to specific illnesses, free care conferred little benefit on the average, but the exceptions were intriguing.

Among adults, having free care improved corrected vision (among those with impaired vision at entry) and lowered blood pressure; the latter reduced the risk of premature death among persons at high risk. Both of these results were stronger among the disadvantaged. Among children, the benefits of free care were possibly large (but statistically insignificant) reductions in iron deficiency anemia and improvement in hearing for poor children who began the study with those two problems. In addition, for disadvantaged adults the prevalence of one or more of a set of five serious symptoms was higher with cost-sharing than with free care at the end of the study.

These results led naturally to a set of questions that could be explored further with analyses focused on particular diagnoses and on a group comprising the low-income HIE participants with particular diagnoses. Specifically, what types of care, for what conditions, might persons on the cost-sharing plans have foregone? Was there something about condition-specific use as a function of cost-sharing that would help extend or explain the aggregate use and health status results? To explore these topics at a less aggregated, more clinically relevant level, we undertook our disease-specific analyses.

We focused on the fee-for-service (FFS) portion of the experiment, using data from insurance claims for ambulatory medical care

* Two of the main HIE publications concern the effect of cost-sharing on demand for dental care[12] and dental health status[13]; because the studies reported in this monograph do not concern dental care, they are not reviewed here.

provided in all six HIE sites during the second year of the experiment. The pertinent aspects of the HIE are described in Chapter 2.

Because of the major advances in conceptualizing "episodes of care" as a unit of analysis, we devote considerable space in Chapter 3 to describing our methods for creating disease-specific episodes of care for individuals. Using both computer algorithms and physician–reviewer overreads, we linked visits, procedures, tests, and medications into clinically meaningful episodes.

We targeted two groups for special attention: (1) adults and children and (2) poor and nonpoor participants. Chapter 3 provides further details on how these groups were defined.

The several independent studies that constitute this work are described and discussed in separate chapters. In Chapter 4, we examine the effect of cost-sharing on the probability that a person would have at least one episode of care in year 2 for up to 150 different diagnostic categories. A related analysis (Chapter 5) determined how cost-sharing influenced the probability that an enrollee would have an episode of care for one of seven different diagnostic groupings that were characterized by the degree to which medical treatment probably would be highly effective (and, by implication, appropriate) or rarely effective (and less appropriate). In both of these studies, the final analyses control for a variety of patient characteristics, such as age, race, sex, geographic site, and health status.

In Chapter 6, we investigate the relationship between cost-sharing and the probability of any use in a year for more than 20 different ambulatory procedures and tests and more than 20 different categories of common prescription drugs. These analyses are done across all outpatient diagnoses and are confined to all adults, all children, and low-income adults and children.

In addition to understanding the impact of cost-sharing on the probabilities of seeking care and on the probabilities of receiving certain drugs or procedures and tests, we were interested in examining the degree to which episodes of care might differ in "intensity" or "size"; that is, whether per-episode rates of services and medications might vary according to generosity of insurance. These studies (which are briefly documented in Appendix E of Lohr et al.[103]) showed no differences in episode size by insurance plan. Thus we did a final set of studies, called "disease profiles," which gave clinical detail on how common problems are managed in the outpatient setting. These profiles combine data across all insurance plans to create the "patterns of care" (separately for adults and children) presented in Chapter 7.

Finally, Chapter 8 discusses the findings from the probability of use and disease profiles studies more fully. The implications of these findings for future policy debates about overuse and underuse of medical care, especially for certain "at-risk" groups, and the possible contributions of this work to the field of health services research are considered.

Chapter 2

Design and Operation of the Health Insurance Experiment

The HIE was a population-based, randomized controlled trial, sponsored by the federal government, that tracked the use of medical services and health status of enrollees over a 3- or 5-year period. It enrolled a representative, random sample of families from six sites selected to represent the four U.S. census regions and urban and rural sites: Dayton, Ohio; Seattle, Washington; Fitchburg and Franklin County, Massachusetts; and Charleston and Georgetown County, South Carolina.

To select sites, we first calculated the optimal number of sites for our budget, which turned out to be six, with any number between four and nine nearly optimal. We decided to use six, selected because they met certain criteria[14]: (1) they represented each census region and thus could account for any regional variation in the degree to which demand for medical care responds to cost-sharing; (2) they represented a spectrum of city size and complexity of the medical delivery system; (3) they varied according to the existing level of excess demand for medical care (at the beginning of the experiment), measured by waiting times for appointments and proportion of primary care physicians accepting new patients; and (4) they provided us both Northern and Southern rural areas, which differed in economic and racial characteristics. In addition, one site had a well-established prepaid group practice, which was necessary for other portions of the experiment.

Persons eligible to enroll in the experiment represented the general populations where they lived, except for several intentional differences. The experiment excluded families with annual incomes exceeding $58,000 (1984 dollars); this represented about 3% of families initially contacted. Also excluded were families in which the head of household was eligible for Medicare or would become so before the end of the study and families participating in the Supplemental Security Income program; this excluded persons who were so disabled that they were eligible for Medicare. Finally, we excluded those eligible for Medicare because they had end-stage renal disease, family members older than 61 years of age at entry to the study, persons eligible for the military medical system, and indefinitely institutionalized individuals (e.g., in prison or in mental institutions).

Low-income families were slightly oversampled, and the enrolled population included families receiving Medicaid assistance. Families who moved stayed in the FFS portion of the experiment as long as they remained in the United States. Major demographic characteristics of the sample, averaged across the sites, do not differ markedly from those of the nation as a whole, except for these intentional departures.

The populations eventually enrolled in the HIE insurance plans were similar to the nonenrolled population with respect to a wide variety of baseline survey variables.[15] HIE samples support inferences to the populations from which they were drawn at least as well as random sampling with a 100% enrollment rate, provided that slight adjust-

ments are made to account for the higher percentage of children among enrolled individuals. Because the adjustments are slight and because we do not wish to generalize to the sites, we have not made these adjustments here.

Insurance Plans

Families were randomly assigned to one of 14 FFS insurance plans that varied the level of cost-sharing and tied the maximum out-of-pocket expenditure directly to income. Plan assignments were made by a random sampling technique, the Finite Selection Model, which made the distribution of more than 25 family and individual characteristics as similar as possible across plans.[16] We offered families only the plan to which we randomly assigned them because we believed that explaining all plans before asking a family to join the experiment would be confusing and make the enrollment process difficult to implement. Thus the family could either accept the experimental plan or decide not to participate.

The 14 FFS plans fall into several groups, differentiated by the amount and type of cost-sharing. One, to which about one-third of the enrolled sample was assigned, provided free care; the others required some form of cost-sharing. All analyses in this report compare the free-care plan with the cost-sharing plans taken together; the main groupings of plans were as follows.

1. The free-care plan. The family received all care without charge (i.e., 0% coinsurance).
2. Thirteen coinsurance plans. Nine plans had either a 25% or a 50% coinsurance rate on all services up to a maximum dollar expenditure (MDE) of $1,000 (in 1973 dollars) or 5%, 10%, or 15% of family income, whichever was less.† Three additional plans had a 95% coinsurance rate and the same income-related MDE. One plan, the individual deductible plan, imposed a 95% coinsurance rate only on ambulatory expenditures, up to a maximum out-of-pocket expenditure of $150 per person ($450 per family) per year; all outpatient care beyond that amount, and all inpatient care, was free on this plan.

The following example illustrates how the cost-sharing plans operated. A family on the 25% coinsurance plan, with a $1,000 MDE, would pay 25% of all medical and dental bills in each year until the total of all bills reached $4,000. At that point, the family would have spent $1,000 out of pocket; hence all further expenditures during that year would be fully reimbursed by its insurance plan. At the beginning of the next year, the family would again pay the 25% coinsurance until it reached its $1,000 MDE.

For all cost-sharing plans, the $150 deductible and the maximum MDE on out-of-pocket expenses remained constant during the experiment; they were not modified to reflect inflation, which over this period was considerable. For poorer families whose cap was less than $1,000, however, the MDE would be adjusted each year to reflect any change in family income.

To help forestall refusals and improve retention rates during the experiment, families who were assigned to a plan that was less generous than their current insurance were given a payment equal to their highest possible financial loss.‡ Payments were made independent of medical use in installments every 4 weeks. For instance, assume that a family had been assigned to a cost-sharing plan with an MDE of $425 and that the family's existing policy had had a $100 deductible and a 20% coinsurance rate above the deductible. The family would have been paid

† In three of these nine plans, the family paid 50% of the cost of mental and dental services; in some sites and years, the MDE was only $750 per year.

‡ In general this was successful. Refusal rates have been shown to have introduced at most very small biases.[6,9,15]

$260 per year (425 − 100 − 0.2[425−100]), or about $20 every four weeks.

Services Covered

All plans covered an identical broad set of services (Appendix A of Brook et al.[9]), specifically: virtually all medical inpatient care; all ambulatory care, including physician visits; laboratory tests, and diagnostic and therapeutic procedures, including well-care services; and mental health visits, up to 52 visits per year. In addition, all prescription (oral and injected) drugs were covered; several over-the-counter medications were covered if prescribed by a physician for a chronic illness for which the individual had filed at least one claim. All dental care, except non-preventive orthodontia, was included, as were vision and hearing services. The plans were administered by the Family Health Protection Plan through a fiscal intermediary (Glen Slaughter and Associates, an insurance trust fund administrator).[17,18]

Chapter 3

General Methods for Diagnosis- and Service-Specific Analyses

The main theme of these analyses is the focus on individual diagnoses, illnesses, or reasons for seeking care, using the second (most stable) year of the experiment and disaggregating to two age and two income groups. A secondary link is the concept of episodes of care for these specific conditions. This chapter describes only the methods or analytic approaches common to all of the analyses; because different techniques were used for different parts of the project, details of those analysis-specific methods are presented in the corresponding chapters.

Focus of Analyses

Year 2

These analyses concern only the FFS portion of the experiment. They are based on insurance claim forms submitted to the HIE for year 2 specific to each site; the analytic sample is restricted to individuals who were enrolled for the entire year.

The experiment was conducted between November 1974 and January 1982. Year 2 dates specific to sites were as follows: Dayton, October 1975–November 1976; Seattle, January 1977–June 1978; and the two Massachusetts sites, June 1977–August 1978. For 5-year enrollees in the South Carolina sites, year 2 was August 1977–December 1978; for 3-year enrollees, it was August 1979–December 1980. Year 2 in any site lasted more than 1 year because enrollment usually took place over several months.

We chose the second year because we expected it to reflect a steady state of the effect of cost-sharing (avoiding transitory effects of either the first or last year of enrollment) and because we were not measuring outcome variables such as health status, for which the longest possible observation period would be preferable. Further, the distribution of plans did not differ much by site. Finally, we did not expect the clinical practice of medicine or people's underlying predilections for seeking care to change much over this 1976–1980 period.

Population Subgroups

In all, 5,814 individuals from 2,005 families originally were enrolled in the FFS portion of the experiment. Analyses reported in this monograph were done on the 5,554 persons who were eligible for all of year 2. Table 3.1 shows the distribution of individuals in the analysis by age group, sex, income, and plan. The actual number of individuals in any one analysis, across Chapters 4–7, may vary slightly, owing to missing data in some instances and to a reclassification of the eligibility status of two or three individuals.

Age Groups. Certain subgroups in the enrolled population were of special interest, largely because of experimental findings already published on the effects of cost-sharing on use of services or on health status. Thus we considered children (defined as enrollees 0–13 years of age) separately from adults (14 years of age and older). For analyses reported in Chapters 4 and 5, age is the actual age in year 2. For those in Chapters 6 and 7, for

TABLE 3.1. Distribution of HIE Enrollees in Year 2, by Demographic Characteristics and Insurance Plan

Demographic Characteristics	Free Plan		Cost-sharing	
	N	%	N	%
Total number of persons	1,881	100.0	3,673	100.0
Age				
Adults (≥14 years)	1,255	66.7	2,441	66.5
Children (<14 years)	626	33.3	1,232	33.5
Sex				
Male	923	49.1	1,747	47.6
Female	958	50.9	1,926	52.4
Low income[c]				
Adults	476	37.9[a]	846	34.7[a]
Children	297	47.4[b]	525	42.6[b]
Average to high income[c]				
Adults	779	62.1[a]	1,595	65.3[a]
Children	329	52.6[b]	707	57.4[b]

[a] Of all adults.
[b] Of all children.
[c] Low income is a family income, adjusted for family size and composition and site cost-of-living differences, at or below the 33rd percentile of the income distribution; average to high income is everyone else.

which exact age was less pertinent, age is as of enrollment, except that newborns and adoptees would be included if they had been eligible for all of year 2.

Income Groups. In addition, for some studies we examined poor and nonpoor enrollees separately. The measure of income is the logarithm of family income averaged over the 2 years prior to enrollment, adjusted for site cost-of-living differences and family size and composition (number of adults and children).§

The formula for the log-of-income variable is:

$$\log (\text{INC} + 1{,}000)/\text{FAMILY})$$

where INC is the arithmetic average of family income for the year before entry into the experiment and the year before that, adjusted for site differences, and the additional $1,000 ensured that a log-of-income value could be calculated for any individual who otherwise would have had zero or negative income. FAMILY is a family size deflator that accounts for both number of family members and composition of the family (number of adults and number of children). A family of four containing two adults and two children younger than 18 years of age, for instance, has a FAMILY value of 1.0, and larger (or smaller) and differently configured families have higher or lower values.‖

A few adults who were missing a value for this log-of-income variable were assigned an imputed income based on a regression equation, with age and sex as explanatory variables. If children were missing an appropriate income variable, we assigned the one calculated for their mothers (or, in the event a child had no mother in the family, the head of household).

§ This "baseline" income reflects relative family incomes as of about 3 years before the medical services studied here were received. For some analyses, we tested a continuous variable of annual income for year 1 of the study with a separate indicator variable for family size. Results did not differ in any appreciable way.

‖ The formula for adjusting for family size and composition is FAMILY = $0.37 + 0.18A + 0.15C_1 + 0.12C_2 + 0.10(C_3 + \ldots C_n)$, where A is the number of adults 18 years and older, C_1 is the first child under 18 years, C_2 is the second child under 18 years, and C_3–C_n are all remaining children.

For these analyses, we defined low-income (poor) persons as those whose family incomes were at or below the 33rd percentile of the income distribution; average- to high-income (nonpoor) persons were all other participants. In mid1984 dollars, the split between poor and nonpoor persons came at an adjusted family income of about $20,200 for a family of four; the mean family income for poor adults so defined was $11,100.

This definition includes a number of persons who are more accurately described as "near poor"—not below the poverty line but also not of average income. For instance, the poverty line threshold in 1984 for a family of four, which the Bureau of the Census estimated as $10,609 for the nation as a whole,[19] would have fallen at about the 14th percentile of our income distribution. Further, among the poor as we defined them, approximately 14% of the adults (14 years of age and older) and 24% of the children were eligible for Medicaid at the time they were enrolled in the experiment. About 27% of the poor adults and 24% of the poor children had no prior health insurance at all.

We did not analyze the very poorest segment of the HIE population separately because of sample size limitations. We may well have diluted our findings about the possible effects of cost-sharing on the very poor, but had we confined our analyses to that group, sample sizes for highly disaggregated, disease-specific analyses would have been so small as to produce generally imprecise estimates. Thus we opted for a definition of low income that provided analytic groups of adequate size and yet preserved a distinction between individuals whose family incomes were below average and those whose family incomes were at or above average.

Limitations of the Study

These findings from the disease- or service-specific analyses must be interpreted with some caution. First, they will not apply to the aged, because the HIE enrolled persons only up to 61 years of age as of the start of the study. Second, we can draw firm conclusions only about relatively discrete sections of the disease spectrum. We defined and observed episodes of nearly 150 different disease groups, but our sample sizes were too small to examine more than a few of these in detail.

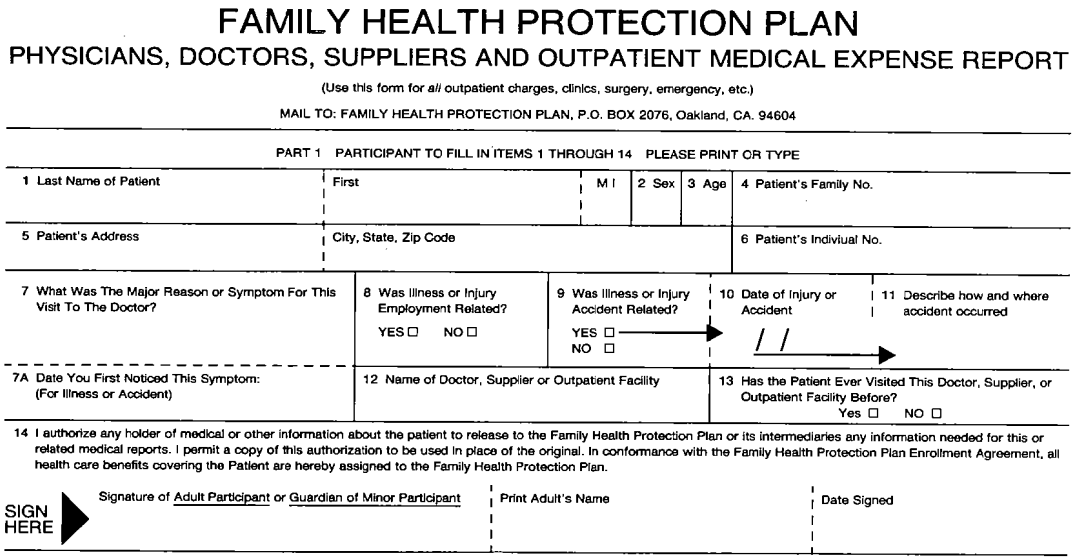
Thus we are unable to say much about several important chronic conditions that can impose great hardship on adults, such as rheumatoid arthritis, chronic pulmonary disease, and cancer. Similarly, we had too few children with chronic diseases such as asthma, with congenital anomalies, or with other life-threatening ailments to conclude anything about the effects of cost-sharing on their access to care. We have focused on common afflictions and reasons for seeking ambulatory care that pertain to general populations, and we do not purport to have much to say about special subgroups of the population, such as severely ill or disabled children.

Building a Diagnosis-Specific Episode File

Episodes of Care

Many investigators of utilization or quality of medical care today advocate the use of episodes, essentially meaning all care for a given spell of illness, for a specific injury, or for a particular chronic illness. For these diagnosis-specific analyses, we adopted an "episode of care" approach. Because of the growing importance of this concept to the field of health services research, a detailed description of the steps needed to develop a diagnosis-specific episode-of-care data base from insurance claims files is provided. The remainder of this chapter may be of relatively greater interest to researchers who undertake similar types of studies based on episodes or insurance claims files.

Episodes of care are not synonymous with episodes of illness. First, for many spells of illness for which individuals eventually get



FAMILY HEALTH PROTECTION PLAN

PHYSICIANS, DOCTORS, SUPPLIERS AND OUTPATIENT MEDICAL EXPENSE REPORT

(Use this form for *all* outpatient charges, clinics, surgery, emergency, etc.)

MAIL TO: FAMILY HEALTH PROTECTION PLAN, P.O. BOX 2076, Oakland, CA. 94604

PART 1 PARTICIPANT TO FILL IN ITEMS 1 THROUGH 14 PLEASE PRINT OR TYPE

1 Last Name of Patient	First	M I	2 Sex	3 Age	4 Patient's Family No.
5 Patient's Address	City, State, Zip Code				6 Patient's Indiviual No.

7 What Was The Major Reason or Symptom For This Visit To The Doctor?	8 Was Illness or Injury Employment Related? YES ☐ NO ☐	9 Was Illness or Injury Accident Related? YES ☐ NO ☐	10 Date of Injury or Accident / /	11 Describe how and where accident occurred
7A Date You First Noticed This Symptom: (For Illness or Accident)	12 Name of Doctor, Supplier or Outpatient Facility		13 Has the Patient Ever Visited This Doctor, Supplier, or Outpatient Facility Before? Yes ☐ NO ☐	

14 I authorize any holder of medical or other information about the patient to release to the Family Health Protection Plan or its intermediaries any information needed for this or related medical reports. I permit a copy of this authorization to be used in place of the original. In conformance with the Family Health Protection Plan Enrollment Agreement, all health care benefits covering the Patient are hereby assigned to the Family Health Protection Plan.

SIGN HERE	Signature of Adult Participant or Guardian of Minor Participant	Print Adult's Name	Date Signed

FIG. 3.1. Physicians' outpatient medical expense report.

care, the symptoms begin some time before the beginning of the episode of care. From just an insurance claims data base, one cannot know when the episode of sickness began. Second, some ailments are self-limited, and individuals may never obtain care for them. These episodes of illness will never be recorded in any claims data base.

The literature on episodes dates to the late 1960s but, until very recently, has been relatively sparse. Donabedian emphasized the need for review of entire episodes of care in quality assessment,[20] and several researchers have developed a variety of ways to create episodes.[4,21–34] In the HIE, analyses by Keeler and Rolph are based on episodes of acute or chronic conditions (as well as preventive care).[3,4] Lohr et al.[35] built episodes based on information from Medicaid insurance claims; these were used in an evaluation of a statewide peer review organization. These algorithms were updated[36] and formed the basis for some of the rules applied in building the data files for the analyses reported in this monograph.

Creating clinically meaningful, diagnosis-specific episodes of care from the HIE claims data base occurred long after routine processing of the insurance claims had taken place. Keesey et al. provide a detailed overview of the claims processing system[37]; their report describes how claims were coded and entered into the HIE data base and how a claims inventory file was created to provide a logically complete view of the line (dollar) charges on a claim.

Insurance Claim Forms

The basic source of data for the FFS analyses reported here was the insurance claim form (Medical Expense Report, or MER) that HIE participants or providers submitted for payment for medical services received.‖ For these analyses, two MERs were important. Visits and procedures, tests, and other ambulatory services were billed on the Physicians' Outpatient MER, as were injected drugs; drugs given away by the physician or

‖ We also developed a form, similar conceptually to a MER, for recording equivalent information from Group Health Cooperative of Puget Sound, which was the site for the prepaid group practice portion of the experiment.[38]

PART 2 DOCTOR OR SUPPLIER TO FILL IN ITEMS 15 THROUGH 29 PLEASE PRINT OR TYPE

15 Full Name of Referring Doctor IF NONE, WRITE NONE.	16 Full name(s) of Providers to Whom You Referred Patient for Consultation, Lab Tests or Other Services IF NONE, WRITE NONE.

17 Describe the Primary Problem or Diagnosis Which Brought the Patient to Your Office and Any Other Problem(s) for Which You Supplied Treatment Please List Primary Problem or Diagnosis on Line A	18 Type of Problem (check one)	19 Treatment History omit if well care or pregnancy.
A.	☐ Acute ☐ Flare-up of Chronic ☐ Well Care (or pregnancy) ☐ Chronic (not flare-up)	☐ Initial Visit for this episode ☐ Repeat Visit for this episode
B.	☐ Acute ☐ Flare-up of Chronic ☐ Well Care (or pregnancy) ☐ Chronic (not flare-up)	☐ Initial Visit for this episode ☐ Repeat Visit for this episode
C.	☐ Acute ☐ Flare-up of Chronic ☐ Well Care (or pregnancy) ☐ Chronic (not flare-up)	☐ Initial Visit for this episode ☐ Repeat Visit for this episode
D.	☐ Acute ☐ Flare-up of Chronic ☐ Well Care (or pregnancy) ☐ Chronic (not flare-up)	☐ Initial Visit for this episode ☐ Repeat Visit for this episode

KEY Place of Service Codes: O = Doctor's Office. IL = Independent Laboratory. H = Patient's Home. IH = Inpatient Hospital. NH = Nursing Home or SNF. EA = Emergency Area. OH = Outpatient Hospital Including Hospital Clinic and Outpatient Surgery. SC = School Clinic. CC = Company Clinic. OL = Other Location Including Other Non-Hospital Clinic
Type of Visit Codes: 1 = Minimal Service. 2 = Brief Examination. 3 = Limited Examination. 4 = Intermediate Examination. 5 = Extended Examination. 6 = Comprehensive Examination. 7 = Unusually Complex Examination. SEE DETAILED INSTRUCTIONS ON REVERSE SIDE
For Inpatient Services. Omit 18, 19 and 21.

20	A Date Of Service	B Place of Service Use code above	C Describe Each Medical or Surgical Procedure and Other Service or Supplies Furnished For Each Date Including Special Lab Tests and the Specific Name of Any Drug Injected.	D Type of Office Visit Use code above	E Relate Treatment to Problem by Ref to 17 A B C or D above	F Charge
1						
2						
3						
4						
5						

21 Were Any Drugs Prescribed? Were any Supplies Prescribed or Suggested? ☐ Yes ☐ No

A If your specify drug(s) and/or supply(ies)	B Relate to Problem by Reference to 17 A B C or D above

22 Name and Address of Doctor or Supplier	23 Social Security or Provider Tax ID Number	24 TOTAL CHARGE	
	Telephone Number	25 AMOUNT PAID IF ANY	
		26 BALANCE DUE	

27 I hereby certify that the services and or supplies listed above have been provided on the date(s) shown
PROVIDER'S SIGNATURE ▶ Date Signed

28 I hereby authorize payment directly to the above named provider of the benefits otherwise payable to me but not to exceed the charges shown. I understand that I am financially responsible for any charges not covered by the Family Health Protection Plan
ADULT PARTICIPANT'S SIGNATURE ▶ Date Signed

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FIG. 3.1. Continued.

dispensed (sold) by the physician also could be recorded or billed on the Physicians' MER. Purchased drugs (i.e., filled prescriptions) were billed on a Pharmacy MER.

Physicians' Outpatient MERs (Fig. 3.1) contained many items of information. Of particular importance to us were the following: name and other identifying information of the patient; name and other identifying information of the provider; date(s) the services were rendered; diagnoses (up to four) complete with codes reflecting whether the

diagnosis was qualified by words such as possible, probable, rule out, questionable; services rendered, which had to be linked to a specific diagnosis recorded on the form; medications prescribed, also linked to diagnosis; medications injected, dispensed, or sold, also linked to diagnosis; and treatment history codes (THCs), by which the provider indicated whether the visit and services given were for an acute illness, a chronic problem, or well care, and whether the visit was a first or a follow-up visit.

Pharmacy MERs (Fig. 3.2) did not contain any diagnostic information per se, but information such as name of prescribing physician, date of prescription, and precise classification of drug type allowed us to match prescribed drugs to visits and hence to diagnoses. The procedures for this are given in more detail below.

For the HIE, diagnoses were coded according to H-ICDA-II (International Classification of Diseases, Hospital Adaptation, Second Edition), procedures and services according to 1974 CRVS (California Relative Value Studies), and drugs according to NDC (National Drug Codes.)#

Diagnostic Categories

The heart of episodes of care for specific conditions and ailments is the diagnosis assigned by the provider; thus our first task in defining outpatient episodes was to establish a comprehensive set of diagnostic groups that would cover the range of problems observed in the ambulatory sector. Such groups had to be reasonably homogeneous clinically, so that most experts would agree that they defined recognizable medical entities, yet not so numerous as to lead to impossibly small sample sizes.

The starting point for defining diagnostic categories was a set of 92 diagnostic clusters for analyzing the content of ambulatory care.[41] Those clusters were intended to cover only the large majority of diagnoses observed in family practitioners' offices.

To account for and classify every diagnosis we encountered in the HIE data base, we had to expand the number of diagnoses; therefore we added groupings including (but not limited to) all of the "other" diagnostic groupings and abnormal laboratory findings. In addition, we had a set of tracer conditions for both adults and children (largely chronic or at least nonacute ailments)¶ for which we wanted specific diagnostic categories. This required splitting some of the basic clusters. Finally, we divided certain tracer conditions (e.g., three categories of otitis media). Ultimately, we specified 150 mutually exclusive diagnostic categories (Appendix A, Table A.1, of Lohr et al.[103]).

Procedure and Drug Categories

Two physicians with extensive experience on the HIE developed a complete categorization system for tests and procedures. Altogether, 87 different categories were defined that cover the entire set of CRVS codes. They include categories for office visits; diagnostic services (e.g., general vision examination, allergy tests); therapeutic services (e.g., physical medicine visit); blood chemistries (e.g., multichannel tests, thyroid tests); hematology (e.g., complete blood count with differential); radiology (e.g., chest x-rays, gastrointestinal contrast studies); and microbiology (e.g., nose and throat cultures, sensitivity tests). An abbreviated listing is given in Appendix A, Table A.2, of Lohr et al.[103]

All codes for diagnoses, procedures, and drugs (respectively, H-ICDA-II, CRVS, and NDC codes) that were used in the HIE, as well as the code books by which insurance claims were processed, are documented in HIE publications.[39,40]

¶ These conditions are defined in two HIE Series (R-2262-HHS and R-2898-HHS for adults and children, respectively)[42,43]; these volumes extensively review the epidemiologic and clinical literature and document the prevalence and disease impact of these conditions within the HIE sample at the beginning of the experiment. Separate reports concern dental health status and psychotropic drugs at the beginning of the experiment.[44-46]

FAMILY HEALTH PROTECTION PLAN

PHARMACY MEDICAL EXPENSE REPORT

MAIL TO: FAMILY HEALTH PROTECTION PLAN, P.O. BOX 2076, OAKLAND, CA. 94604

PART 1—PARTICIPANT TO FILL IN ITEMS 1 THROUGH 7 PLEASE PRINT OR TYPE

1 Last Name of Patient	First	MI	2 Sex	3 Age	4 Patient's Family No.
5 Patient's Address	City, State, Zip Code				6 Patient's Indiviual No.

7 I authorize any holder of medical or other information about the patient to release to the Family Health Protection Plan or its intermediaries any information needed for this or related medical reports. I permit a copy of this authorization to be used in place of the original. In conformance with the Family Health Protection Plan Enrollment Agreement, all health care benefits covering the Patient are hereby assigned to the Family Health Protection Plan.

SIGN HERE ▶ Signature of Adult Participant or Guardian of Minor Participant | Print Adult's Name | Date Signed

PART 2—PHARMACIST TO COMPLETE PART 2 FILL IN ITEMS 8 THROUGH 15, PLEASE PRINT OR TYPE

8 PHARMACIST TO COMPLETE PART TWO. PLEASE PRINT OR TYPE. For drugs purchased with a prescription, fill in items 8 through 15. For drugs purchased without a prescription complete the following boxes. Name of drug. Strength (if applicable). Dosage form. Metric quantity and Charge. Also, sign and date this form.

NOTE: Over-the-counter (non-legend) drugs (with or without a prescription) should be paid for by the participant at the time of purchase as FHPP cannot guarantee their reimbursement to the provider.

A Date Item Dispensed	Prescription No.	Name of Drug Dispensed & Manufacturer (See Item 9 below)		Strength	Dosage form	Physician's Dosage Instructions	
Date Prescription Written	How many refills were authorized on this Prescription No.?	Physician Prescribed Brand ☐ Generic ☐	Name and Address of Prescribing Physician		Metric Quantity	Prescription Was: ☐ Written by Physician ☐ Phoned by Physician	Charge
B Date Item Dispensed	Prescription No.	Name of Drug Dispensed & Manufacturer (See Item 9 below)		Strength	Dosage form	Physician's Dosage Instructions	
Date Prescription Written	How many refills were authorized on this Prescription No.?	Physician Prescribed Brand ☐ Generic ☐	Name and Address of Prescribing Physician		Metric Quantity	Prescription Was ☐ Written by Physician ☐ Phoned by Physician	Charge
C Date Item Dispensed	Prescription No.	Name of Drug Dispensed & Manufacturerer (See Item 9 below)		Strength	Dosage form	Physician's Dosage Instructions	
Date Prescription Written	How many refills were authorized on this Prescription No.?	Physician Prescribed Brand ☐ Generic ☐	Name and Address of Prescribing Physician		Metric Quantity	Prescription Was: ☐ Written by Physician ☐ Phoned by Physician	Charge
D Date Item Dispensed	Prescription No.	Name of Drug Dispensed & Manufacturer (See Item 9 below)		Strength	Dosage from	Physician's Dosage Instructions	
Date Prescription Written	How many refills were authorized on this Prescription No.?	Physician Prescribed Brand ☐ Generic ☐	Name and Address of Prescribing Physician		Metric Quantity	Prescription Was ☐ Written by Physician ☐ Phoned by Physician	Charge

9 For Compounded Prescriptions List the Ingredients and Total Charge for Each Compounded Prescritpion	10. TOTAL CHARGE
	11. AMOUNT PAID, IF ANY
13 Name and Address of Provider	12. BALANCE DUE
	14 Employer I.D. Number
	Telephone No.
15 I hereby certify that the services and or supplies listed above have been provided on the date(s) shown PROVIDER'S SIGNATURE ▶	Date Signed
16 I hereby authorize payment directly to the above-named provider of the benefits otherwise payable to me, but not to exceed the charges shown. I understand that I am financially responsible for any charges not covered by the Family Health Protection Plan. ADULT PARTICIPANT'S SIGNATURE ▶	Date Signed

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FIG. 3.2. Pharmacy medical expense report.

One of these two physicians also developed a therapeutic classification system for drugs and medications. Ninety-three major classifications were defined (e.g., antianginal agents, bronchodilators, antacids). Many had subclassifications as well; within diuretics, for instance, separate entries were made for thiazide, diuretics with potassium-sparing properties, and thiazide with other antihypertensive agents. Appendix A, Table A.3, of Lohr et al.[103] has the short version of this HIE-specific list.

Linking Services to Diagnoses

Assigning Diagnoses to Visits. The HIE MERs could have up to four diagnoses specified by the physician submitting the claim; this facilitated assigning diagnoses to visits, which was the first step in building person-specific episodes. The physician or other provider completing the claim made the actual link between a listed diagnosis and the visit and services rendered. The first-listed diagnosis on the claim typically would be the principal problem for which care was rendered at this particular visit; subsequently listed diagnoses could be used to indicate complications, comorbidities that might be treated opportunistically, and diagnoses to be ruled out, as well as other disorders for which definitive diagnostic or therapeutic steps were taken.

Occasionally, however, this amount of information prompted some problems for building episodes of care, especially when multiple diagnoses of a similar sort (e.g., throat pain and pharyngitis) appeared for a given (line) charge on the claim form. Because this was mainly an issue for acute infectious illnesses, we defined a hierarchy of selected diagnoses that ranked a set of infectious respiratory diseases and symptoms from most to least bacterial in origin: acute otitis media and otitis media not otherwise specified; streptococcal sore throat; sinusitis; pneumonia; pharyngitis and tonsillitis (and throat pain); acute lower respiratory infection (acute bronchitis); acute middle respiratory infection (laryngitis and tracheitis); fever; chronic otitis media; influenza; acute upper respiratory infection; hypertrophy of the tonsils or adenoids; and cough. When two diagnoses on this list were linked to a visit or other service, the diagnosis we used was the higher ranking one.

Linking Procedures and Drugs to Diagnosis. Our basic approach was to create linkages from a procedure or drug to a visit and then to an appropriate diagnosis within a visit. The following gives a brief description of these processes.

We made the basic linkages of procedure to visit by computer whenever the procedure appeared on the same claim form as the visit and had the same or a close date or when the procedure and visit were on different claims but matched according to the "referred from/referred to" provider boxes on the claim forms. This was the most common way these linkages were made.

In all other situations, manual linking was done in two stages that involved comparing printouts of data on every unlinked procedure with printouts of every visit made by the enrollee during the year (which included diagnoses, referral information, and dates of service). Physician reviewers did this manual linking, and a procedure could remain "unlinked."** A combination of factors influenced linking decisions: the amount of "natural" (medical) connection between the procedure and diagnosis, identification of referral/referring providers, and the time spans involved. No absolute time span automatically invalidated a link, but in practice 3 weeks was the usual outer limit for linking procedures to visits.

** George A. Goldberg, MD, was chiefly responsible for this activity. We also acknowledge the extensive assistance of Bonnie Scott, MD (now of San Francisco, California); Kevin F. O'Grady, MD (now of Health Data Institute, Inc., Newport Beach, California); and Nicole Lurie, MD (now at the University of Minnesota, Minneapolis); all were members of the Rand staff at the time.

If the visit had only one diagnosis, then linkage of a procedure to diagnosis was automatic once it had been linked to visits; this was done by computer. If the visit had multiple diagnoses, a physician–reviewer examined a printout of all procedures assigned to multiple-diagnosis visits and hand-matched the procedure to one of the listed diagnoses. Procedures could be (and were) linked to more than one diagnosis if they were medically related to two or more diagnoses specified for the visit; thus, for diagnosis-specific analyses, they could be counted more than once.

Prescription drugs were typically billed on Pharmacy MERs. However, if a physician prescribed a medication, then information about that prescription was to be recorded on the Physician Outpatient MER as well. Thus we developed a set of computer rules that would automatically link drugs (from a Pharmacy MER) to visits (on a Physicians' Outpatient MER) as the first round in building complete episodes. Approximately 19 different "rules" (match types) eventually emerged (Appendix B of Lohr et al.[103]); each was validated (medically tested) by hand-reviewing the computer matches in a sample of cases.

The rules differed in the "quality" of the match between the Pharmacy MER [A] and the Physicians' Outpatient MER [B]. Match type 1, for instance, involved a match on prescription date [A] and date of physician's service [B] *plus* a match on prescribing physician [A] and physician billing for a visit [B] *plus* a match on NDC code of purchased drug [A] and NDC code of the drug named on the Outpatient MER [B]. By contrast, match type 12 involved a match on the prescription date [A] and the date of service [B] plus or minus 2 weeks *plus* a match on [A] and [B] on HIE therapeutic code (rather than NDC code). The rules differed in the percentages of matches for which they accounted. Match type 1, for instance, accounted for 26.0% of all matches, and match type 12 for only 0.5%.

A special rule governed the assignment of groups of drugs used to treat specific chronic conditions; called match type 16, it essentially looked for the presence of the relevant chronic disease during the year, whenever a corresponding drug had been purchased. This rule accounted for roughly 18% of all matches for purchased drugs.

A number of filled prescriptions (7% of the total) remained unlinked to visits after the computerized drug–visit linkages were accomplished. These were linked manually insofar as was possible by physician–reviewers in a process similar to that used for procedures.

Once the basic drug–visit linkage was established, the drug was associated with a diagnosis. The drug–diagnosis match was done automatically by computer if the visit had only one diagnosis and by hand when visits had multiple diagnoses. As with procedures, a drug could be linked to multiple diagnosis or could remain unlinked.

Creating Episodes of Care

Diagnosis-specific episodes of care could then be constructed from the claims data bases that had diagnoses assigned to visits, procedures, and medications.†† For the analyses presented in this report, we built FFS episodes for year 2 for each site. No special allowances were made for episodes that might have started in year 1 or those that might have continued into year 3. Because the insurance claims files for year 2 were complete by the time these analyses were done, we have no reason to believe that any visits, drugs, or other services were systematically missing from the data base.

The fundamental structure of an episode is a visit (together with the services linked to it as described above) or a series of visits

†† Joan Keesey was the senior programmer for all this work. We acknowledge as well the programming assistance of Chih-Ming Fan, who did much of the file building, and Nancy Vrotsos, who assisted with both file building and analysis.

(and their associated services) that "belong" together. Treatment history codes (THCs)‡‡ from the claim forms plus specified time spans between (consecutive) visits for the same diagnosis were used to define rules for creating episodes.

The first step was to divide the 150 diagnostic groupings into four diagnostic types: acute conditions, chronic conditions, conditions that could be either acute or chronic ("either"), and well care.

The next step was to designate certain visits or services as belonging to one episode on the basis of either THC or diagnosis only; these rules took precedence over more complex episode rules. First, any diagnosis with a THC specifically for well care was classified as well care. That is, well-care episodes were specified prior to applying any episode rules to the remaining claims. Second, for certain diagnoses (e.g., eczema, hay fever), an episode was defined on the basis of diagnosis and time between visits, regardless of which THCs were recorded on the claim forms.

The third step was to apply the episode rules to all remaining visits. Different rules (e.g., different time spans between visits or different patterns of THCs) were specified for chronic conditions (e.g., high blood pressure), acute conditions (e.g., strep throat), and disorders that could be either (e.g., anemia, sinusitis, varicose veins). Appendix B of Lohr et al.[103] specifies the rules in more detail.

The rule for chronic conditions was simple: all services for the diagnosis in question in year 2 constituted the episode. Approximately five basic rules governed episodes of care for acute conditions. For instance, assume a person had two outpatient MERs, both of which carried a THC indicating an initial acute visit for the same diagnosis. The two MERs would be linked into a single episode if the dates of service were within 14 days of each other (inclusive); they would each form a separate episode if the dates of service were more than 14 days apart.

Finally, about 60 basic rules could be applied to create episodes for "either" acute or chronic conditions. For example, for a series of THCs specifying repeat flareups of chronic problems, two (or more) MERs with these THCs would be linked into a single episode if the dates of service were within 90 days of each other and separated into two episodes if the dates of service were more than 90 days apart.

Once all possible linkages of services into episodes of care were accomplished by computer, all cases not treated by the original rules were reviewed manually by a physician. Where needed (rarely), additional rules to cover "exceptional" cases were developed. These typically involved specific decisions (implemented by computer) to "dump for inspection" certain visits within (or outside of) a certain time span for mandatory review by a physician. This happened, for instance, for "either" diagnoses in which a THC indicating flareup of a chronic condition was followed closely by a THC, for the same diagnosis, indicating initial acute visit: visits within 30 days of each other were considered the same episode; visits more than 60 days apart were considered two episodes; and visits 31–60 days apart were reviewed manually.

Misassigned Services. In this work we encountered services that probably were assigned incorrectly to particular diagnoses; they accounted for less than 0.5% of all procedures. In some cases, procedures, tests, drugs injected, and drugs prescribed had been assigned by attending physicians on the claim forms to diagnostic categories that, upon inspection, appeared to make no sense medically. Other problems probably represented keypunch errors or errors produced by the various match rules.

‡‡ Individual codes for THCs were defined for the following: initial acute; initial chronic; repeat acute; chronic routine; initial flareup of chronic; well care; repeat flareup of chronic; acute not otherwise specified; chronic not otherwise specified (Appendix B of Lohr et al.[103]).

To reduce the problem, physician–reviewers examined all 150 disease profiles and eliminated services that, from a medical standpoint, did not belong at all. For instance, x-rays of the spine and pelvis were deleted from an episode of viral exanthems (such as measles) and antidepressants were removed from an episode of fever.§§

§§ George A. Goldberg, MD, was responsible overall for this task. Frank A. Sonnenberg, MD, now of Tufts–New England Medical Center, Boston, did much of this review and related documentation.

Episode Count File

On the basis of all of these rules and linkages, an episode count was developed. Identification numbers for each HIE enrollee had, of course, been retained during this entire process, so that the episode count essentially enumerates and identifies all of the diagnosis-specific episodes of care for each individual who had been enrolled for all of year 2. This formed the basic episode of care data file from which work files for the various analyses were extracted.

Chapter 4

Effect of Cost-sharing on the Probability of Episodes of Care for Specific Diseases

The analyses in this chapter deal with three major questions. First, was the difference in the per-person probability of any medical contact in a year between the free and cost-sharing plans the same for various diagnoses? For example, did cost-sharing have more (or less, or the same) impact on curtailing access to care for chronic disease as for acute illness? Was the effect the same or different for various types of preventive care and screening? Information on these topics helps clarify the degree to which imposing or increasing levels of cost-sharing will act in a relatively targeted or relatively nonspecific way to control the use of health care.

Second, were these plan and diagnosis differences the same for the poor and the nonpoor? Third, were they the same for children and adults? For instance, did cost-sharing lower medical contact rates for poor but not well-to-do children, or did it affect care seeking equivalently across ages or income groups? More information on these questions would help to settle nagging problems of whether cost-sharing, even the income-related levels imposed by the HIE plans, might have differentially affected certain population groups, especially the disadvantaged.

Background

Earlier HIE findings showed a significantly lower rate of use of ambulatory care by persons on various cost-sharing plans, compared with those having free care. On the average, both adults and children who faced cost-sharing had about one-third fewer visits and ambulatory episodes of care than did those who had free care.[1,2]

Other analyses demonstrated a responsiveness to plan across three major groupings of care; compared with individuals on the free plan, persons on the cost-sharing plans had about 34% fewer episodes of acute care, 26% fewer episodes of foreseeable chronic care, and 23% fewer episodes of well care.[3] Raising the level of cost-sharing also lowered the demand for and expenditures on ambulatory mental health services.[5] For instance, the probability of any use of ambulatory mental health care was cut 50% from the free care plan to a plan with high cost-sharing. Cost-sharing significantly decreased the use of emergency room (ER) care, more so for less urgent problems.[6] Finally, persons assigned to the cost-sharing plans were about one-third less likely to visit a physician for minor symptoms, although they sought care for serious symptoms at nearly the same rate as persons on the free plan.[7]

Other than in the ER and mental health contexts, these analyses did not examine whether the impact of cost-sharing was the same for all types of outpatient care defined at the level of specific diagnoses. In particular, we did not know whether the likelihood of medical contact (i.e., the probability of at least one episode of care in a year) would differ between the free and cost-sharing

plans in the same way for more narrowly defined ambulatory complaints and disorders. Further, we wished to know whether the cost-sharing effects would be the same for conditions occurring in both adults and children. In addition, when we disaggregated to the level of specific diagnosis, we wanted to determine whether the cost-sharing effects were the same for the poor and the nonpoor, because some of the previous studies, conducted at a higher level of aggregation, suggested that they were (conditional on the lower cost-sharing for the poor).[1,6,7]

Finally, previous analyses in both children and adults indicated that having free care was not uniformly associated with improved health status. Free care improved vision (for those with poor vision at entry) and reduced blood pressure for the average adult; the latter lowered the risk of premature death among those at high risk (judged according to an index that combined the effects of blood pressure levels, cholesterol levels, and smoking behaviors).[8,9,47] Both the vision and blood pressure effects appeared to be concentrated among the poor. Analyses for children showed no measurable benefit at the end of the study for several health status measures for the average child or for those of low income, except for a possible beneficial effect (statistically insignificant but possibly clinically important) for poor children in reducing levels of iron deficiency anemia[10] or improving hearing.[11] Further, there was no benefit of free care for persons of higher socioeconomic status who reported suffering one of a set of serious symptoms at the start of the HIE, but free care did bring improvement to persons of lower economic standing with equivalent types of symptoms.[7]

Methods

Observed Probabilities of an Episode of Care

These analyses proceeded in three basic steps. First, using the episode count file we calculated the observed percentages of poor and nonpoor adults and children who had had at least one episode of care in year 2. We then narrowed the focus to those diagnostic categories in which at least 2% of the subsample of interest had had an episode of care. For these categories, we determined which age and income groups experienced a statistically significant effect of cost-sharing ($P < 0.05$, two-tailed t-test of differences in independent samples). To account for the problem of multiple comparisons within a group, we also defined statistically significant differences with an appropriate correction (a modified Bonferroni test).* This correction is quite conservative and may have low statistical power,[49] so significant differences are shown at $P < 0.10$ (two-tailed test).

Predicted Probabilities of an Episode of Care

Second, we selected 14 frequently occurring diagnostic categories for analyses with regression methods. This allowed more precise estimates than examination of the observed percentages by controlling statistically for site differences, for any, even small, initial differences between plans in age and sex distributions, and for a global measure of health status, the General Health Ratings Index.[50] These 14 disease categories were chosen to represent a broad spectrum of the reasons for which members of a general population seek medical care. They had reasonable prevalence rates.

Logistic regression techniques were used.[51] The dependent variable was the probability that each individual would have an episode

* The Bonferroni test calculates a "corrected" probability level by dividing the nominal P value of interest (e.g., 0.05) by the total number of comparisons (n). The modified test calculates a corrected probability level for *each* t-statistic; the procedure is to rank order each t-statistic of interest (e.g., all those >1.96) from highest to lowest and divide the nominal P value for the first t-statistic by n, that for second t-statistic by n-1, that for the third by n-2, and so on to n-k, stopping when the next t-statistic fails to reach significance according to the calculated value.[48]

TABLE 4.1. Names and Definitions of Variables in Diagnosis-specific Logistic Regressions

Variable	Definition
Cost	An indicator variable equal to 1 if the participant was assigned to one of the cost-sharing plans.
Low	An indicator variable indicating that the person belonged to a poor (low-income) family. Poor was defined as being at or below the 33rd percentile of the distribution of an income variable that was adjusted for family size and composition and for site.
Adult	An indicator variable for participants 14 years of age or older.
Age	The age of the participant at the start of his or her second year of enrollment.
Age-squared	The square of age.
Male	An indicator variable equal to 1 if the participant was male (0 if female).
White	An indicator variable equal to 1 if the participant was white (0 if nonwhite).
GHRI	General Health Ratings Index measured at enrollment. GHRI is a favorably scored 22-item scale for adults (7-item scale for children, completed by parents) that is transformed to a 0–100 scale; higher scores represent a better self-rating of one's health.
Seattle	An indicator variable for participants in the Seattle, Washington site.
Fitchburg	An indicator variable for participants in the Fitchburg, Massachusetts site.
Franklin	An indicator variable for participants in the Franklin County, Massachusetts site.
Charleston	An indicator variable for participants in the Charleston, South Carolina site.
Georgetown	An indicator variable for participants in the Georgetown County, South Carolina site.

Note: For interaction terms and quantitative data on individual regressions, see Appendix D of Lohr et al.[103]

of care for a particular diagnosis at least once in year 2. Important explanatory variables were insurance plan and income level; other covariates included age, sex, race, health status, and site.

Numerous models using a large set of variables and different specifications of interactions with cost-sharing were tried.† Table 4.1 presents the final set of main variables; Appendix D in Lohr et al.[103] gives data on the 14 separate logistic regressions (coefficients, standard errors, and t-statistics).

Third, we used the coefficients from the logistic regressions presented in the Appendix to predict the probability of medical contact for specific diagnoses for the "average" person in four age and income subgroups (e.g., a nonpoor adult on the free plan or a poor child on the cost-sharing plan who otherwise represented the average person). Specifically, we predicted the probability of an episode of care for each child or adult, using each individual's own values for the explanatory variables and the logit coefficients. These predictions were made assuming (1) that the individual was on a cost-sharing plan and (2) that he or she was on the free plan. To produce the values reported later in this chapter, we took the mean of these predicted probabilities based on individual data. We computed t-tests of differences between the predicted mean probability of use for adults or children on the free plan and adults or children on the cost-sharing plans, using the standard errors of the estimated means.‡

Results

In analyzing and discussing these data, we comment on statistical significance, trends across diseases, and possible clinical signif-

† Logistic regression is used to explain the variance in the log odds of the dependent variable, where log odds is defined as log $(P/1\text{-}P)$, where P is the probability of, in this case, a diagnosis-specific episode of care. Thus the basic model for these analyses (and those in Chapter 5) was $\log (P/1-P) = \alpha + \beta_1 x_1 + \ldots + \beta_n x_n$, + error, where P is the probability that the individual had one episode of care in year 2, and x_1–x_n are the explanatory variables (age, sex, race, site, health status, income, and insurance plan) shown in Table 4.1. The estimated probability can equivalently be defined as $P = 1/(1+e^{-D})$, where D is $a + b_1x_1 + \ldots b_nx_n$. We did all exploratory modeling using ordinary least squares methods. Findings and inferences about explanatory variables did not differ meaningfully between OLS and logistic approaches.

‡ We thank Willard G. Manning, PhD, of Rand for assistance in developing the software to estimate predicted standard errors for the logistic regression analyses.

icance. The latter is important because the number of people with any one disease is small; thus even large differences may not be statistically significant, but overall the patterns may have some important implications for access to care for chronic and acute illness and for well care. We believe that the diagnostic categories in the trend analysis represent such a wide spectrum of diseases that they are sufficiently independent to warrant the analysis and associated interpretations.

Effect of Cost-sharing on Medical Contact: Observed Probabilities

Although we defined 150 different diagnostic groups, not all were observed in our population in year 2. Diagnostic categories for which care was sought in year 2 numbered 97 for poor adults, 118 for nonpoor adults, 48 for poor children, and 64 for nonpoor children (Table 4.2). Even among diagnostic groups for which HIE participants got care, many appeared only infrequently, so we restricted our first (nonregression) analyses to "common" conditions for which at least 2% of the age and income group had an episode of care (row 2, Table 4.2). Detailed tables in Appendix C of Lohr et al.[103] show the percentages of individuals on the free and cost-sharing plans with an episode of care in year 2, for all diagnostic groups meeting this 2% threshold.

Being on a cost-sharing plan was associated with lower likelihood of care for adults and children across a wide disease spectrum; evidently, the lower use of ambulatory care seen in the aggregate[1,2] occurred across the board. For example (row 3, Table 4.2), for both poor and nonpoor adults on cost-sharing plans, about 90% of the diagnostic categories had lower rates of medical contact. All of the 20 common diagnostic categories for which poor children obtained care showed lower percentages with cost-sharing, although this was true for only about two-thirds of the 30 conditions for which nonpoor children received care.

Statistically significant differences between the free and cost-sharing plans (row 4, Table 4.2) were observed mainly for poor

TABLE 4.2. Number and Percentage of Common Diagnostic Groups for Which Care Seeking Was Observed to Be Lower on Cost-Sharing Plans

Comparison of Care Seeking Rates on Free and Cost-sharing Plans	Adults		Children	
	Poor (N = 1,322)	Nonpoor (N = 2,374)	Poor (N = 822)	Nonpoor (N = 1,036)
Number of diagnostic groups for which participants sought care in year 2	97	118	48	64
Number of diagnostic groups for which >2% of participants sought care	39	45	20	30
Percentages of diagnostic groups for which care seeking was lower on the cost-sharing plans[a]				
Care seeking lower	87%	91%	100%	67%
Care seeking significantly lower[b]	36%	40%	70%	3%
Care seeking significantly lower, after multiple comparisons correction[c]	18%	9%	25%	0%

[a] Percentages of the number of diagnostic groups shown in row 2. For diagnosis-specific data, see Appendix C of Lohr et al.[103]

[b] $P < 0.05$, two-tailed t-test.

[b] $P < 0.10$, two-tailed t-test, multiple comparisons correction.

children. The data indicate that for 14 of the 20 diagnostic categories (70%) for which 2% or more of poor children sought care, such medical contact was significantly lower among those on cost-sharing plans. This is in marked contrast to the pattern for nonpoor children (1 of 30 diagnostic categories). For adults, both income groups demonstrated significant differences, but for proportionally fewer diagnostic categories than for poor children.

After applying the multiple comparisons correction (row 5, Table 4.2), we determined that cost-sharing had no measurable effect on care seeking for any diagnosis among nonpoor children, but it still significantly deterred use for one-quarter of the diagnostic groups for poor children. The effect of cost-sharing on adults was intermediate between the values for poor and nonpoor children and differed less by income than did the values for children.

From these data on the actual observed probabilities that an individual would obtain medical care for specific diagnostic categories, we inferred that the greatest likelihood of a cost-sharing effect occurred for poor children and the lowest for nonpoor children. Adults seemingly were affected less than children, and to a similar degree across income groups.

Cost-sharing decreased the likelihood of medical contact for most chronic conditions studied in these exploratory analyses, but generally to a lesser degree than for the acute or preventive categories that we examined. Tables 4.3 and 4.4 list, for adults and children, respectively, the diagnostic categories

TABLE 4.3. Summary of Diagnostic Groups With Significantly Lower Observed Probabilities of an Episode of Care for Adults on Cost-sharing Plan, by Income Group

Poor Adults	Nonpoor Adults
Hay fever	
	Obesity
Anxiety neurosis[a]	
Chronic sinusitis[a]	
	Peripheral neuropathy, neuritis, and sciatica
Vision examinations[a]	
General medical examination[a]	General medical examination[a]
Pre- and postnatal care	
	Influenza
Acute pharyngitis	
Chest pain	Chest pain
Abdominal pain[a]	Abdominal pain[a]
	Acne
	Nonfungal skin infections
Skin rashes and other skin diseases[a]	Skin rashes and other skin diseases[a]
Vaginitis or cervicitis	Vaginitis or cervicitis
	Urinary tract infection
	Degenerative joint disease
	Disc displacement or derangement
	Low back pain diseases and syndromes[a]
Bursitis and fibrositis	
Lacerations, contusions, and abrasions[a]	Lacerations, contusions, and abrasions
	Fractures
	Other gastrointestinal disease
Other signs and symptoms	
	Other injuries and adverse effects

Note: All diagnostic groups shown had significantly ($P < 0.05$) lower "observed" probabilities with cost-sharing.
[a] The effect was significant at $P < 0.10$, two-tailed test, even with multiple comparisons corrections. See Appendix C, Tables C.3–C.6, of Lohr et al.[103] for details.

TABLE 4.4. Summary of Diagnostic Groups With Significantly Lower Observed Probabilities of an Episode of Care for Children on Cost-sharing Plans, by Income Group

Poor Children	Nonpoor Children
Vision examination	
General medical examination[a]	
Otitis media, not otherwise specified	
Otitis media, acute	
Influenza	
Acute upper respiratory infection (URI)[a]	Acute upper respiratory infection (URI)
Acute pharyngitis	
Streptococcal sore throat[a]	
Acute bronchitis	
Diarrhea and gastroenteritis	
Skin rashes and other skin diseases	
Acute sprains and strains	
Lacerations, contusions, and abrasions[a]	
Other injuries and adverse effects[a]	

Note: All diagnostic groups shown had significantly ($P < 0.05$) lower "observed" probabilities with cost-sharing.
[a] The effect was significant at $P < 0.10$, two-tailed test, even with multiple comparisons correction. See Appendix C, Tables C.9–C.12, of Lohr et al.[103] for details.

for which cost-sharing had a statistically significant deterrent effect on care seeking. The highlighted categories were significant even after the multiple comparisons correction was applied.

Effect of Cost-Sharing on Medical Contact: Regression Analyses and Predicted Probabilities

The inferences about the effects of cost-sharing on subgroups defined by age or income, which are based on observed probabilities, may be erroneous. Because the sample is not perfectly balanced by plan, other factors, such as health status or geographic location, which were not taken into account in the exploratory studies, may in fact be influencing the findings. To clarify or confirm these effects of insurance plan and possible interactions with income, we turned to logistic regression analyses for 14 common diagnoses with incidence rates that permitted meaningful statistical analysis. Regression techniques permit us to control for such factors; specifically, our approach permits us to control for all major variables that usually explain the use of medical care (e.g., age, sex, health status) and then examine the effect of income and cost-sharing. Logistic regression is the appropriate technique when the dependent variable is bounded between 0 and 1 (as is the case with probabilities) and when the data are analyzed at the level of individuals (i.e., are not grouped).

Table 4.5 gives the percentages of adults or children who filed at least one claim (and thus had at least one episode of care) in year 2 for each of the 14 diagnostic categories. Appendix D of Lohr et al.[103] contains information on the regression equations (variables, coefficients, and associated t-test values) used to produce the predicted probabilities reported in Tables 4.6 and 4.7.

How Do Patient Factors Affect Use of Care? We examined the coefficients (and associated statistical significance) of explanatory variables in our logistic regressions (Tables D.1–D.14 in Lohr et al.[103]) to determine the relationship between these variables and the probability of use of medical care for our 14 diagnoses. Factors related to the underlying rate of disease in a population predicted the rate at which medical care was sought for these conditions, when other variables (Table 4.1) were controlled. The associations be-

TABLE 4.5. Frequency of Diagnostic Categories Included in Logistic Regression Analyses

Diagnostic Category	Percent of Population With Diagnosis in Year 2	
	Adults (N = 3,643)	Children (N = 1,830)
Chronic conditions		
Hay fever	3.0	4.6
Hypertension	7.3	[a]
Obesity	2.9	[a]
Preventive care		
Vision examination and refraction	19.6	11.9
General medical examination	14.3	31.8
Acute and other conditions		
Acute URI	6.1	11.9
Acute pharyngitis	6.3	14.2
Otitis media	2.0	13.3
Diarrhea and gastroenteritis	[a]	2.7
Vaginitis and cervicitis	9.1[b]	[a]
Skin rashes and other skin diseases	11.2	8.7
Lacerations, contusions, and abrasions	7.9	11.5
Acute sprains and strains	3.9	3.0
Other injuries and adverse effects	9.7	7.3

[a] Fewer than 2% of the sample filed a claim for this condition in year 2.
[b] Percentage based on women only.

tween our explanatory variables and use of care were generally in expected directions.

Age was strongly and directly related to the likelihood of treatment for hypertension, whose prevalence rises with age. Age was strongly but inversely related to conditions such as acute pharyngitis; diarrhea and gastroenteritis; and lacerations, contusions, and abrasions. The nonlinear term shows that some conditions, such as upper respiratory infection and otitis media, decrease with age until the early 40s.

Men and boys were less likely to receive treatment for most conditions we studied. However, they were significantly more likely to get care for lacerations and other injuries and adverse effects. Being white was associated with higher probabilities of contact for nearly all diagnoses, including general medical examination, hay fever, skin rashes, acute upper respiratory infections, pharyngitis, otitis media, vaginitis, lacerations, and other injuries. However, nonwhites were significantly more likely to be treated for hypertension.

The General Health Ratings Index (GHRI), a measure of self-perceived, overall health, was significantly related to medical use, according to the size and significance of its coefficients in our regressions. The lower this measure of general health (i.e., the poorer one's perceived health), the more likely a person was to receive care for any of the chronic or acute conditions we studied. However, the GHRI was significantly and positively related to the probability that an individual would receive a general medical examination, even controlling for age and the several other factors. That is, individuals who were healthier according to the GHRI were more likely to receive such an examination than sicker persons.

HIE sites were included in the regressions as an access measure because the sites had been chosen to differ with respect to ready availability of primary health care. The site variables may also reflect site-specific health factors, such as a greater rate of industrial accidents in one location than in another. We observed no consistent trends or patterns

TABLE 4.6. Predicted Percentages of Adults With an Episode of Care by Diagnosis, Income, and Plan

Diagnosis	Poor Adults (N = 1,303)			Nonpoor Adults (N = 2,340)		
	Free	Cost-sharing	Cost-sharing as % of Free	Free	Cost-sharing	Cost-sharing as % of Free
Chronic conditions						
Hay fever	4.2	1.6	39[a]	3.4	3.2	94
Hypertension	7.4	5.8	78	8.0	7.6	95
Obesity	2.5	3.6	147	4.1	2.0	49[a]
Preventive care						
Vision examination	22.2	12.8	58[a]	23.3	20.3	87
General medical examination	17.7	9.6	54[a]	19.0	13.5	71[a]
Acute conditions						
Acute URI	6.7	4.4	66	7.6	6.0	79
Acute pharyngitis	8.2	4.4	54[a]	8.4	5.8	68[a]
Otitis media	3.2	1.5	45[b]	1.7	2.1	122
Vaginitis and cervicitis[c]	13.9	6.9	50[a]	13.3	7.2	54[a]
Skin rashes and other skin diseases	14.0	8.0	57[a]	14.7	10.2	69[a]
Lacerations, contusions, and abrasions	13.2	7.6	58[a]	8.7	6.2	72[a]
Acute sprains and strains	4.7	3.7	76	4.5	3.5	77
Other injuries and adverse effects	11.5	9.0	78	11.8	8.4	72[a]

[a] Effect of cost-sharing significant at $P < 0.05$.
[b] Effect of cost-sharing significant at $P < 0.10$.
[c] Data are for women only.

in effects of site on the probability of medical contact for these conditions, however.

How Do Cost-sharing and Income Affect Use of Care? Cost-sharing reduced medical contact for most conditions: those conditions for which medicine provides a highly effective treatment (e.g., vaginitis, pharyngitis) as well as for those where medical treatment has less to offer (e.g., acute upper respiratory infection). Tables 4.6 and 4.7 show the probabilities with which adults and children on the free and cost-sharing plans sought medical care for these conditions. These estimates are based on the logistic coefficients (Appendix D[103]) and are shown as percentages. The figures in the tables reflect values for individuals who differ in whether they face any cost-sharing and in income but who otherwise have characteristics like those found in the entire experiment. Hence these predictions summarize the effects of plan and income on medical contact.

Differences between plans are shown in the columns labeled cost-sharing as a percentage of free. For instance (Table 4.6), the probability that a poor adult would obtain care for hay fever if he or she was on the cost-sharing plan (i.e., 0.016, or 1.6%) was 39% of the probability calculated for such a patient with free care (0.042, or 4.2%).§ The differences between free plan and cost-sharing plan probabilities are noted at both $P < 0.05$ and $P < 0.10$ (two-tailed t-test). The significance levels of plan differences reported in Tables 4.6 and 4.7 may differ from

§ The percentages shown in the column labeled Cost-sharing as % of free were calculated on raw data and therefore may not accord exactly with values calculated on the rounded probabilities shown in the tables.

TABLE 4.7. Predicted Percentages of Children With an Episode of Care, by Diagnosis, Income, and Plan

Diagnosis	Poor Children (N = 807)			Nonpoor Children (N = 1,023)		
	Free	Cost-sharing	Cost-sharing as % of Free	Free	Cost-sharing	Cost-sharing as % of Free
Chronic conditions						
Hay fever	4.4	4.9	109	5.1	4.4	86
Preventive care						
Vision examination	13.0	8.0	61[a]	14.5	12.9	89
General medical examination	32.7	22.2	68[b]	41.9	33.2	79[b]
Acute conditions						
Acute URI	16.6	8.1	49[b]	16.2	10.6	65[b]
Acute pharyngitis	15.5	8.7	56[b]	18.4	15.1	82[b]
Otitis media	15.3	10.4	68[a]	14.4	13.6	94
Diarrhea and gastroenteritis	4.4	1.6	37[b]	3.5	2.4	68
Skin rashes and other skin diseases	10.1	6.1	60[a]	11.7	8.6	73
Lacerations, contusions and abrasions	18.8	8.7	46[b]	9.7	11.1	115
Acute sprains and strains	4.2	1.4	33[b]	1.8	4.0	219[c]
Other injuries and adverse effects	9.9	4.4	44[b]	7.1	8.1	114

[a] Effect of cost-sharing significant at $P < 0.10$.
[b] Effect of cost-sharing significant at $P < 0.05$.
[c] Difference between free and cost-sharing significant at $P < 0.05$.

the significance levels of the coefficients on the plan variable in the logistic regressions (Appendix D[103]) because the differences in the predictions include the effects of plan interacted with indicators of income and of being an adult.

Among the three chronic conditions affecting adults (Table 4.6), cost-sharing was statistically significantly related to lower care seeking for hay fever: for low-income adults, the cost-sharing rate was about 39% of that on the free plan, although for other adults cost-sharing had little effect. No significant differences among the plans and income groups were found for hypertension, and cost-sharing significantly deterred use for obesity only among adults of higher income.

Cost-sharing significantly reduced the probabilities of both types of well care episodes for low-income adults: the probabilities of receiving a general medical or vision examination on the cost-sharing plan were less than 60% of the free plan probabilities. For higher-income adults, members of the cost-sharing plan used 70–90% as much preventive care as free plan enrollees.

Finally, across several acute and other disorders, cost-sharing reduced the number of persons who sought care. For the disadvantaged, the cost-sharing probabilities were 45–80% of those on the free plan.

Of the 11 diagnostic categories relevant for children (Table 4.7), 7 showed a significant effect of cost-sharing in reducing contact for disadvantaged children. For the two preventive examination categories, the probabilities of use with cost-sharing were about 60–70% (low-income) and 80–90% (higher-income) of those with free care. For the various acute conditions, rates of use were sig-

nificantly lower on cost-sharing plans, with cost-sharing probabilities 33–68% as much as free plan probabilities for poor children.

Does Income Affect Medical Use and Response to Cost-sharing? Among children, higher income had a significant effect of raising the probability of seeking medical care for the two preventive services but for only one condition (acute pharyngitis). In one case—lacerations, contusions, abrasions—children from poor families were significantly more likely ($P < 0.01$) to receive care. Among adults, income was not significantly positively related to use for any diagnosis. Poor adults were, however, more likely to be treated for lacerations.

We can, however, still ask whether, and how, income affects a person's response to cost-sharing. Cost-sharing requirements may lower use only among disadvantaged individuals, who find the out-of-pocket costs imposed by such plans especially difficult to meet. To test this hypothesis, we included an interaction term in the logistic regressions to test whether more affluent people had a significantly different response to cost-sharing than did the less affluent.

The interaction terms are significant and show a greater response among the poor for three diagnostic categories for children, all related to trauma or accidents: lacerations; acute sprains and strains; and other injuries.‖ These three categories differed from all others studied in that each showed higher rates of use among the poor than among the nonpoor. For one problem (lacerations), care-seeking rates among the poor on the free care plan were actually higher than the free plan rates among the nonpoor, with a significant deterrent effect of cost-sharing among poor children. These injury-related problems may occur more frequently among low-income people[52] (which would increase precision for this group), or low-income people may be more likely to seek treatment for them if they have free care, or both. On the average, an injury in a low-income person may be more severe and thus be associated with a higher likelihood of seeking care.

Returning to Tables 4.6 and 4.7, we can look at differential effects of cost-sharing and income on use by comparing the rates in the third columns of those tables with the rates in the sixth columns. The lower the percentage shown, of course, the greater the impact of cost-sharing. Subtracting the poor rates (third column) from the nonpoor rates (sixth column) gives an idea of the magnitude of the differential. For instance, for pharyngitis in children, the differential is 26 percentage points (82% minus 56%), as is the differential for otitis media. Such differentials are likely to be clinically significant.

Further, taken as a group, the percentage reductions caused by cost-sharing are larger among poor adults (relative to nonpoor) for 11 of 13 categories and among poor children for 10 of 11 categories. If the categories were independent and if the two income groups were in fact similar, the likelihood of observing this would be about 1% for adults and about 0.5% for children; that is, we would reject the hypothesis of a similar response across income groups. The categories are not perfectly independent, because the same individuals can appear across diagnoses. However, because the prevalence rates for a given diagnosis rarely exceed 10% and because more than 70% of participants had an outpatient visit in a year, it appears that different individuals account for episodes of these various diagnoses.

Therefore, we believe that the dependence across diagnostic categories is minimal and that we can reject the hypothesis of no interaction between plan and income. The poor reduced their use of ambulatory care more than the nonpoor. This was especially true for children.

‖ If the modified multiple comparisons correction is applied in looking at the coefficients in these 11 disease categories for children, the one for other injuries is only borderline significant.

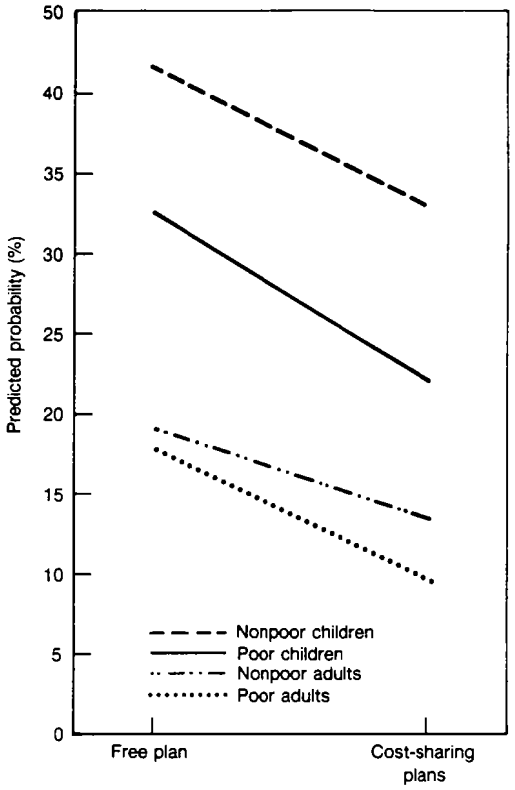

FIG. 4.1. Predicted probabilities of a general medical examination.

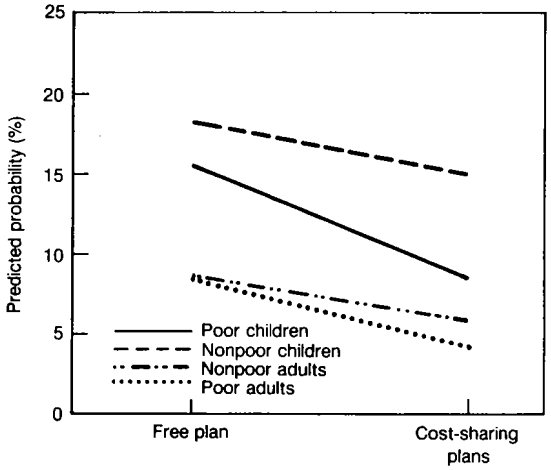

FIG. 4.2. Predicted probabilities of an episode of care for acute pharyngitis.

General Medical Examinations, Acute Pharyngitis, and Lacerations

Several effects of cost-sharing are illustrated in Figures 4.1–4.3, which show the predicted probabilities of an episode of care for the poor and nonpoor child and the poor and nonpoor adult who is otherwise representative of our participants. (For actual data, see Tables 4.6 and 4.7.)

The horizontal axis is a proxy for price, with free care representing a lower price than cost-sharing (but not a zero price); the vertical axis (probability of care) is a proxy for demand. Thus these lines can be interpreted as a form of demand curve; the steeper the line, the more responsive is that group to the effects of price. The solid and dashed lines represent children; the dotted lines, adults. Lines that approach or cross each other are of special interest, because they reflect instances in which the cost-sharing effect may be stronger for one income group than the other.

The graph for general medical examinations (Fig. 4.1) illustrates the deterrent effects of both cost-sharing and low income on use for children. The impact of cost-sharing is similar for children in the two income groups

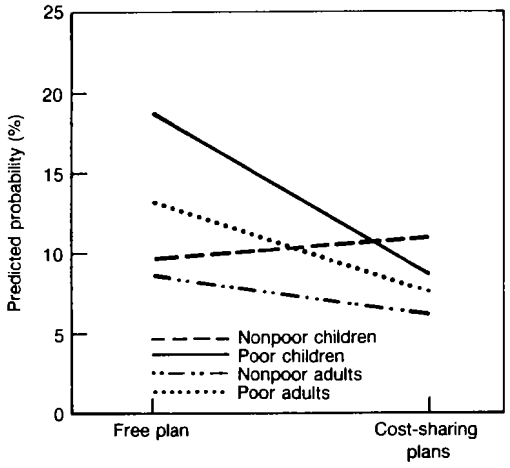

FIG. 4.3. Predicted probabilities of an episode of care for lacerations, contusions, or abrasions.

(the demand curves are nearly parallel), but use is notably lower among the poor. One striking feature is that poor children with free care had these examinations at about the same rate as nonpoor children on cost-sharing plans. Although cost-sharing reduces use among adults, in contrast to children income has a much smaller effect. In fact, adults on the free plan have nearly the same level of use of general medical examinations regardless of income.

The cost-sharing effects for acute pharyngitis were similar for the two income groups (Fig. 4.2). Being poor decreased the probability of an episode of care for children; like the values for general medical examinations, poor children with free care and nonpoor children with cost-sharing had nearly equivalent probabilities of getting care for pharyngitis and tonsillitis. Being poor was associated with less of a decrease in use for adults.

Figure 4.3 shows the pattern of medical contact for the trauma/accident category, comprising lacerations, contusions, and abrasions. Low-income children who had free care had the highest rate of care seeking for this problem, and their rates were markedly higher than poor children on cost-sharing plans. Among nondisadvantaged children, use did not vary significantly by plan, and cost-sharing participants had slightly higher rates. In fact, poor children with cost-sharing used these acute care services at about the same rate as nonpoor children with free care. For adults, cost-sharing was always associated with lower use, but again higher income apparently was associated with a lower likelihood of seeking care for these trauma-related problems.

Discussion

Impacts of Cost-sharing

The rate at which a diagnosis is made depends on the underlying rate at which the disease or condition is present in the population, the likelihood that a person will seek care for a condition once it is (perceived to be) present, and the likelihood that a physician will assign the diagnosis once care is rendered. Our insurance plans, however, were closely balanced at the start of this randomized experiment in regard to the prevalence of numerous conditions, impairments, and levels of previous health; further, we have no reason to suspect that disease incidence would vary systematically by plan. Hence our observed (or predicted) medical contact rates by plan will reflect plan differences in the likelihood of seeking care (or of being given a specific diagnosis), not incidence or prevalence of disease.

Given previous HIE results, we expected to see that cost-sharing would lower care seeking. What emerged, however, is a pattern in which cost-sharing had a greater impact—when measured by the likelihood of any contact in a single year—on encounters for certain types of preventive care and for a variety of acute (but not necessarily trivial) illnesses, such as accident-related problems and common infections. It had a lesser, but detectable, influence on care seeking for some of the more prevalent chronic problems.

The effect of cost-sharing was often greater among low-income than higher-income persons. Although these differences were rarely statistically significant taken one at a time, they were clinically significant and (plausibly) statistically significant taken as a group.

In interpreting our results, it is important to bear in mind that the level of cost-sharing imposed in the HIE was related to annual family income. All cost-sharing plans had an out-of-pocket cap beyond which additional care was fully reimbursed for the remainder of the year. The cap was (with one exception) a percentage of family income up to a $1,000 maximum, so the expenditure needed before care was fully reimbursed was lower for poorer families. As a result, families with incomes below the HIE median were about 6 percentage points more likely to ex-

ceed their MDEs in a year, compared with persons with above-the-median incomes.# This may be related to care-seeking patterns in which low-income individuals were less responsive to cost-sharing for inpatient care than were higher-income individuals.

Therefore, poor families in the HIE had in a sense effectively less cost-sharing than the middle- and upper-income families. This may account for the facts that, in examining regression coefficients, we detected strong, direct associations between income and use in only three diagnostic categories (two of which are preventive) and the effect of cost-sharing differed by income only for accident-related problems. Nonetheless, taken as a group, the plan response for disadvantaged adults and children does appear greater than that for nondisadvantaged persons.

Relationship to Health Status Results

We should interpret these findings in light of reported health status results. Cost-sharing was a relatively small deterrent for seeking any care specifically for hypertensives identified by claim form diagnoses, but it was a relatively large deterrent for some types of outpatient care (such as annual general medical examinations), for which detection of unsuspected high blood pressure (and subsequent confirmation) might be an important outcome. This would seem to accord with the finding of another HIE study,[47] in which the effect of free care in improving blood pressure status was not related to changing patterns of treatment for confirmed hypertensives but rather to the greater likelihood of diagnosing and confirming hypertension in previously undiagnosed hypertensives on the free care plan.

The results for vision examinations among adults support the experimental findings on health status, which showed a marked improvement in functional far vision among persons with free care, especially the poor.[8,9] Having free care produced a higher probability of a vision examination in a year for poor adults, which, in turn, led to the significantly improved levels of functional far vision observed among adults at the end of the experiment.

The previously reported findings about child health status showed no appreciable benefits of free care for several general and diagnosis-specific measures after 3 or 5 years in the study.[10,11] Although free care increased care seeking among children for a wide variety of acute and other problems in year 2, these are typically complaints and disorders that do not "map" directly to the longer-term health status of children. However, the one nearly significant ($P = 0.12$) benefit of free care in that age group—lower rates of anemia among poor children—might be related to their higher likelihood of general medical examinations when care is costless.

Summary

As expected, cost-sharing lowered the likelihood that HIE participants would obtain care for numerous individual diagnoses. The decreased probability of contact during a year appeared to be more likely for the acute and preventive diagnostic categories than for the chronic conditions. It appeared to be stronger for children than for adults, although this did not lead to measurable decrements in general health status. The HIE cost-sharing plans were designed explicitly to take cognizance of the lower family resources among the poor (by being income-related), but even so they affected use more among the poor than among the nonpoor. The deterrent effect was greatest for children from low-income families.

This figure applies to all cost-sharing plans except the individual deductible plan. For that plan, which was not income-related, 52% of the upper half of the income distribution exceeded the deductible versus 36% of the lower half.

Chapter 5

Effect of Cost-sharing on Use of Medically Effective and Less Effective Care

To this point we have refrained from commenting on whether cost-sharing curtailed "inappropriate" or "unnecessary" medical use more than, or less than, it reduced "appropriate" care seeking. We did, however, indicate in our previously reported work that for both the average adult and child, our health status results were such that we could rule out the likelihood of a large beneficial effect of the additional services used when the person had free care; the confidence intervals around the differences between the free and cost-sharing plans were rather tight.[8-11] Hence one might infer that much of the reduction occasioned by cost-sharing had been in relatively unnecessary use, because reductions of appropriate services would affect these health status measures.

To decide whether this inference was correct, we sought to determine whether cost-sharing had equivalent deterrent effects on the likelihood of medical contact for groupings of diagnoses for which medical interventions may be variably useful. Specifically, we assigned the major diagnostic categories to one of seven groupings that had been ranked according to expected level of effectiveness of medical care. We then asked whether the probabilities of any medical contact differed similarly by plan for diagnostic groups in which care is highly, probably, or only rarely effective.

Defining homogeneous groupings of diagnoses for which medical care might, on average, be more or less effective is an especially difficult task. Assigning conditions into "medical care-effective" groups is relatively straightforward for a considerable range of specific acute and chronic conditions; these would include (among others) problems involving major trauma, several respiratory and genitourinary tract infections, and various chronic conditions involving the endocrine or cardiovascular systems. Although clinicians might argue as to whether, in given cases, medical care might be judged "highly" or only "quite" effective, the basic presumption is that care is appropriate and necessary and carries more benefit than risk.

In other areas, however, the correct classification of diagnoses is much less clearcut. To contrast our highly effective category, we attempted to classify a set of diagnoses and symptoms for which medical care is, on the average, of little direct value (e.g., for being overweight) or for which self-care and over-the-counter remedies are efficacious (e.g., for a cold [acute upper respiratory infection]). Medical advice for a few of the conditions or symptoms that we included in our less effective or rarely effective categories may well be important to rule out more serious illness. For a few others, medical attention may accelerate recuperation or partially relieve symptoms or impairments. In general, however, we tried to define a set of hierarchical categories such that most clinicians

would agree to the following: medical care for conditions at the lower effectiveness end of the spectrum is, on the average, less critical or appropriate than care for conditions at the upper end of the spectrum.

Further, shifts between adjacent categories probably would not change the main implications of the analysis reported in this chapter: cost-sharing had a relatively nonselective impact across diagnoses on curtailing the use of services for most persons.

Methods

Medical Effectiveness Groups

The seven medical effectiveness groups we investigated were defined in terms of whether medical care was deemed to be highly effective, quite effective, less effective, or rarely effective in reducing symptoms, improving function, or enhancing the likelihood of survival (Table 5.1). The highly effective category had three subdivisions (for acute, acute or chronic, and chronic conditions) and the rarely effective category had two (self-care also rarely effective, and over-the-counter or self-care effective). Diagnoses were assigned to these groups through an iterative ranking and reranking process involving several physicians at Rand. In addition, profiles of claims data were carefully examined to determine what actually was included in these diagnostic categories. For instance, the chest pain diagnosis was assigned to the rarely effective category after it was seen from the claims analysis to be a catch-all diagnosis of minor complaints for which nonspecific remedies were prescribed. Final assignments were those agreed on by the two more senior physicians.*

Plan of Analysis

These analyses are based on the same data files as those used for the disease-specific utilization analyses. The same general approach as that taken for the diagnosis-specific utilization analyses was used here, except that within any one effectiveness group, an episode of care was counted only once. For instance, for highly effective care for acute problems, an episode of acute otitis media and an episode of lacerations for the same individual would be counted only once. Chapter 4 (Methods) gives more details. Tables D.15–D.21 in Appendix D of Lohr et al.[103] contain the logistic regressions.

Results

Predicted Probabilities of Use: Average Adult and Child

Cost-sharing was generally just as likely to lower use when care is thought to be highly effective as when it is thought to be only rarely effective. For the average adult and average child, cost-sharing was associated with a statistically significantly lower likelihood ($P < 0.05$) of at least one medical encounter for nearly all the effectiveness categories.† We observed no pattern suggesting that the decreases prompted by cost-sharing were larger for one or the other of the age groups. Neither was there any obvious trend suggesting that cost-sharing would deter care seeking more as one moved "down" the effectiveness ranking.

Table 5.2 summarizes the findings for the average adult and child, showing the proportions on the free plan and cost-sharing as a percentage of the free plan rate. For adults, the likelihood of receiving ambulatory care for at least one condition in each of the seven groups was typically about one-

* Robert H. Brook, MD, and George A. Goldberg, MD, took the lead in this effort and resolved differences among the group that did the original rankings. The authors thank Nicole Lurie, MD, Assistant Professor of Medicine, Center for Health Services Research, University of Minnesota, Minneapolis, and Albert L. Siu, MD, Assistant Professor of Medicine, UCLA Department of Medicine, Los Angeles, for their assistance.

† All these were also significant at $P < 0.10$, two-tailed test, with a multiple comparisons correction. Differences were nonsignificant at $P < 0.05$ for highly effective care for chronic conditions (adults), highly effective care for "acute or chronic" conditions (children), and less effective and rarely effective care (children).

TABLE 5.1. Medical Effectiveness Groupings

- Group 1: Highly Effective Treatment by Medical Care System
  - Medical care highly effective: acute conditions
    - Eyes—conjunctivitis
    - Otitis media, acute
    - Acute sinusitis
    - Strep throat
    - Acute lower respiratory infections (acute bronchitis)
    - Pneumonia
    - Vaginitis and cervicitis
    - Nonfungal skin infections
    - Trauma—fractures
    - Trauma—lacerations, contusions, abrasions
  - Medical care highly effective: acute or chronic conditions
    - Sexually transmitted disease or pelvic inflammatory disease
    - Malignant neoplasm, including skin
    - Gout
    - Anemias
    - Enuresis
    - Seizure disorders
    - Eyes—strabismus, glaucoma, cataracts
    - Otitis media, not otherwise specified
    - Chronic sinusitis
    - Peptic and nonpeptic ulcer disease
    - Hernia
    - Urinary tract infection
    - Skin—dermatophytoses
  - Medical care highly effective: chronic conditions
    - Thyroid disease
    - Diabetes
    - Otitis media, chronic
    - Hypertension and abnormal blood pressure
    - Cardiac arrythmias
    - Congestive heart failure
    - Chronic bronchitis, chronic obstructive pulmonary disease
    - Rheumatic disease (rheumatoid arthritis)
- Group 2: Quite Effective Treatment by Medical Care System
  - Diarrhea and gastroenteritis (infectious)
  - Benign and unspecified neoplasm
  - Thrombophlebitis
  - Hemorrhoids
  - Hay fever (chronic rhinitis)
  - Acute pharyngitis and tonsillitis
  - Acute middle respiratory infections (tracheitis, laryngitis)
  - Asthma
  - Chronic enteritis, colitis
- Group 2 Continued
  - Perirectal conditions
  - Menstrual and menopausal disorders
  - Acne
  - Adverse effects of medicinal agents
  - Other abnormal findings
- Group 3: Less Effective Treatment by Medical Care System
  - Hypercholesterolemia, hyperlipidemia
  - Mental retardation
  - Peripheral neuropathy, neuritis, and sciatica
  - Ears—deafness
  - Vertiginous syndromes
  - Other heart disease
  - Edema
  - Cerebrovascular disease
  - Varicose veins of lower extremities
  - Prostatic hypertrophy, prostatitis
  - Other cervical disease
  - Other musculoskeletal disease
  - Lymphadenopathy
  - Vehicular accidents
  - Other injuries and adverse effects
- Group 4: Medical Care Rarely Effective or Self-care Effective
  - Medical care rarely effective
    - Viral exanthems
    - Hypoglycemia
    - Obesity
    - Chest pain
    - Shortness of breath
    - Hypertrophy of tonsils or adenoids
    - Chronic cystic breast disease
    - Other breast disease (nonmalignant)
    - Debility and fatigue (malaise)
  - Over-the-counter or self-care effective
    - Influenza (viral)
    - Fever
    - Headaches
    - Cough
    - Acute URI
    - Throat pain
    - Irritable colon
    - Abdominal pain
    - Nausea or vomiting
    - Constipation
    - Other rashes and skin conditions
    - Degenerative joint disease
    - Low back pain diseases and syndromes
    - Bursitis or synovitis and fibrositis or myalgia
    - Acute sprains and strains
    - Muscle problems

quarter to one-third lower on the cost-sharing plans. For instance, for "highly effective care for acute conditions," the probability of obtaining care was 0.28 with free care and 0.19 with cost-sharing (a 33% reduction). For the "rarely effective (but self-care effective)" category, the probabilities were 0.39 and 0.29, respectively, a 25% reduction.

The one exception among adults, which was important, was for chronic disease, for

TABLE 5.2. Predicted Percentages of Adults and Children With an Episode of Care, by Medical Effectiveness Categories and Plan

Medical Care Effectiveness Category	Adults (N = 3,643)			Children (N = 1,830)		
	Free	Cost-sharing	Cost-sharing as % of Free	Free	Cost-sharing	Cost-sharing as % of Free
Highly effective						
Acute conditions	28.4	19.0	67[a]	32.0	23.1	72[a]
Acute/chronic	16.8	13.3	79[a]	19.4	16.1	83
Chronic	12.6	10.7	85	4.7	2.4	52[a]
Quite effective	23.2	17.6	76[a]	22.4	17.6	79[a]
Less effective	25.0	18.6	74[a]	12.9	9.7	76
Rarely effective	10.5	7.4	70[a]	5.1	3.4	67
Rarely effective but self-care effective	38.8	29.2	75[a]	35.6	23.9	67[a]

[a] Effect of cost-sharing significant at $P < 0.05$.

which the rates did not differ significantly by plan. This is consistent with the disease-specific findings reported in Chapter 4.

Care seeking for children was from one-fifth to almost one-half lower with cost-sharing across the seven medical effectiveness categories. For highly effective/acute conditions, the probability of care was 0.32 with free care and 0.23 with cost-sharing (a 28% reduction). For rarely effective but self-care effective, the probabilities were 0.36 and 0.24, respectively (a 33% reduction).

Predicted Probabilities of Use: Poor and Nonpoor Enrollees

As with the diagnosis-specific analyses, we wished to determine whether these effects were similar for the poor and the nonpoor. We restricted the analyses to the two ends of the effectiveness spectrum: medical care highly effective/acute conditions and medical care rarely effective but self-care effective.‡ Both have substantial samples (around one-third of adults and children obtaining care in year 2), and both had significant cost-sharing effects for the average person.

Tables 5.3 and 5.4 present these results, showing the probabilities of care seeking (expressed as percentages) and the cost-sharing rates as a percentage of the free plan rate, for low-income and average- to high-income individuals who are otherwise similar and representative of an average person. Within the two groupings shown, use rates were nearly identical among free care participants in both income groups. For adults (Table 5.3), cost-sharing significantly affected both income groups for both effectiveness categories. It tended to be stronger for poor adults, but not significantly so.

The pattern was different for children (Table 5.4). Cost-sharing significantly decreased care seeking for the rarely effective category for both poor and nonpoor children, and more so for the poor. For highly effective care there was no significant decrease in care seeking among the nonpoor, but there was such a reduction among the poor. Moreover, the nonpoor were significantly different from

‡ Perhaps one-third of the diagnoses in the highly effective/acute conditions grouping were lacerations, contusions, and abrasions, but other prevalent conditions within this grouping included vaginitis and acute bronchitis for adults and nonfungal skin infections, streptococcal sore throat, and acute bronchitis for children. In the rarely effective grouping, the most common conditions among adults were skin rashes and all other skin diseases (i.e., other than infections, acne, etc.), acute URI, and bursitis, fibrositis, and myalgia; for children, acute URI and the skin rashes category comprised more than one-half of the grouping.

TABLE 5.3. Predicted Percentages of Adults With an Episode of Care, by Medical Effectiveness Category, Income, and Plan

Medical Care Effectiveness Category	Poor Adults (N = 1,303)			Nonpoor Adults (N = 2,340)		
	Free	Cost-sharing	Cost-sharing as % of Free	Free	Cost-sharing	Cost-sharing as % of Free
Medical care highly effective for acute conditions[a]	28.4	16.8	59[b]	26.9	19.2	71[b]
Medical care rarely effective, but OTC or self-care effective[c]	38.7	27.2	70[b]	38.8	30.1	78[b]

[a] For example, otitis media, acute bronchitis, vaginitis, lacerations.
[b] Effect of cost-sharing significant at $P < 0.05$.
[c] For example, acute URI, low back pain syndromes, acute sprains and strains.

the poor. Specifically, the probability of at least one episode of highly effective ambulatory care for poor children in cost-sharing plans was 56% of the level for those with free care; this is in marked contrast to the 85% figure for nonpoor children.

Figures 5.1 and 5.2, based on the data in Tables 5.3 and 5.4, illustrate that the free-to-cost-sharing differential is greater for low-income children than for any other group. That is, the downward slope line is steeper (solid lines on the graphs) for that subgroup than for any other. This is especially true for the highly effective/acute conditions category, where the lines for the poor and nonpoor children cross (Fig. 5.1). In that instance, poor children on the free plan had a higher probability of care than did nonpoor children (34% vs. 30%), whereas poor children with cost-sharing had a markedly lower probability than nonpoor (19% vs. 26%). The decrease in care seeking among poor children, for both of these effectiveness categories, was more than 40%.

Discussion

Persons on the cost-sharing plans did not obtain as much care for various ailments and complaints for which medical care may be questionably useful. They also did not get as

TABLE 5.4. Predicted Percentages of Children With an Episode of Care, by Medical Effectiveness Category, Income, and Plan

Medical Care Effectiveness Category	Poor Children (N = 807)			Nonpoor Children (N = 1,023)		
	Free	Cost-sharing	Cost-sharing as % of Free	Free	Cost-sharing	Cost-sharing as % of Free
Medical care highly effective for acute conditions[a]	34.3	19.2	56[b]	30.3	25.8	85
Medical care rarely effective, but OTC or self-care effective[c]	35.3	19.3	54[b]	35.8	27.1	76[b]

[a] For example, otitis media, strep throat, lacerations, fractures.
[b] Effect of cost-sharing significant at $P < 0.05$.
[c] For example, acute URI, noninfectious skin rashes, acute sprains and strains.

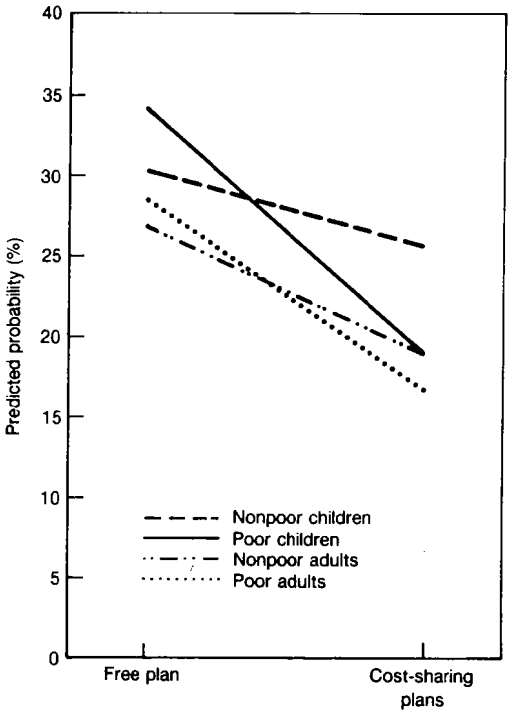

FIG. 5.1. Predicted probabilities of an episode of care for acute conditions for which medical care is considered highly effective.

much treatment for a variety of problems for which medical intervention in general was judged by physicians trained in both clinical medicine and epidemiology to be appropriate and efficacious. On the basis of these results, we can say that cost-sharing did not lead to rates of care seeking that were more "appropriate" from a clinical perspective. That is, cost-sharing did not seem to have a selective effect in prompting people to forego care only or mainly in circumstances when such care probably would be of relatively little value.

Cost-sharing appeared to deter medical encounters across a wide spectrum of complaints and illnesses for which intervention by physicians and other caregivers is variously effective. The one exception to this may be for children who came from families of average to above-average incomes. Cost-sharing did not decrease their use of highly effective care, but it did lower their use of rarely effective care. For poor children, by contrast, as for adults across the income spectrum, cost-sharing seemed to reduce use of highly effective services about as much as rarely effective services. For at least some segments of the population, then, cost-sharing can have some untoward effects in influencing people's choices about when to obtain medical care and when to forego it.

That cost-sharing caused a nonspecific reduction in use is consistent with analyses of antibiotic use.[53] Cost-sharing reduced appropriate use of antimicrobials (e.g., for bacterial infections or other disorders such as acne) as much as it did inappropriate use (e.g., for viral infections such as the common cold). The decreases in both cases were nearly 50%.

This conclusion does not coincide entirely

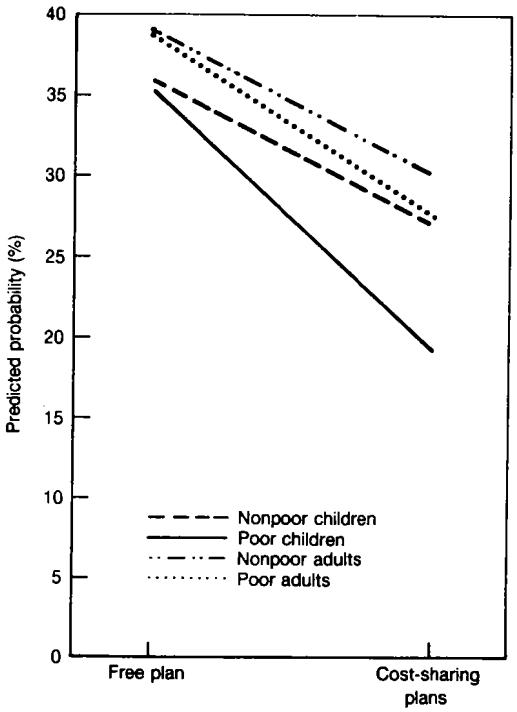

FIG. 5.2. Predicted probabilities of an episode of care for conditions for which medical care is considered rarely effective but self-care is considered effective.

with interpretations about the effects of cost-sharing on emergency room (ER) use.[6] Cost-sharing deterred ER use more if the problems were "less urgent" (e.g., abrasions and contusions, upper respiratory infection, headache) than if they were "more urgent" (e.g., lacerations, urinary tract infection, head injury). The issue in the ER study, however, was the seriousness of the diagnosis and the need for immediate care; this is a different perspective than medical treatment rendered in all ambulatory settings, which usually is not immediate. Further, on the average, patient knowledge about the need for medical care is probably better for many conditions treated in an ER than it is for those treated in a doctor's office.

We are exploring the appropriateness question further in several ways, including investigating the quality of the process of care for several acute and chronic conditions. Quality of care for persons with elevated blood pressure tended to be better on the free plan than on the cost-sharing plans[47]; for instance, a significantly higher percentage of the former had controlled blood pressure and reported following a low-salt diet or stopping smoking, and prescription of medications was more appropriate. Analyses of the quality of care (both process and patient outcomes) for certain other chronic conditions are also underway.

These findings might be questioned on the grounds that these seven diagnostic groupings are too broadly defined. If the groupings are too much alike and do not adequately represent a true clinical spectrum from very effective to ineffective care, then we cannot conclude from these data that the impact of cost-sharing was nonspecific.

Three factors are important in considering the question of the homogeneity of our effectiveness categories. First, if medical care is comparatively ineffective for certain complaints, and if people know that, then we would expect that they would not value the care very much. Thus any clinical errors in assigning diagnoses to groups will promote homogeneity across the groups. Second, even if medical care is highly effective, people may differ in the extent to which they value it. Cost-sharing could have deterred people who found little value in even the relatively certain benefits of such care. Finally, the degree to which persons may actually benefit from care for specific diagnoses within any one effectiveness category also may differ. This, too, works toward homogeneity among the groups.

These three factors—errors in judging clinical effectiveness or in making the diagnosis, varying patient assessments of the value of care, and variation within diagnostic categories—all would tend to reduce the observed differences among them. Even in the face of such homogeneity, however, we could reasonably have expected to observe some differences, if cost-sharing had a strong selective effect in deterring use of ineffective or minimally valued care. Thus we conclude that these results are consistent with the view that cost-sharing had mainly a nonspecific influence on care seeking. Except in nonpoor children, we found no evidence of any specific deterrent effect just on inappropriate use.

If this is true, why did we see no plan effect for most of our health status measures? Surely, decreased use of appropriate care should be reflected in one or another of those measures. There are three possible explanations.

First, the premise may be incorrect; perhaps the three factors cited above did obscure a strong selective effect. We do not find this explanation plausible, but others may differ.

Second, decreases in the use of appropriate care might have produced secondary decrements in health status that were real but that were either too small to detect or would take a longer time to detect. Given the narrowness of the confidence limits for most of the health measures, at least for the average adult and child, and given the lack

of evidence for a cumulative health status effect over the life of the experiment, this explanation is not very satisfactory.

Third, the additional care on the free plan may have had negative as well as positive effects that offset each other when outcomes were analyzed. Persons on the free plan received benefits (in the form of improved health status) from care for conditions in the highly effective category, but they also may have suffered adverse effects of being labeled as sick or disabled when receiving unnecessary medical care for conditions in the rarely effective category. Conversely, those on the cost-sharing plans received fewer benefits of free care but also avoided the potential risks of inappropriate care. The net effect of these two forces may be to produce no or only small positive increments in health. Although this conclusion is clearly somewhat conjectural, we believe it potentially important and thus worthy of further exploration, either with the experimental data or in other settings.

Chapter 6

Use of Selected Drugs and Procedures

This chapter presents the first data from a general population on the use of specific tests, procedures, and drugs over the course of a year. Our findings provide a benchmark, not heretofore available, of the probabilities of annual use of common services and medications against which rates from other studies, insurance plans, or countries might be compared. They also give one indication of the degree to which relatively low-cost, but presumably high-volume, services are or are not responsive to cost-sharing in ways consistent with the findings on ambulatory care episodes.

According to data from the first four HIE sites, aggregate expenditures on drugs varied by insurance plan[54]; as expected, individuals with more generous insurance purchased more pharmaceuticals. As with medical care generally, then, we wished to know whether this effect of cost-sharing would be observed in various classes of medications or only in some medications. In addition, we investigated whether the cost-sharing effects would be observed in various categories of procedures and tests commonly used in treating outpatient problems.

Methods

Drug and Procedure Categories Studied

For drugs, we identified six categories within which 24 specific medications were grouped (Table 6.1): therapies for chronic or specific conditions; tranquilizers, sleeping pills, and antidepressents; pain remedies; gastrointestinal symptomatic agents; agents for infections; and preventive agents.

We classified drugs according to their major application. We also studied some specific drugs: benzodiazepines as a subset of minor tranquilizers; oral penicillin, and amoxicillin or ampicillin, within all penicillins.

These data are based on insurance claims submitted to the HIE; thus they do not include nonprescription medications that may have been purchased over the counter for which a claim could not be (or for convenience was not) filed. All prescription drugs were covered by the HIE insurance plans. Over-the-counter drugs were covered only if they had been prescribed by a physician for a group of specified chronic conditions for which the enrollee had filed at least one claim. Hence our findings for drugs that can be acquired without a prescription do not reflect total use in the HIE population; this is especially true for mild analgesics, antacids, cold remedies, and vitamins.

The drug data do not reflect intensity of use, in the sense of indicating how much, rather than whether, use was made of a given agent. However, other work indicated that dosages and amounts of medications specified per prescription did not differ by insurance plan.[53] Therefore, we infer that this variable—probability of any use—will adequately reflect the impact of cost-sharing on use of medications.

Similarly, we defined seven categories of procedures employed in ambulatory medical care (Table 6.2): common x-rays; less common x-rays or radiologic studies; preventive

TABLE 6.1. Drug Categories Used for Across-diagnosis Analyses

- Therapies for chronic or specific conditions
  - Agents for high blood pressure and various cardiac conditions (water loss and antihypertensives)
    - Diuretics
    - Clonidine and methyldopa (antihypertensives)
    - Beta-blockers
  - Agents for control of diabetes
    - Oral hypoglycemics (sulfonylureas)
    - Insulin
  - Anorexiants
  - Estrogens
- Tranquilizers, sleeping pills, and antidepressants
  - Minor tranquilizers
    - All benzodiazepines as a subset of minor tranquilizers
  - Major tranquilizers
  - Antidepressants
- Pain remedies
  - Mild analgesics
  - Narcotic analgesics
  - Nonsteroidal antiinflammatories
- Gastrointestinal symptomatic agents
  - Antispasmodics (agents that relax muscles of the intestinal wall)
  - Antacids
- Agents for infections
  - Cold remedies
  - Bronchodilators (also used for asthma)
  - All penicillins
    - Oral penicillin
    - Amoxicillin and ampicillin
  - Erythromycins (nontopical only)[a]
  - Tetracyclines (also used for acne)
  - Lincomycin and clindamycin (nontopical only)[a]
- Preventive agents
  - Birth control pills[b]
  - Vitamins
    - Vitamin B_{12}
  - Fluoride-containing products

[a] Nontopical refers to agents not applied to the skin.
[b] Women only.

screening tests; minor skin procedures; standard laboratory tests related to chronic diseases; standard laboratory tests related to either chronic or acute illness; and standard laboratory tests related mainly to acute problems. X-rays of extremities were disaggregated into those of the upper and lower extremities. The subcategory of complete blood count (with differential) is a subset of all hematology tests that include a hemoglobin or hematocrit.

Probability of Any Use

The remainder of this chapter reports on the observed proportions of persons on each plan with at least one use during year 2. "At least one use" is equivalent to at least one insurance claim filed for the drug or procedure in question. The data base for these studies comprised all year 2 claims for outpatient care and for pharmacy purchases

TABLE 6.2. Procedure and Test Categories Used for Across-diagnosis Analyses

- Common x-rays
  - Chest x-rays
  - X-rays of spine and pelvis
  - X-rays of all extremities
    - Upper extremities (wrist, hand, finger)
    - Lower extremities (ankle, foot, toe)
- Less common x-rays or radiologic studies
  - X-rays of the skull and face
  - X-rays of the abdomen
  - Gastrointestinal contrast studies (upper GI series and barium enema)
  - Intravenous pyelogram (IVP) (kidney contrast studies)
  - Gall bladder contrast series
- Preventive screening tests
  - Tuberculosis skin test
  - Pap smears[a]
  - Stool for occult blood (test for undetected blood in the feces)
- Minor skin procedures
  - Destruction of warts
  - Destruction of benign skin lesions
- Standard laboratory tests: chronic disease-related
  - Glucose levels (blood sugar tests)
  - Thyroid function tests
  - Triglyceride levels (tests for blood fats)
- Standard laboratory tests: chronic or acute disease-related
  - Urinalysis
  - All hematocrit and hemoglobin
    - Complete blood count with differential as a subset of any blood work that includes hematocrit and hemoglobin
- Standard laboratory tests: acute disease-related
  - Nose and throat cultures
  - Other cultures
  - Other microbiology (smears and stains)

[a] Women only.

TABLE 6.3. Percentages of Adults With Any Use of Selected Drugs in One Year

Type of Drug	Free Plan (N = 1,255) N	Free Plan (N = 1,255) %	Cost-sharing (N = 2,441) N	Cost-sharing (N = 2,441) %	Cost-sharing as % of Free	*t*-Statistic
Therapies for chronic or specific conditions						
Diuretics	84	6.7	136	5.6	83	1.33
Clonidine and methyldopa	10	0.8	31	1.3	159	−1.40
Beta-blockers	23	1.8	27	1.1	60	1.67
Oral hypoglycemics	9	0.7	18	0.7	103	−0.07
Insulin	11	0.9	12	0.5	56	1.29
Anorexiants	41	3.3	43	1.8	54	2.65
Estrogens	41	3.3	63	2.6	79	1.15
Tranquilizers, sleeping pills, antidepressants						
Minor tranquilizers	108	8.6	146	6.0	70	2.83
All benzodiazepines	99	7.9	133	5.4	69	2.74
Major tranquilizers	20	1.6	26	1.1	67	1.23
Antidepressants	40	3.2	50	2.0	64	1.99
Pain remedies						
Mild analgesics	231	18.4	274	11.2	61	5.67[a]
Narcotic analgesics	132	10.5	135	5.5	53	5.08[a]
Nonsteroidal antiinflammatories	79	6.3	101	4.1	66	2.71
Gastrointestinal symptomatic agents						
Antispasmodics	63	5.0	78	3.2	64	2.56
Antacids	23	1.8	31	1.3	69	1.28
Agents for infections						
Cold remedies	130	10.4	152	6.2	60	4.18[a]
Bronchodilators	35	2.8	34	1.4	50	2.68
All penicillins	183	14.6	210	8.6	59	5.21[a]
Oral penicillin	82	6.5	83	3.4	52	3.98[a]
Amoxicillin and ampicillin	88	7.0	94	3.8	55	3.86[a]
Erythromycins	84	6.7	96	3.9	59	3.42[a]
Tetracyclines	138	11.0	181	7.4	67	3.48[a]
Lincomycin and clindamycin	15	1.2	28	1.1	96	0.13
Preventive agents						
Birth control pills[b]	68	10.3	102	7.7	75	1.95
Vitamins	31	2.5	37	1.5	61	1.90
Vitamin B_{12}	6	0.5	15	0.6	128	−0.54

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

[b] Rates calculated for women only (661 on the free plan and 1,327 on the cost-sharing plan).

across all six sites. All cost-sharing plans are combined and compared with the free plan.

We did separate analyses for all adults, all children, low-income adults, and low-income children. Table 2.1 gave the total numbers of individuals by plan for these analyses. Because interpretations by plan of the unadjusted findings are so consistent with the results of Chapters 4 and 5, we did not carry out any regression analyses of these data.

Results

Effects of Cost-sharing on Use of Drugs

Tables 6.3–6.6 summarize the results of the medications analyses.* The tables show

* If a drug (or, later, procedure) was not used at all on one plan or the other for any age or income group, it is not shown in the table. In every such case the comparison was between zero use on one plan and minimal (e.g., 0.2%) on the other. Zero use was not consistently associated with cost-sharing.

TABLE 6.4. Percentages of Low-income Adults With Any Use of Selected Drugs in One Year

Type of Drug	Free Plan (N = 476) N	Free Plan (N = 476) %	Cost-sharing (N = 846) N	Cost-sharing (N = 846) %	Cost-sharing as % of Free	t-Statistic
Therapies for chronic or specific conditions						
Diuretics	26	5.5	28	3.3	61	1.78
Clonidine and methyldopa	1	0.2	5	0.6	281	−1.13
Beta-blockers	3	0.6	5	0.6	94	0.09
Oral hypoglycemics	4	0.8	9	1.1	127	−0.41
Insulin	4	0.8	6	0.7	84	0.26
Anorexiants	12	2.5	12	1.4	56	0.73
Estrogens	11	2.3	16	1.9	82	1.12
Tranquilizers, sleeping pills, antidepressants						
Minor tranquilizers	33	6.9	41	4.8	70	1.51
All benzodiazepines	28	5.9	34	4.0	68	1.46
Major tranquilizers	6	1.3	9	1.1	84	0.32
Antidepressants	14	2.9	15	1.8	60	1.30
Pain remedies						
Mild analgesics	88	18.5	79	9.3	50	4.48[a]
Narcotic analgesics	51	10.7	43	5.1	47	3.51[a]
Nonsteroidal antiinflammatories	21	4.4	26	3.1	70	1.20
Gastrointestinal symptomatic agents						
Antispasmodics	19	4.0	22	2.6	65	1.32
Antacids	10	2.1	13	1.5	73	0.72
Agents for infections						
Cold remedies	46	9.7	19	2.2	23	5.13[a]
Bronchodilators	10	2.1	13	1.5	73	0.72
All penicillins	58	12.2	55	6.5	53	3.30[a]
Oral penicillin	25	5.2	22	2.6	50	2.29
Amoxicillin and ampicillin	29	6.1	28	3.3	54	2.21
Erythromycins	28	5.9	27	3.2	54	2.18
Tetracyclines	45	9.4	37	4.4	46	3.36[a]
Lincomycin and clindamycin	5	1.1	2	0.2	22	1.64
Preventive agents						
Birth control pills[b]	30	11.5	39	7.8	68	1.70
Vitamins	13	2.7	8	0.9	35	2.18

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

[b] Rates calculated for women only (261 on the free plan, 502 on the cost-sharing plan).

the percentages of persons on the free and cost-sharing plans with at least one use of the medication in question, the ratio of the free plan percentages to the cost-sharing plan percentages (in the column labeled cost-sharing as percent of free),† and the *t*-test of that difference. Disregarding any problem of multiple comparisons, we considered a *t*-statistic of 1.96 or greater ($P < 0.05$, two-tailed test) significant. When a standard Bonferroni correction is applied, a significant *t*-statistic (for $P < 0.10$, two-tailed test) usually must reach 2.81.‡

† These ratios were calculated on raw data, so the values may not correspond exactly to those that would be produced if they were calculated on the rounded percentages given in the tables.

‡ For 24 comparisons, the correction requires a *t*-test of 2.90; for 21 comparisons, the figure is 2.81.

TABLE 6.5. Percentages of Children With Any Use of Selected Drugs in One Year

Type of Drug	Free Plan (N = 626) N	Free Plan (N = 626) %	Cost-sharing (N = 1,232) N	Cost-sharing (N = 1,232) %	Cost-sharing as % of Free	t Statistic
Therapies for chronic or specific conditions						
Diuretics	1	0.2	1	0.1	51	0.44
Insulin	1	0.2	1	0.1	51	0.44
Anorexiants	2	0.3	2	0.2	51	0.62
Tranquilizers, sleeping pills, antidepressants						
Minor tranquilizers	2	0.3	1	0.1	25	0.00
Pain remedies						
Mild analgesics	16	2.6	25	2.0	79	0.70
Narcotic analgesics	9	1.4	11	0.9	62	1.00
Nonsteroidal antiinflammatories	1	0.2	3	0.2	152	−0.39
Gastrointestinal symptomatic agents						
Antispasmodics	8	1.3	14	1.1	89	0.26
Agents for infections						
Cold remedies	103	16.4	111	9.0	55	4.40[a]
Bronchodilators	18	2.9	28	2.3	79	0.76
All penicillins	190	30.4	255	20.7	68	4.45[a]
Oral penicillin	104	16.6	134	10.9	65	3.31[a]
Amoxicillin and ampicillin	109	17.4	132	10.7	62	3.82[a]
Erythromycins	76	12.1	71	5.8	47	4.35[a]
Tetracyclines	14	2.2	16	1.3	58	1.39
Lincomycin and clindamycin	2	0.3	4	0.3	102	−0.02
Preventive agents						
Vitamins	3	0.5	1	0.1	17	1.38
Fluoride-containing products	24	3.8	26	2.1	55	1.98

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

All Adults and Low-income Adults. For virtually every drug studied, cost-sharing produced a lower probability of any use among all adults (Table 6.3). Of the 23 main categories of drugs, the probability of use was higher with cost-sharing for only 2: clonidine and methyldopa (medications for high blood pressure) and oral hypoglycemics (medications for diabetes). None of these differences was significant.

For all adults, the probability of any use was significantly lower on the cost-sharing plans, even after applying the multiple comparisons correction, for the following drug groups: mild analgesics; narcotic analgesics; cold remedies; all penicillins (and oral penicillin only, ampicillin or amoxicillin); erythromycins; and tetracyclines. In addition, differences between the free and cost-sharing plans were at least borderline significant for anorexiants (appetite suppressants), minor tranquilizers (and all benzodiazepines), nonsteroidal antiinflammatories, antispasmodics, and bronchodilators.

For these medications, the proportions of all adults who had at least one drug use on the cost-sharing plans were typically about 50–70% of the proportions on the free plan. That is, use on the free plan was in some cases nearly twice as high as with cost-sharing.

Low-income adults generally had lower rates of use of drugs than did the total population of adults (and, hence, than their

TABLE 6.6. Percentages of Low-income Children With Any Use of Selected Drugs in One Year

Type of Drug	Free Plan (N = 297) N	Free Plan (N = 297) %	Cost-sharing (N = 525) N	Cost-sharing (N = 525) %	Cost-sharing as % of Free	t-Statistic
Pain remedies						
Mild analgesics	8	2.7	7	1.3	50	1.28
Narcotic analgesics	5	1.7	2	0.4	23	1.64
Nonsteroidal antiinflammatories	1	0.3	2	0.4	113	−0.10
Gastrointestinal symptomatic agents						
Antispasmodics	4	1.3	2	0.4	28	1.34
Agents for infections						
Cold remedies	54	18.2	32	6.1	34	4.89[a]
Bronchodilators	9	3.0	7	1.3	44	1.52
All penicillins	88	29.6	74	14.1	48	5.09[a]
Oral penicillin	47	15.8	36	6.9	43	3.76[a]
Amoxicillin and ampicillin	55	18.5	41	7.8	42	4.22[a]
Erythromycins	31	10.4	17	3.2	31	3.72[a]
Tetracyclines	6	2.0	5	1.0	47	1.16
Preventive agents						
Fluoride-containing products	11	3.7	8	1.5	41	1.79

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

higher-income counterparts) on both the free and cost-sharing plans (Table 6.4). (Lower use on the free plan occurred for the same two drug groups as among all adults.) Use was statistically significantly lower with cost-sharing (even with the correction) for mild and narcotic analgesics, cold remedies, all penicillins, and tetracyclines. The differentials for poor adults between the free and the cost-sharing plans were similar to those for all adults (i.e., cost-sharing rates about 50% of free rates); however, the use of cold remedies on the cost-sharing plan was less than 25% of that on the free plan.§

The overall pattern was one in which use of specific therapies for chronic conditions (e.g., for high blood pressure or diabetes) and use of major psychotropic agents (mind-affecting drugs, such as minor tranquilizers and sleeping pills) did not differ by plan. Use of certain preventive agents also did not differ materially by plan. In contrast, drugs employed to treat problems characterized in part by pain and those used for respiratory or other acute infections were significantly more likely to be used by adults on the free plan.

All Children and Low-income Children. Use of many of the drugs included in these analyses was very rare among children, especially all medications for chronic conditions, all psychotropic agents, and several other medications. Only mild analgesics, drugs for acute conditions, and fluoride-containing products were used with any frequency (i.e., by more than about 2% of the sample studied). The proportions on the cost-sharing plans were about 50–70% of those on the free plan (Table 6.5).

Among all children, the probability of any use was significantly lower on the cost-sharing plans only for cold remedies (cost-sharing about 55% of free rates) and the antibiotics common to this age group (cost-sharing

§ Cold remedies are one drug group that can be purchased without a prescription; for such over-the-counter purchases, no claim would be filed. Thus these rates of use will be underestimates, but noncovered purchases would not be likely to make up this differential between the two plans.

about 68% of free for all penicillins and about 47% for erythromycins) (Table 6.5).

The findings were similar but more striking for low-income children (Table 6.6). In particular, there was very little use of therapies for chronic diseases or gastrointestinal symptoms and no use of psychotropic drugs. However, among all the agents for acute infections, the rates of use on the cost-sharing plan were all less than 50% of those in the free plan, and two (cold remedies and erythromycins) were 34% or less. The plan differentials, especially for use of antibiotics, were stronger among the low-income children than among higher-income children. Comparison of data (cost-sharing as a percent of free) in Tables 6.6 with those in Table 6.5 shows all five ratios for antibiotics to be lower for low-income children.

Effects of Cost-sharing on Use of Tests and Procedures

All Adults and Low-income Adults. Tables 6.7 and 6.8 show the percentages of adults with at least one use of a specific test or procedure in year 2. For all adults, the lower probability of use of these services, when faced with cost-sharing, was universal even if not always significant (Table 6.7). Significant plan differences in the use of tests ($P < 0.10$, with multiple comparisons correction) were seen for common x-rays and gastrointestinal contrast studies and for standard laboratory tests for acute or nonspecific chronic conditions. In some cases, such as x-rays of extremities, urinalyses, and hemoglobins, the probabilities of use on the cost-sharing plan were about three-quarters of those on the free plan; in other cases, such as throat and other cultures, the cost-sharing probabilities were just greater than one-half of those on the free plan.

When only low-income adults were studied, probabilities of use were not uniformly lower with cost-sharing (Table 6.8); the 3 exceptions (of 26 comparisons) were relatively uncommon tests or minor procedures. The procedures that showed significantly lower use with cost-sharing (even with the correction) were x-rays of the spine or pelvis (cost-sharing 44% of free), urinalyses and hemoglobins (62% and 67%, respectively), and various cultures (31% for nose and throat cultures). These findings do not confirm that cost-sharing was necessarily more of a deterrent for low-income than for average- to high-income enrollees. However, comparing data on cost-sharing as a percent of free in Tables 6.7 and 6.8, especially for standard laboratory tests used in acute or acute or chronic conditions, points to a larger effect of cost-sharing among the poor.

Use of Pap smears differed between low-income women and all women (and hence between poor and nonpoor). Taking all women together, there was little difference by plan (cost-sharing rate 91% of free rate). By contrast, for only poor women, the 65% differential was significant.

All Children and Low-income Children. Many tests and procedures included in these analyses (i.e., less common radiologic studies or tests for specific chronic diseases) were performed only rarely, if ever, on children (Table 6.9).‖ The most frequent tests or procedures (e.g., those provided to about 10% or more of children) included x-rays of the extremities, tuberculosis (TB) skin tests, urinalyses, hemoglobins, and nose and throat cultures. The probabilities of use among all children (Table 6.9) were significantly lower with cost-sharing for three types of services (x-rays of extremities, urinalyses, hemoglobins). In these three cases, use on the cost-sharing plan was about two-thirds the use on the free plan.

Among only low-income children, the same services were the predominant ones (Table 6.10). With the multiple comparisons correction, only one service—x-rays of extremities, with the upper extremities subset—was significantly lower on the cost-

‖ As with drugs, if a test or procedure was not used on one plan, it is not included in the table. Pap smears are excluded because of the difficulty of defining a sample of girls of appropriate age to use as denominator.

TABLE 6.7. Percentages of Adults With Any Use of Selected Procedures in One Year

Type of Procedure	Free Plan (N = 1,255) N	Free Plan (N = 1,255) %	Cost-sharing (N = 2,441) N	Cost-sharing (N = 2,441) %	Cost-sharing as % of Free	*t*-Statistic
Common x-rays						
Chest	175	13.9	226	9.3	66	4.11[a]
Spine or pelvis	106	8.4	111	4.5	54	4.38[a]
All extremities	125	10.0	175	7.2	72	2.81[a]
Upper extremities	59	4.7	84	3.4	73	1.79
Wrist, hand, finger	37	2.9	47	1.9	65	1.85
Lower extremities	77	6.1	102	4.2	68	2.48
Ankle, foot, toe	46	3.7	70	2.9	78	1.27
Less common x-rays or radiologic studies						
Skull	16	1.3	22	0.9	71	1.01
Abdomen	23	1.8	24	1.0	54	1.98
Gastrointestinal contrast	58	4.6	62	2.5	55	3.09[a]
Intravenous pyelogram	12	1.0	18	0.7	77	0.67
Gall bladder	24	1.9	20	0.8	43	2.56
Preventive screening tests						
Tuberculosis skin test	25	2.0	34	1.4	70	1.30
Pap smears[b]	232	35.1	422	31.8	91	1.48
Stool for occult blood	18	1.4	31	1.3	89	0.41
Minor skin procedures						
Destruction of warts	18	1.4	23	0.9	66	1.27
Destruction of benign skin lesions	12	1.0	22	0.9	94	0.16
Standard laboratory tests: chronic disease-related						
Glucose levels	136	10.8	199	8.2	75	2.59
Thyroid function	90	7.2	135	5.5	77	1.90
Triglyceride levels	95	7.6	146	6.0	79	1.79
Standard laboratory tests: chronic or acute disease-related						
Urinalysis	325	25.9	465	19.0	74	4.66[a]
Hematocrit and hemoglobin	311	24.8	453	18.6	75	4.29[a]
Complete blood count	216	17.2	298	12.2	71	3.99[a]
Standard laboratory tests: acute disease-related						
Nose and throat cultures	72	5.7	75	3.1	54	3.58[a]
Other cultures	92	7.3	103	4.2	58	3.70[a]
Other microbiology	46	3.7	57	2.3	64	2.17

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

[b] Rates for Pap smears calculated for women only (661 on the free plan and 1,327 on the cost-sharing plan).

sharing plans. Use was generally lower among the poor children than among all children (and hence lower than among the nonpoor).

The one major reversal by income concerned the probability of an x-ray of the extremities (both upper and lower), which was markedly higher among poor children on the free plan than among all (or nonpoor) children. In addition, the probability of such x-rays among poor children on the cost-sharing plans was the lowest of all. Specifically, use

TABLE 6.8. Percentages of Low-income Adults With Any Use of Selected Procedures in One Year

Type of Procedure	Free Plan (N = 476) N	Free Plan (N = 476) %	Cost-sharing (N = 846) N	Cost-sharing (N = 846) %	Cost-sharing as % of Free	*t*-Statistic
Common x-rays						
Chest	52	10.9	57	6.7	62	2.51
Spine or pelvis	40	8.4	31	3.7	44	3.32[a]
All extremities	44	9.2	58	6.9	74	1.51
Upper extremities	22	4.6	33	3.9	84	0.62
Wrist, hand, finger	15	3.2	19	2.2	71	0.95
Lower extremities	25	5.2	30	3.5	68	1.42
Ankle, foot, toe	11	2.3	23	2.7	118	−0.46
Less common x-rays or radiologic studies						
Skull	12	2.5	10	1.2	47	1.66
Abdomen	12	2.5	12	1.4	56	1.34
Gastrointestinal contrast	16	3.4	21	2.5	74	0.89
Intravenous pyelogram	3	0.6	3	0.4	56	0.66
Gall bladder	6	1.3	7	0.8	66	0.72
Preventive screening tests						
Tuberculosis skin test	6	1.3	7	0.8	66	0.72
Pap smears[b]	93	35.6	117	23.3	65	3.61[a]
Stool for occult blood	6	1.3	11	1.3	103	−0.06
Minor skin procedures						
Destruction of warts	6	1.3	5	0.6	47	1.16
Destruction of benign skin lesions	2	0.4	4	0.5	112	−0.14
Standard laboratory tests: chronic disease-related						
Glucose levels	38	8.0	53	6.3	78	1.15
Thyroid function	24	5.0	32	3.8	75	1.05
Triglyceride levels	22	4.6	32	3.8	82	0.72
Standard laboratory tests: chronic or acute disease-related						
Urinalysis	117	24.6	129	15.2	62	4.01[a]
Hematocrit and hemoglobin	108	22.7	128	15.1	67	3.31[a]
Complete blood count	67	14.1	73	8.6	61	2.92[a]
Standard laboratory tests: acute disease-related						
Nose and throat cultures	29	6.1	16	1.9	31	3.52[a]
Other cultures	46	9.7	35	4.1	43	3.64[a]
Other microbiology	24	5.0	19	2.2	45	2.49

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

[b] Rates for Pap smears calculated for women only (261 on the free plan and 502 on the cost-sharing plan).

on the free plan was four times higher than use on the cost-sharing plans.

Discussion

Cost-sharing was associated with lower probabilities of use during 1 year for numerous medications and diagnostic tests and procedures. The main utilization measure in this chapter is the probability of at least one use (i.e., at least one insurance claim submitted) for relatively common drugs and services of clinical interest. Our findings suggest that the classes of drugs and procedures with a lower likelihood of use among participants on the cost-sharing plans tended to be those that would appear mainly in di-

TABLE 6.9. Percentages of Children With Any Use of Selected Procedures in One Year

Type of Procedure	Free Plan (N = 626) N	Free Plan (N = 626) %	Cost-sharing (N = 1,232) N	Cost-sharing (N = 1,232) %	Cost-sharing as % of Free	*t*-Statistic
Common x-rays						
Chest	34	5.4	39	3.2	58	2.19
Spine or pelvis	11	1.8	16	1.3	74	0.74
Extremities	64	10.2	77	6.2	61	2.85[a]
Upper extremities	37	5.9	39	3.2	54	2.57
Wrist, hand, finger	20	3.2	25	2.0	64	1.44
Lower extremities	30	4.8	43	3.5	73	1.30
Ankle, foot, toe	17	2.7	28	2.3	84	0.57
Less common x-rays or radiologic studies						
Skull	8	1.3	15	1.2	95	0.11
Abdomen	6	1.0	3	0.2	25	1.73
Gastrointestinal contrast	2	0.3	3	0.2	76	0.29
Intravenous pyelogram	7	1.1	5	0.4	36	1.56
Preventive screening tests						
Tuberculosis skin test	61	9.7	116	9.4	97	0.23
Stool for occult blood	2	0.3	4	0.3	102	−0.02
Minor skin procedures						
Destruction of warts	12	1.9	10	0.8	42	1.82
Destruction of minor skin lesions	5	0.8	5	0.4	51	0.98
Standard laboratory tests: chronic disease-related						
Glucose levels	7	1.1	11	0.9	80	0.45
Thyroid function	4	0.6	3	0.2	38	1.14
Triglycerides	1	0.2	2	0.2	102	−0.01
Standard laboratory tests: chronic or acute disease-related						
Urinalysis	131	20.9	174	14.1	67	3.57[a]
Hematocrit and hemoglobin	119	19.0	154	12.5	66	3.56[a]
Complete blood count	45	7.2	62	5.0	70	1.79
Standard laboratory tests: acute disease-related						
Nose and throat cultures	75	12.0	110	8.9	74	1.99
Other cultures	34	5.4	44	3.6	66	1.77
Other microbiology	2	0.3	6	0.5	152	−0.56

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

agnoses that themselves were seen less often on the cost-sharing plans.

We observed less effect of cost-sharing on the probability of an episode of care for various chronic conditions and less effect on the likelihood of diagnostic or follow-up tests and medications for chronic conditions. Conversely, cost-sharing had a much greater impact on the probability of an episode of care for a variety of acute complaints. These analyses confirm a much lower rate of use of diagnostic procedures and remedies for such problems as respiratory infections or accidental injuries if the patient had to share in the costs of such services. Also, other analyses in Chapter 7 (and see Appendix E of Lohr et al.[103]) indicate that once individuals made contact with the medical care system (i.e., had at least one episode of care for a given diagnosis) the "size" of the episode, in terms of per-episode rates of use of visits, tests, and medications, did not differ by plan.

TABLE 6.10. Percentages of Low-income Children With Any Use of Selected Procedures in One Year

Type of Procedure	Free Plan (N = 297) N	Free Plan (N = 297) %	Cost-sharing (N = 525) N	Cost-sharing (N = 525) %	Cost-sharing as % of Free	*t*-Statistic
Common x-rays						
Chest	17	5.7	15	2.9	50	1.87
Spine or pelvis	4	1.3	6	1.1	85	0.25
All extremities	38	12.8	17	3.2	25	4.58[a]
Upper extremities	22	7.4	8	1.5	21	3.65[a]
Wrist, hand, finger	13	4.4	7	1.3	30	2.36
Lower extremities	18	6.1	10	1.9	31	2.76
Ankle, foot, toe	8	2.7	8	1.5	57	1.08
Less common x-rays or radiologic studies						
Skull	3	1.0	6	1.1	113	−0.18
Gastrointestinal contrast	2	0.7	1	0.2	28	0.94
Preventive screening tests						
Tuberculosis skin test	23	7.7	25	4.8	61	1.65
Stool for occult blood	1	0.3	3	0.6	170	−0.50
Minor skin procedures						
Destruction of warts	3	1.0	1	0.2	19	1.34
Destruction of benign skin lesions	3	1.0	2	0.4	38	0.98
Standard laboratory tests: chronic disease-related						
Glucose levels	2	0.7	5	1.0	141	−0.44
Thyroid function	1	0.3	1	0.2	57	0.38
Standard laboratory tests: chronic or acute disease-related						
Urinalysis	40	13.5	43	8.2	61	2.28
Hematocrit and hemoglobin	40	13.5	48	9.1	68	1.84
Complete blood count	20	6.7	23	4.4	65	1.38
Standard laboratory tests: acute disease-related						
Nose and throat cultures	32	10.8	31	5.9	55	2.35
Other cultures	15	5.1	14	2.7	53	1.64
Other microbiology	1	0.3	4	0.8	226	−0.84

[a] Differences between free and cost-sharing plans significant at $P < 0.10$, two-tailed test, with multiple comparisons correction.

Therefore, we infer that the use of drugs and procedures did not differ materially between the free and cost-sharing plans, once an enrollee had accessed the medical system. What did differ was the likelihood of "being exposed" to certain types of services, because the underlying rates of obtaining *any care at all* for certain diagnoses differed significantly between the free and cost-sharing plans.

We did not directly analyze probabilities of use for average- to high-income individuals, but we can venture some generalizations about the overall effects of income based on comparisons between findings for low-income persons and all individuals. Being poor had the expected effect of decreasing the likelihood of use of most medications and procedures studied, for both the free and cost-sharing plans.

The findings relating to x-rays of the extremities provide an interesting exception to this generalization about income, especially for children, even as they underscore the argument that the effect of cost-sharing is to

deter obtaining care at all, and not to influence the amount of care once at least one contact has been made with the medical system. Chapter 4 showed that the highest probability of an episode of care for lacerations, contusions, and abrasions and for other injuries was observed for poor children on the free plan; the lowest probability was for poor children on the cost-sharing plan. (Figures for average- to high-income children were intermediate.) Here we see that the highest rates of x-rays of the extremities (both upper and lower) occurred among poor children with free care and the lowest rates among poor children with cost-sharing. The parallel with the effect on the probability of any contact is striking.

More extensive analyses on the use of antibiotics[53] corroborate the simpler findings reported here: even when controlling for age, sex, geographic location (HIE site), health status, and income, persons with more generous insurance used about 85% more antibiotics per capita per year than people who shared in the costs of their medical care. Further, the distribution of classes of antibiotics (e.g., penicillins vs. tetracyclines vs. cephalosporins) did not differ by plan, suggesting that cost-sharing did not deter the use of any particular type of antimicrobials (e.g., more powerful, more broad-spectrum, or more expensive drugs).

Summary

Cost-sharing reduced the use of selected tests and drugs, principally by deterring participants from seeking any care for a wide variety of specific conditions. That is, it did not seem to reduce the use of these diagnostic services or medications independent of the reductions it brought in rates of entire episodes of care.

Nevertheless, cost-sharing did lower exposure to tests, procedures, and drugs by as much as 50%. The appropriateness of such reductions is unknown. We cannot say whether, for example, adverse drug reactions from unnecessary medications were prevented, or whether, for example, needed preventive tests were forestalled. Both positive and negative outcomes may well be attributable to these cost-sharing effects.

Chapter 7

Disease Profiles and Patterns of Care

The disease-specific analyses on probability of care seeking led directly to separate studies of the use of specific types of services for particular diagnostic groups. In these studies, we describe clinical patterns of care. These disease profiles represent the first broad picture, across many chronic and acute problems or reasons for seeking care, of the average per-episode use of services in a general adult and pediatric population.

There is little information on the content of diagnosis-specific episodes of care. The National Ambulatory Medical Care Survey (NAMCS) released data on visits (not episodes) for diseases of the circulatory system,[55] the respiratory system,[56] and several conditions more properly classified as symptoms (cough, headache, and pain).[57–59] Although several NAMCS summaries contain data on the percentage distribution of office visits by specific symptoms and diagnoses, information on the content of visits is aggregated across conditions.[60–62] Further, commentaries on some HIE findings concerning insurance plan and health status noted specifically that more information was needed on the "actual content of care provided."[63,64]

The importance of considering specific diagnoses is highlighted by the sometimes expressed belief that it is the little-ticket items used in common illnesses that account for much of the growth in annual medical expenditures, rather than the few big, highly visible technologies.[65] This point is raised more often with respect to inpatient than to outpatient care, and even this conventional wisdom has recently been challenged with regard to hospital care.[66] The question remains as to the rates of use of, for example, routine tests or discretionary services or medications in the ordinary practice of ambulatory medicine.

In addition to the question of utilization (annual rates of use), the companion subject of quality (diagnosis-specific types of services) holds interest. Although more detailed analyses of the quality of care for specific chronic and acute conditions are underway, we can begin to address generic quality-of-care issues related to the "process" of medical care with the data presented here. Thus some of the commentary about these descriptive disease profiles is from the clinical quality-of-care perspective; further descriptions of commonly accepted diagnostic and therapeutic modalities for many of these conditions can be found in the respective volumes of the HIE series on measuring physiologic health status.[42,43]

Methods

We focused on the 24 conditions for adults and 10 conditions for children listed in Table 7.1. Persons interested in specific conditions can locate the relevant tables by reference to columns 3 or 6 of Table 7.1.

The diagnostic groups were chosen from the total of 150 disease groupings defined at the outset of these analyses, and they overlap the diagnostic categories reported in earlier chapters. The basic selection criteria were that the conditions be of clinical interest,

TABLE 7.1. Number of Episodes and Persons Receiving Diagnosis for Diagnostic Categories in Disease Profiles Analyses

Condition	Adults (N = 3,696)			Children (N = 1,858)		
	No. of Episodes	No. of Persons	Table No.	No. of Episodes	No. of Persons	Table No.
Chronic conditions						
Hypertension[a]	266	266	7.3	[b]	[b]	[b]
Diabetes[a]	88	88	7.4	[b]	[b]	[b]
Obesity[a]	105	105	7.5	[b]	[b]	[b]
Acne[a]	71	71	7.6	[b]	[b]	[b]
Degenerative joint disease	95	95	7.7	[b]	[b]	[b]
Either acute acute or chronic						
Ulcer and nonulcer peptic disease	92	80	7.8	[b]	[b]	[b]
Anxiety neurosis	117	108	7.9	[b]	[b]	[b]
Depressive neurosis	115	109	7.10	[b]	[b]	[b]
Hay fever	118	113	7.11	92	85	7.12
Skin rashes and other skin diseases[c]	469	409	7.13	184	164	7.14
Low back pain diseases and syndromes	154	139	7.26	[b]	[b]	[b]
Headaches	150	128	7.15	[b]	[b]	[b]
Urinary tract infection	158	148	7.16	[b]	[b]	[b]
Bursitis and fibrositis	235	208	7.27	[b]	[b]	[b]
Acute condition						
Vaginitis or cervicitis	226	182	7.17	[b]	[b]	[b]
Influenza (viral)	98	92	7.18	[b]	[b]	[b]
Acute upper respiratory infection (URI)	259	223	7.19	304	224	7.20
Acute pharyngitis or tonsillitis	220	201	7.21	282	221	7.22
Acute bronchitis	144	133	7.23	79	66	7.24
Otitis media[d]	[b]	[b]	[b]	401	294	7.25
Acute sprains and strains	164	145	7.28	57	54	7.29
Lacerations, contusions, and abrasions	329	291	7.30	242	212	7.31
Preventive care						
Vision examinations and refractions	721	721	7.32	220	220	7.33
General medical examinations	534	532	7.34	589	588	7.35
Gynecologic examinations	232	232	7.36	[b]	[b]	[b]

[a] These conditions had been designated a priori as chronic and the episode lasted the entire year.
[b] The condition had few or no episodes in this age group.
[c] Excludes dermatophytoses and nonfungal infections.
[d] Includes acute otitis media and otitis media not otherwise specified; excludes chronic (serous) otitis media.

especially to primary care practitioners, have sufficient prevalence to warrant this content analysis, and represent the spectrum from chronic to acute to preventive/well care diagnostic categories.

We defined four major categories of services: visits, procedures, purchased drugs, injected drugs. After compiling the diagnosis-specific profiles, three physicians* individually reviewed the elements within each

* Robert H. Brook, MD, and George A. Goldberg, MD, took the lead in this effort. In addition, Frank A. Sonnenberg, MD, now at Tufts–New England Medical Center, Boston, made a separate review of all profiles and documented all exclusions.

major category of services (except visits) and eliminated those judged to be totally irrelevant to the condition being observed (e.g., birth control pills linked to a visit for influenza).† They then selected specific drugs or procedures to highlight, based on their implicit judgments about clinical interest and significance. In most cases, this selection was made because they expected the drug or procedure to appear in the episode (e.g., antimicrobials for urinary tract infections), but sometimes elements were chosen to illustrate their low prevalence or the unexpected appearance of elements considered of dubious quality of care (e.g., injected vitamins for truly hypertensive patients).

For the major service categories and the highlighted elements, we calculated the diagnosis-specific per-episode rate of use. In the tables, a single line (in brackets) gives the total number of visits, procedures, and purchased or injected drugs; sums of the highlighted items do not necessarily equal these totals. For two conditions (vaginitis or cervicitis and gynecologic examination), the data are for women only.

Results

Episode Size or Intensity of Care

From earlier analyses at a somewhat more global level,[3] we knew that episode size—the per-episode rates of visits, of all procedures combined, of purchased drugs, and of injected drugs—did not differ between the free and cost-sharing plans in any material way. Our analyses at the level of individual diagnoses confirmed those previous findings. Details can be found in Appendix E of Lohr et al.[103]

Of 278 comparisons of diagnosis-specific per-episode rates of office visits, procedures, oral (prescription filled) drugs, and injected drugs, only 12 were different between the free and cost-sharing plans, at a significance level of $P < 0.05$. Most had t-statistic values less than 3.0; had an appropriate multiple comparisons correction been applied, all but one or two of these "significant" differences would have been rendered insignificant. Further, of the 12 ostensibly significant differences, 5 showed higher rates on the cost-sharing plans. Six of the 12 differences were observed among low-income children; of those 6, 4 had higher per-episode rates of services on the cost-sharing plans. In short, episode size did not differ by plan in any meaningful way.

The next section briefly summarizes the overall patterns of care for adults and for children. Following that, we comment on the individual disease-specific tables. If we studied the same condition among both adults and children, we discuss the patterns of care for both age groups together. In all cases, data are aggregated across plans.

Overall Patterns of Care for Adults

For adults, the fewest number of visits per episode of care (about one per episode) occurred for self-limited conditions, such as respiratory conditions (e.g., influenza, pharyngitis, acute upper respiratory infections [URI]) and conditions likely to result from minor accidents (e.g., lacerations, sprains). Similarly, the preventive or well care examinations, not surprisingly, averaged only about one visit per episode.

Ailments that imply pain severe enough to seek medical care, such as headaches or peptic ulcer disease, averaged about two visits per episode. Chronic conditions (e.g., diabetes, hypertension, acne), for which an episode constituted an entire year, had between two and three visits per year. The most visits, about five to seven per episode, were for psychiatric illnesses (anxiety neurosis, depressive neurosis), obesity, and hay fever, although the nature of these visits differed considerably.

† These often appeared to be errors arising from computer algorithms that linked services to visits to diagnoses. They occurred infrequently (fewer than 0.5% of all procedures needed to be excluded from the profiles for these reasons).

TABLE 7.2. Summary of Per-episode Rates of Services for Selected Conditions in One Year, for Adults and Children Separately

	Rates per Episode					
	Visits		Procedures		Purchased Drugs	
Diagnostic Category	Adults	Children	Adults	Children	Adults	Children
Hay fever	5.3	4.5	1.2	1.1	2.9 [4.1]	2.3 [3.4]
Skin rashes	1.9	1.5	0.6	0.3	1.5	1.0
Acute URI	1.1	1.1	0.4	0.3	1.9	1.2
Pharyngitis	1.0	1.0	0.7	0.6	1.1	1.2
Acute bronchitis	1.1	1.2	0.9	0.4	1.8	2.1
Acute strains and sprains	1.2	0.9	1.1	1.0	0.4	[a]
Lacerations	1.1	1.3	0.6	0.6	0.4	0.2
Vision examination	1.0	1.0	[a]	[a]	0.8[b]	0.6[b]
General medical examination	1.0	1.2	2.1	1.0	0.4 [0.2]	0.2 [0.8]

Note: Rates of injected drugs shown in brackets.
[a] The rate was less than 0.05.
[b] For vision impairment, this refers to supplies (lenses, frames).

The smallest numbers of procedures and drugs (fewer than one per episode) were for self-limited conditions, such as influenza, acute URI, and lacerations. The largest number of procedures was done for episodes of diabetes (3.6 per episode) and low back pain (3.4 per episode). (Procedures in low back pain include visits for manipulation and physical medicine.)

As might be expected, the largest number of drugs was purchased for disorders that require maintenance medications (diabetes, hypertension, acne, and depression). Only one condition (hay fever) had a substantial number of injections per episode (mostly allergy antigens).

Overall Patterns of Care for Children

For children, hay fever was the only condition with a sizable number of visits per episode (about 4.5, compared with about 5.3 for adults). Otitis media (middle ear infection, either acute or unspecified as to acute or chronic) prompted about 1.4 visits per episode, as did skin rashes. Most other diagnostic categories had only about one visit per episode.

Per-episode rates of procedures were highest for children with hay fever and with acute strains and sprains (about one per episode). Procedure rates were also about one per episode for general medical examinations.

Only acute bronchitis and hay fever had much more than one purchased drug per episode. Antibiotics appeared in about 60% of episodes of acute URI (the "common cold") and in 90% of episodes of otitis media. As with adults, only hay fever had an appreciable number of injectable drugs (mainly allergy antigens).

Patterns of Care for Adults and Children

We considered several diagnostic groups in both adults and children (Table 7.2). By and large, adult episodes were slightly "larger" than children's, in the sense that per-episode rates of services tended to be slightly higher. In examining only acute conditions, such as the respiratory infections, we observed patterns of relatively low use of procedures (e.g., blood work and bacterial cultures) and of x-rays—commonly in fewer than 25% of episodes. One inference is that

the little-ticket elements of a diagnostic workup for some of these problems (e.g., pharyngitis or acute bronchitis) were not being overprovided. The use of drugs (many of which were antibiotics) was much higher, however, particularly in a context in which the cause of these problems is viral, not bacterial.

Disease-specific Profiles of Care

Tables 7.3 through 7.7 concern conditions that were defined as chronic for these profiles. Episodes thus lasted a year, so average per-episode rates are equivalent to average per-person rates. All services and medications given for the diagnoses were counted; no attempt was made to distinguish routine chronic care from care for flareups. For medications, the counts and rates of medications usage are only an approximation of the relative use of the various agents, because there is no reason to believe that all prescriptions for all the different medications covered the same intervals of time.

Hypertension (Table 7.3). The visit rate for hypertension was nearly three per year. Relatively few numbers of procedures were used in the management of high blood pressure. For instance, only about one-quarter of all year-long episodes included an electrocardiogram, which seems appropriate since there is no demonstrated reason for individuals with high blood pressure to receive this test routinely each year. Similarly, the rate of use of chest x-rays (in only 15% of episodes) does not seem excessive. About one blood chemistry test was done per episode per year. The rates of use of urinalyses and cell counts may appear high (in more than one-quarter of all episodes), given that there is no strong medical indication for performing either test to monitor a hypertensive patient; some of this use, however, was undoubtedly related to routine well care, for which urinalyses and cell counts are common.

TABLE 7.3. Number and Per-episode Rates of Services and Drugs in Episodes of Hypertension: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 266)[a]
Visits	[758]	[2.85]
Procedures	[610]	[2.29]
Electrocardiograms	72	0.27
Chest x-rays	39	0.15
Urinalyses	79	0.30
Cholesterol and lipid tests	102	0.38
Noncholesterol blood chemistries	186	0.70
Cell counts	73	0.27
Injected drugs	[35]	[0.13]
Diuretics	17	0.06
Vasodilators	1	<0.01
Vitamins	17	0.06
Purchased drugs	[1,520]	[5.71]
Beta blockers	110	0.41
Diuretics	706	2.65
Clonidine/ methyldopa	233	0.88
Reserpine	189	0.71
Vasodilators	66	0.25
Other antihypertensive agents	14	0.05
Potassium	100	0.38
Psychotropic drugs	97	0.36

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

[a] The per-episode rate is also the per-person annual rate.

The most commonly prescribed drug class was diuretics. Potassium prescriptions (used to counteract the potassium-loss effect of diuretics) were given only about one-seventh as often as diuretics; some may consider this a bit low, although the average size of the potassium prescription (in terms of days covered) may be greater than that for diuretics. During the period covered by this analysis (1976–1980), reserpine, clonidine, and methyldopa appeared to be used more commonly for this diagnosis than were beta blockers; the latter were only coming into widespread use as antihypertensive agents.

TABLE 7.4. Number and Per-episode Rates of Services and Drugs in Episodes of Diabetes: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 88)[a]
Visits	[208]	[2.36]
Procedures	[315]	[3.58]
Vision services	7	0.08
Electrocardiograms	8	0.09
Chest x-rays	6	0.07
Urinalyses	37	0.42
Glucose tests	204	2.32
Nonglucose chemistry	30	0.34
Cell counts	15	0.17
Injected drugs	[17]	[0.19]
Insulin	2	0.02
Purchased drugs	[385]	[4.38]
Sulfonylureas	154	1.75
Insulin	206	2.34

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

[a] The per-episode rate is also the per-person annual rate.

Psychotropic drugs, especially minor tranquilizers, were used frequently to treat high blood pressure. This seemed surprising in view of the lack of documented benefit of these medications for this condition. Very few injected drugs were used; however, the rate of injected vitamins was higher than it should be, again given the lack of any documented benefit of vitamins in hypertension.

Diabetes (Table 7.4). The per-episode rates of visits and glucose (blood sugar) tests were nearly identical for diabetes (2.3 per person), suggesting that diabetics were seen and tested a little more than once every 6 months, on the average. Rates of use of electrocardiograms, chest x-rays, and blood cell counts were low (per-episode rates of 0.07–0.17); physicians apparently restricted their use of nonspecific tests for these patients. The rate of vision services, considered important in monitoring the effects of diabetes on the eyes, was low; however, some providers rendering these services may have billed for routine examinations rather than recording on an insurance claim that the patient was being followed for possible complications of diabetes.

The rates of prescription for oral antidiabetic medications and insulin suggest that patients were probably receiving long-term prescriptions, which is reasonable. The rate of insulin injected at the time of a visit to the physician was very low, appropriately so because such treatment should rarely be needed during a routine visit.

Obesity (Table 7.5). On the average, patients seen for obesity were seen more often than those with either hypertension or diabetes, nearly four times per year. Virtually no formal psychiatric services were provided explicitly for this problem. By contrast, more than one-quarter of all episodes involved

TABLE 7.5. Number and Per-episode Rates of Services and Drugs in Episodes of Obesity: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 105)[a]
Visits	[415]	[3.95]
Procedures	[147]	[1.40]
Formal psychiatric services	5	0.05
Electrocardiograms	11	0.10
Urinalyses	31	0.30
Thyroid blood tests	28	0.27
Cell counts	21	0.20
Injected drugs	[111]	[1.06]
Vitamins	107	1.02
Anorexiants	3	0.03
Purchased drugs	[317]	[3.02]
Anorexiants	192	1.83
Diuretics	56	0.53
Anxiolytics	27	0.26
Thyroid hormone	35	0.33

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

[a] The per-episode rate is also the per-person annual rate.

thyroid blood tests, and urinalyses and routine blood cell counts were relatively frequent. Some overutilization may be present here, because the latter two tests bear no relationship to the cause or treatment of obesity, and a thyroid test generally needs to be obtained only once for any obese individual. The use of injected vitamins was very high, particularly because they have no known benefit in obesity. Other drugs of questionable efficacy in obesity, such as thyroid hormones and diuretics (which not only lower elevated blood pressure but also promote fluid loss), also were used with some frequency; however, the most commonly used drug therapy for obesity was anorexiants (appetite suppressants).

Acne (Table 7.6). Individuals 14 years of age and older were seen for acne, on the average, about once every 4 months. About one-half of the episodes included the use of ultraviolet light and other dermatologic therapies. The medications used appeared to be quite appropriate, divided mainly between nonantimicrobial, nonsteroidal topical agents (applied to the skin) and antibiotics (mainly tetracyclines): more than one prescription each per episode. Nearly one-half of the acne episodes also received a prescription for topical steroids.

TABLE 7.6. Number and Per-episode Rates of Services and Drugs in Episodes of Acne: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 71)[a]
Visits	[211]	[2.97]
Procedures	[42]	[0.59]
Ultraviolet and other dermatologic therapy	37	0.52
Cell counts	2	0.03
Injected drugs	[13]	[0.18]
Steroids	7	0.10
Purchased drugs	[364]	[5.13]
Dermatologic, topical agents[b]	151	2.13
Tetracyclines	125	1.76
Erythromycins	38	0.53
All other antimicrobials	10	0.14
Steroids	32	0.45

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

[a] The per-episode rate is also the per-person annual rate.

[b] About one-half of this category is nonantimicrobial, nonsteroidal agents.

TABLE 7.7. Number and Per-episode Rates of Services and Drugs in Episodes of Degenerative Joint Disease: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 95)[a]
Visits	[163]	[1.72]
Procedures	[225]	[2.37]
Manipulation	18	0.19
Physical medicine visits	16	0.17
X-rays of spine/pelvis	19	0.20
X-rays of extremities	29	0.30
Urinalyses	45	0.47
Cell counts	24	0.25
Sedimentation rate	12	0.13
Tests for rheumatoid factor, latex fixation, antinuclear antibodies	16	0.17
Remaining immunology tests	11	0.12
Injected drugs	[42]	[0.44]
Steroids	15	0.16
Gold compounds	20	0.21
Purchased drugs	[307]	[3.23]
Mild analgesics and antiinflammatory drugs	280	2.95
Muscle relaxants	23	0.24
Anxiolytics	1	0.01

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

Does not include rheumatoid arthritis.

[a] The per-episode rate is also the per-person annual rate.

Degenerative Joint Disease (Table 7.7). Pa-

TABLE 7.8. Number and Per-episode Rates of Services and Drugs in Episodes of Peptic Diseases: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 92)
Visits	[157]	[1.71]
Procedures	[129]	[1.40]
X-rays of upper GI tract	33	0.36
Barium enema	1	0.01
Cholecystography	9	0.10
X-rays of urinary tract	5	0.05
Urinalysis	14	0.15
Cell counts	23	0.25
Purchased drugs	[274]	[2.98]
Analgesics with salicylates or nonsteroidal antiinflammatory agents	11	0.12
Psychotropic agents	21	0.23
Antispasmodics	83	0.90
Antacids	122	1.33
Cimetidine	6	0.06
Antiemetics	24	0.26

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.
Includes ulcer and non-ulcer peptic disease.

tients with degenerative joint disease (mainly "typical" arthritis) had about 1.7 visits per episode; 20–30% of episodes involved x-rays (of the spine or extremities), and almost 50% included urinalyses. The latter may be related to the high rates of injected gold (probably for only a few patients), because physicians routinely check for protein in the urine when gold injections are used. Because this diagnostic group was solely degenerative joint diseases (i.e., it excludes rheumatoid arthritis), the use of gold compound injections at all is suspect. The purchased drugs included mainly mild analgesics (against pain) and antiinflammatory agents (against inflammation)—nearly three per episode per year—and this seems very appropriate.

Ulcer and Nonulcer Peptic Disease (Table 7.8). Persons seen for peptic disorders averaged about 1.7 visits per episode. The rates of use of the numerous different procedures for this diagnosis all seem medically reasonable and totaled about 1.4 per episode. The blood counts presumably were used to monitor for possible bleeding within the gastrointestinal tract.

Use of analgesics with salicylates or nonsteriodal antiinflammatory agents was appropriately low (because these drugs can initiate peptic disease and increase the likelihood of bleeding); some may believe it was not low enough, but there are no benchmark standards. Use of antiemetics (agents against vomiting) to this degree is questionable. Use of cimetidine, which decreases acid production from the stomach, was low because it was coming into general use only around this period, having been granted Food and Drug

TABLE 7.9. Number and Per-episode Rates of Services and Drugs in Episodes of Anxiety Neurosis: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 117)
Visits and psychiatric therapy	[658]	[5.62]
Office visits	109	0.93
Individual therapy	412	3.52
Group/family therapy	96	0.82
Other formal psychiatric services	41	0.35
Procedures: nonpsychiatric	[34]	[0.29]
Purchased drugs	[360]	[3.08]
Minor tranquilizers	203	1.74
Antihistamines	27	0.23
Hypnotics	49	0.42
Antipsychotics	28	0.24
Antidepressants	48	0.41

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

Administration approval in mid1977. Until that time, antacids were the main accepted form of therapy for the common peptic disorders, as reflected in these data. The evidence for believing that psychotropic agents and antispasmodics are effective therapies is mixed; these rates probably reflect a common wisdom that these drugs may be of some benefit and, at worst, will do no harm.

Anxiety Neurosis and Depressive Neurosis (Tables 7.9 and 7.10). Individual therapy was the modal form of care for both anxiety and depressive neuroses; per-episode visit rates were almost two visits per episode higher for depressive diagnoses (7.5) than for anxiety (5.6).

Minor tranquilizers were by far the major form of drug therapy for anxiety neurosis, being used more than four times as often as hypnotics (sleep-inducers) or antidepressants. In contrast, antidepressants were (as expected) the drug of choice for depressive neuroses, but they were used only about half again as often as antipsychotics and minor tranquilizers. The low use of lithium seems appropriate, as it is indicated only for one specific type of depression.

TABLE 7.10. Number and Per-episode Rates of Services and Drugs in Episodes of Depressive Neurosis: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 115)
Visits and psychiatric therapy	[866]	[7.53]
Office visits	83	0.72
Individual therapy	643	5.59
Group/family therapy	131	1.14
Other formal psychiatric services	9	0.08
Procedures: nonpsychiatric	[43]	[0.37]
Purchased drugs	[469]	[4.08]
Minor tranquilizers	103	0.90
Antihistamines	17	0.15
Hypnotics	31	0.27
Antipsychotics	118	1.03
Antidepressants	171	1.49
Lithium	13	0.11

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

TABLE 7.11. Number and Per-episode Rates of Services and Drugs in Episodes of Hay Fever: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 118)
Visits	[621]	[5.26]
Procedures	[141]	[1.19]
Allergy tests	69	0.58
Lung function tests	9	0.08
Cell counts	12	0.10
Microbiologic cultures, smears, and stains	1	0.01
	5	0.04
Injected drugs	[479]	[4.06]
Allergy antigens	462	3.92
Steroids	13	0.11
Antibiotics	1	0.01
Purchased drugs	[337]	[2.86]
Agents for hay fever symptoms	305	2.58
Steroids	13	0.11
Antibiotics	10	0.08

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

Hay Fever (Tables 7.11 and 7.12). Visits for hay fever appeared to be very common (especially when contrasted with the number of visits for more threatening illnesses among adults such as diabetes), but for the most part they were office visits only for allergy injections. Diagnostic testing was confined largely to allergy tests, with little use of lung function tests or any nose or throat cultures. Children had a lower use of allergy tests than adults but virtually identically low rates of use of other procedures and tests.

The major purchased drugs were agents for hay fever symptoms (about 2.6 per epi-

TABLE 7.12. Number and Per-episode Rates of Services and Drugs in Episodes of Hay Fever: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 92)
Visits	[416]	[4.52]
Procedures	[103]	[1.12]
Allergy tests	31	0.34
Lung function tests	7	0.08
Cell counts	9	0.10
Microbiologic cultures, smears, and stains	5	0.05
Injected drugs	[314]	[3.41]
Allergy antigens	311	3.38
Steroids	3	0.03
Purchased drugs	[210]	[2.28]
Agents for hay fever symptoms	98	1.06
Steroids	8	0.09
Antibiotics	16	0.17

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

sode). There was very little use of steroids or antibiotics in either injectable or oral form, which is appropriate.

Skin Rashes and Other Skin Diseases (Tables 7.13 and 7.14). The intensity of services for skin rashes appeared to be higher for adults than for children: about one-third more visits, half again as many purchased drugs, and twice as many procedures and tests. Use of injectable drugs was very low; the main therapy for these complaints was steroids, mostly topical (applied to the skin).

Headaches (Table 7.15). Use of manipulation and physical medicine traditionally has not been considered effective for the treatment of headache. The high rates of their use (nearly one per episode) are probably explained by a minority of individuals receiving these services frequently. Apart from these services, the visit rate for headache averaged 1.7 per episode. Other diagnostic services, such as x-rays, rarely were used, and this is considered appropriate. The very low rate of computed tomography (CT) scans reflects at least in part that they were not widely available for ambulatory patients when these data were collected.

The per-episode rate of use of all drugs was greater than 2.3, of which about one-fifth were injectable drugs. The types of purchased drugs appear appropriate; mild analgesics were used about three times as often as agents for migraine headaches and anxiolytics (minor tranquilizers). Strong analgesics were prescribed infrequently.

Urinary Tract Infection (Table 7.16). Not surprisingly, the per-episode rate of use of

TABLE 7.13. Number and Per-episode Rates of Services and Drugs in Episodes of Skin Rashes: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 469)
Visits	[902]	[1.92]
Procedures	[301]	[0.64]
Allergy tests	19	0.04
Ultraviolet and other dermatologic therapy	67	0.14
Urinalyses	21	0.04
Multichannel blood tests	11	0.02
Cell counts	24	0.05
Microbiologic cultures, smears, and stains	17	0.04
Pathology	47	0.10
Syphilis tests	11	0.02
Injected drugs	[100]	[0.21]
Steroids	29	0.06
Antihistamines	52	0.11
Purchased drugs	[686]	[1.46]
Steroids	296	0.63
Antihistamines	96	0.20
Antimicrobials	123	0.26
Other dermatologic agents	97	0.21

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

urinalyses (1.2) nearly matched the rate of visits for urinary tract infection (1.4). By contrast, the rate of urine cultures (to prove an infection and identify the causative organism) was rather low (0.4 per episode). Quality-of-care criteria for urinary tract infection often specify that a follow-up urine culture or urinalysis be performed for everyone with this diagnosis; in that light, the rates shown here would be thought low, but the criterion also can be questioned. Therapy was mainly antimicrobials, chiefly sulfonamides, and, among antibiotics, tetracyclines. The use of urinary tract analgesics (pyridium) was low.

Vaginitis or Cervicitis (Table 7.17). Diagnosis and treatment for these conditions yielded relatively low-intensity episodes of care. The per-episode visit rate was 1.4. The level of prescribed medications, about one

TABLE 7.14. Number and Per-episode Rates of Services and Drugs in Episodes of Skin Rashes: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 184)
Visits	[280]	[1.52]
Procedures	[56]	[0.30]
Allergy tests	7	0.04
Urinalyses	10	0.05
Multichannel blood tests	1	0.01
Cell counts	11	0.06
Microbiologic cultures, smears, and stains	4	0.02
Pathology	3	0.02
Injected drugs	[11]	[0.06]
Steroids	4	0.02
Antihistamines	2	0.01
Purchased drugs	[176]	[0.96]
Steroids	80	0.43
Antihistamines	35	0.19
Other dermatological agents	37	0.20

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

TABLE 7.15. Number and Per-episode Rates of Services and Drugs in Episodes of Headaches: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 150)
Visits	[255]	[1.70]
Procedures	[233]	[1.55]
Vision services	10	0.07
Manipulation and physical medicine	129	0.86
CT scans	1	0.01
X-rays of sinus	5	0.03
X-rays of skull	12	0.08
X-rays of cervix	7	0.05
Cell counts	19	0.13
Injected drugs	[67]	[0.45]
Anxiolytics	17	0.11
Analgesics	18	0.12
Antiemeties	19	0.13
Vitamins	8	0.05
Purchased drugs	[280]	[1.87]
Mild analgesics and antiinflammatory drugs	147	0.98
Strong analgesics	6	0.04
Agents for migraine headaches	53	0.35
Anxiolytics	47	0.31
Antidepressants	12	0.08
Vitamins	5	0.03

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

per episode, suggests that this condition was not being overtreated. The "spread" of therapies (antibiotics, topical sulfa drugs, antifungal agents, and antitrichimonal agents), none with high per-episode rates, implies that different causes of these diseases were being treated. However, the relative lack of diagnostic testing (cultures, smears, and stains) makes it difficult to ascertain how a specific therapy might have been selected by the physician.

Influenza (Table 7.18). Episodes of influenza (both respiratory and gastrointestinal) typically involved only one visit and relatively low use of diagnostic tests and procedures, such as chest x-rays or bacteriologic

TABLE 7.16. Number and Per-episode Rates of Services and Drugs in Episodes of Urinary Tract Infection: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 158)
Visits	[220]	[1.39]
Procedures	[330]	[2.09]
X-rays of urinary tract	5	0.03
Cell counts	5	0.03
Cultures	64	0.40
Smears and stains	3	0.02
Urinalyses	189	1.20
Injected drugs	[17]	[0.11]
Purchased drugs	[414]	[2.62]
Sulfonamides (oral)	82	0.52
Sulfonamides (topical)	11	0.07
Nitrofurans	34	0.22
Aminoglycosides	22	0.14
Antifungal agents	14	0.09
Penicillins and erythromycins	37	0.23
Amoxicillin and ampicillin	37	0.23
Cephalosporins	19	0.12
Tetracyclines	49	0.31
Lincomycin and clindamycin	7	0.04
All other antimicrobial agents	2	0.01
Pyridium-containing agents	22	0.14

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

cultures. There was substantial use of oral antibiotics (especially tetracyclines) and even of injected antibiotics. This is considered questionable for an ailment that is viral (rather than bacterial) in etiology, therefore unresponsive to antibiotics, and rarely accompanied by a secondary bacterial infection.

Acute Upper Respiratory Infection (Tables 7.19 and 7.20). Episodes of acute URI typically were restricted to a single visit; from one-quarter to one-third of episodes (among children and adults, respectively) involved some diagnostic procedures. Among adults, chest x-rays and nose or throat cultures were used somewhat more frequently than urinalysis or blood cell counts; among children, cultures and cell counts were used more frequently than x-rays or urinalyses.

The rate of use of injectable drugs was very high for adults, given that only under the rarest circumstances can medications appropriate for colds not be given orally. As expected from the literature and from other HIE analyses,[53] use of antibiotics was unacceptably high for what was almost certainly a viral disorder. The antibiotics for adults were split between penicillins or erythromycins and tetracyclines, whereas for children the agents were confined almost solely to penicillins or erythromycins (types of agents appropriate for the younger age group).

Acute Pharyngitis and Tonsillitis (Tables 7.21 and 7.22). The pattern of care for acute

TABLE 7.17. Number and Per-episode Rates of Services and Drugs in Episodes of Vaginitis and Cervicitis: Women, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 226)
Visits	[307]	[1.36]
Procedures	[276]	[1.22]
Urinalyses	51	0.23
Cell counts	14	0.06
Cultures	26	0.12
Smears and stains	70	0.31
Pap smears	90	0.40
Purchased drugs	[242]	[1.07]
Estrogens	8	0.04
Sulfonamides (topical)	43	0.19
Amoxicillin and ampicillin	10	0.04
Tetracyclines	9	0.04
All other antibiotics	3	0.01
Antifungal agents	89	0.39
Antitrichimonal agents	30	0.13

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

pharyngitis ("sore throat") differed somewhat from that for acute URI, although in both cases, and for both adults and children, the mean per-episode rate of visits was just one. Use of some diagnostic procedures (cell counts and, especially, nose and throat cultures) was higher than for acute URI, as expected, because culture results can influence the type of therapy. In one of the few reversals between adults and children, the per-episode use of cultures was slightly higher for the latter (0.44 vs. 0.37 per episode). This seems reasonable, because determining the presence or absence of a streptococcal throat infection (which, when present, must be treated with antibiotics) is probably more important in children.

Use of antibiotics among adults was about the same for pharyngitis and URI (about two-

TABLE 7.18. Number and Per-episode Rates of Services and Drugs in Episodes of Influenza: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 98)
Visits	[103]	[1.05]
Procedures	[58]	[0.59]
Chest x-rays	8	0.08
Urinalyses	11	0.11
Cell counts	14	0.14
Nose and throat cultures	6	0.06
Injected drugs	[26]	[0.26]
Analgesics	1	0.01
Agents for respiratory symptoms	3	0.03
Penicillins	9	0.09
Tetracyclines	4	0.04
Lincomycin and clindamycin	4	0.04
Purchased drugs	[161]	[1.64]
Analgesics	18	0.18
Antitussives	30	0.31
All other agents for respiratory symptoms	25	0.26
Penicillins	11	0.11
Erythromycins	6	0.06
Amoxicillin and ampicillin	9	0.09
Tetracyclines	22	0.22
All other antimicrobial agents	3	0.03
Agents for gastrointestinal symptoms	27	0.28

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

TABLE 7.19. Number and Per-episode Rates of Services and Drugs in Episodes of Upper Respiratory Infection: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 259)
Visits	[274]	[1.06]
Procedures	[96]	[0.37]
Chest x-rays	21	0.08
Urinalyses	13	0.05
Cell counts	13	0.05
Nose and throat cultures	23	0.09
Injected drugs	[78]	[0.30]
Analgesics	1	<0.01
Agents for respiratory symptoms	17	0.07
Antiemetics	2	0.01
Penicillins and erythromycins	28	0.11
Tetracyclines	8	0.03
Lincomycin and clindamycin	15	0.06
All other antibiotics	2	0.01
Purchased drugs	[501]	[1.93]
Analgesics	34	0.13
Antitussives	81	0.31
All other agents for respiratory symptoms	180	0.69
Penicillins and erythromycins	103	0.40
Cephalosporins	7	0.03
Tetracyclines	56	0.22
All other antibiotics	8	0.03
Agents for gastrointestinal symptoms	14	0.05

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

TABLE 7.20. Number and Per-episode Rates of Services and Drugs in Episodes of Acute Upper Respiratory Infection: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 304)
Visits	[333]	[1.10]
Procedures	[81]	[0.27]
Chest x-rays	10	0.03
Urinalyses	10	0.03
Cell counts	21	0.07
Nose and throat cultures	24	0.08
Injected drugs	[20]	[0.07]
Penicillins	16	0.05
Purchased drugs	[353]	[1.16]
Analgesics	6	0.02
Antitussives	30	0.10
All other agents for respiratory symptoms	135	0.44
Penicillins and erythromycins	154	0.51
Cephalosporins	5	0.02
Tetracyclines	9	0.03
All other antibiotics	7	0.02
Agents for gastrointestinal symptoms	2	0.01

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

thirds of episodes receiving an antibiotic), but for pharyngitis more reliance was placed on penicillins and erythromycins. For children, nearly 9 in 10 episodes of pharyngitis received antibiotics, meaning that perhaps as many as one-half of the episodes treated with antibiotics did not have a confirmatory throat culture. The rate of injected drugs for adults is high; the rate of injected lincomycin and clindamycin, in particular, was excessive.‡

Acute Bronchitis (Tables 7.23 and 7.24). The per-episode visit rates for acute bronchitis for both adults and children were between 1.1 and 1.2, suggesting a relatively low rate of return visits. Many quality-of-care criteria sets or standards suggest that a return visit is appropriate for this condition. Chest x-rays, presumably to be sure that pneumonia was not present, were used much more frequently among adults than among children (0.31 vs. 0.08 per-episode rates); use of almost all other diagnostic procedures was quite low, especially for children. As with the other acute respiratory problems, use of antibiotics was widespread (0.84 and 1.08 purchases per episode for adults and children, respectively). As with pharyngitis, the rate of injected drugs seemed high, because

TABLE 7.21. Number and Per-episode Rates of Services and Drugs in Episodes of Acute Pharyngitis: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 220)
Visits	[230]	[1.04]
Procedures	[150]	[0.68]
Chest x-rays	6	0.03
Urinalyses	4	0.02
Cell counts	25	0.11
Nose and throat cultures	82	0.37
Injected drugs	[53]	[0.24]
Analgesics and other agents for respiratory symptoms	6	0.03
Penicillins and erythromycins	14	0.06
Tetracyclines	13	0.06
Lincomycin and clindamycin	17	0.08
Purchased drugs	[246]	[1.12]
Analgesics	18	0.08
Antitussives	17	0.08
All other agents for respiratory symptoms	56	0.25
Penicillins and erythromycins	114	0.52
Cephalosporins	3	0.01
Tetracyclines	29	0.13

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

‡ Some experts take the position that clindamycin (a semisynthetic derivative of lincomycin) is contraindicated in office practice[67]; in any case, its use should be reserved for selected, serious infections.

drugs taken by mouth are commonly recognized as efficacious.

Otitis Media (Table 7.25). We studied otitis media (infections of the middle ear either specified as acute or "not otherwise specified") only in children. The per-episode visit rate was 1.4. This implies that fewer than one-half of the episodes involved a follow-up visit to determine whether the problem had resolved satisfactorily, yet many criteria sets specify a return visit as an integral part of good quality care. Relatively few episodes involved diagnostic tests, including audiometry. The per-episode rate of antibiotic use was only about 0.85, for a condition for which antimicrobial agents are almost universally expected. Explanations for this observed rate could be that some of these cases were considered to be viral or chronic (serous) otitis media, thus not needing antibiotics, or that antibiotics were prescribed but not purchased.

TABLE 7.22. Number and Per-episode Rates of Services and Drugs in Episodes of Acute Pharyngitis: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 282)
Visits	[279]	[0.99]
Procedures	[174]	[0.62]
Chest x-rays	2	0.01
Urinalyses	8	0.03
Cell counts	17	0.06
Nose and throat cultures	123	0.44
Injected drugs	[33]	[0.12]
Penicillins	23	0.08
All other antibiotics	5	0.02
Purchased drugs	[326]	[1.16]
Analgesics	10	0.04
Antitussives	14	0.05
All other agents for respiratory symptoms	51	0.18
Penicillins and erythromycins	222	0.79
Cephalosporins	12	0.04
Tetracyclines	5	0.02
All other antibiotics	8	0.03

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

TABLE 7.23. Number and Per-episode Rates of Services and Drugs in Episodes of Acute Bronchitis: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 144)
Visits	[159]	[1.10]
Procedures	[122]	[0.85]
Chest x-rays	44	0.31
Urinalyses	8	0.06
Cell counts	21	0.15
Nose and throat cultures	5	0.03
Sputum cultures	7	0.05
Injected drugs	[39]	[0.27]
Analgesics	1	0.01
Agents for respiratory symptoms	7	0.05
Penicillins and erythromycins	13	0.09
Tetracyclines	6	0.04
Lincomycin and clindamycin	5	0.03
All other antibiotics	2	0.01
Purchased drugs	[263]	[1.83]
Analgesics	12	0.08
Antitussives	46	0.32
Bronchodilators	17	0.12
All other agents for respiratory symptoms	54	0.38
Penicillins and erythromycins	59	0.41
Tetracyclines	52	0.36
Cephalosporins	7	0.05
All other antibiotics	3	0.02
Agents for gastrointestinal symptoms	2	0.01

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

Low Back Pain Diseases and Syndromes (Table 7.26). The simple visit rate per episode for this complaint is only about one, but because manipulation and physical medicine both involve visits and were counted only as procedures, the actual visit rate may approach 3.3. About one-half of all episodes

TABLE 7.24. Number and Per-episode Rates of Services and Drugs in Episodes of Acute Bronchitis: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 79)
Visits	[93]	[1.18]
Procedures	[30]	[0.38]
Chest x-rays	6	0.08
Urinalyses	2	0.02
Cell counts	8	0.10
Nose and throat cultures	4	0.05
Sputum cultures	1	0.01
Injected drugs	[8]	[0.10]
Penicillins	4	0.05
Purchased drugs	[163]	[2.06]
Antitussives	23	0.29
Bronchodilators	14	0.18
All other agents for respiratory symptoms	33	0.42
Penicillins and erythromycins	81	1.02
Tetracyclines	2	0.02
All other antibiotics	2	0.02

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

received x-rays of the spine and pelvis (or of extremities), a diagnostic step of questionable utility in most patients with back pain. Rates of other diagnostic tests, either routine ones, such as urinalysis and blood cell counts, or uncommon ones, such as those for rare diseases of the connective tissue or immunologic system, were (appropriately) quite low.

Use of oral medications strongly emphasized mild analgesics (nearly 1.6 purchases per episode) and included muscle relaxants (0.5 purchases per episode); use of strong analgesics, antidepressants, and steroids was quite low. The striking finding, overall, was the high use of manipulation and physical medicine compared with the use of diagnostic tests or medications.§

§ As with headaches, use of manipulations and physical medicine for low back pain and bursitis or fibrositis are restricted to a minority of individuals who obtain many such services over the spell of illness.

Bursitis and Fibrositis (Table 7.27). As with low back pain, manipulations and physical medicine services were frequent (0.70 per episode). The actual visit rate per episode was about two when those services are counted as visits. Three-quarters of the x-rays (totaling about 0.4 per episode) were of the extremities; this is not surprising. Rates of all other procedures and tests were low. The main therapies were mild analgesics and antiinflammatory agents (about 0.62 per episode), but steroid injections (0.15) were not rare.

Acute Sprains and Strains (Tables 7.28 and 7.29). The intensity of episodes for this grouping of complaints was higher for adults than for children; for instance, the visit rate

TABLE 7.25. Number and Per-episide Rates of Services and Drugs in Episodes of Otitis Media: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 401)
Visits	[571]	[1.42]
Procedures	[103]	[0.26]
Audiometry	21	0.05
Chest x-rays	5	0.01
Cell counts	15	0.04
Nose and throat cultures	9	0.02
Other bacterial cultures	15	0.04
Injected Drugs	[18]	[0.04]
All antimicrobials	15	0.04
Purchased Drugs	[555]	[1.38]
Agents for respiratory symptoms	161	0.40
Topical ear preparations	35	0.09
Amoxicillin and ampicillin	191	0.48
All other penicillins	60	0.15
Cephalosporins	5	0.01
Erythromycins	34	0.08
Sulfonamides	50	0.12
All other antimicrobials	7	0.02

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

Includes acute otitis media and otitis media not otherwise specified.

(including manipulation and physical medicine) for adults was greater than 1.4 and for children, 0.9. X-rays of the extremities were the major diagnostic procedure, with a per-episode rate of 0.65 for adults and 0.82 for children. Mild analgesics for pain were the only purchased drugs of any frequency, and then only for adults. There appeared to be little medical treatment of this problem for children, beyond the reassurance provided by being seen and ruling out more serious injury.

TABLE 7.26. Number and Per-episode Rates of Services and Drugs in Episodes of Low Back Pain Diseases and Syndromes: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 154)
Visits	[162]	[1.05]
Procedures	[518]	[3.36]
Psychiatric services	10	0.06
Manipulation	286	1.86
Physical medicine visits	58	0.38
X-rays of spine or pelvis	72	0.47
X-rays of extremities	4	0.03
Urinalyses	19	0.12
Cell counts	17	0.11
Sedimentation rate	9	0.06
Tests for rheumatoid factor, latex fixation, antinuclear antibodies	4	0.03
Remaining immunology tests	5	0.03
Injected drugs	[14]	[0.09]
Purchased Drugs	[362]	[2.35]
Strong analgesics	12	0.08
Mild analgesics and anti-inflammatory agents	239	1.55
Muscle relaxants	77	0.50
Antidepressants	7	0.04
Steroids	9	0.06

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

TABLE 7.27. Number and Per-episode Rates of Services and Drugs in Episodes of Bursitis and Fibrositis: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 235)
Visits	[318]	[1.35]
Procedures	[338]	[1.44]
Manipulation	113	0.48
Physical medicine visits	51	0.22
X-rays of spine or pelvis	24	0.10
X-rays of extremities	74	0.31
Cell counts	29	0.12
Sedimentation rate	13	0.06
Tests for rheumatoid factor, latex fixation, antinuclear antibodies	7	0.03
Remaining immunology tests	12	0.05
Injected drugs	[40]	[0.17]
Steroids	36	0.15
Purchased drugs	[189]	[0.80]
Mild analgesics and anti-inflammatory agents	146	0.62
Muscle relaxants	16	0.07
Steroids	17	0.07

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

Lacerations, Contusions, and Abrasions (Tables 7.30 and 7.31). Visit rates for this set of trauma- and accident-related conditions were slightly higher for children (almost 1.3) than for adults (1.1). Procedures (about 0.6 per episode for both age groups) were almost exclusively x-rays, mainly of the extremities; probably they were performed to be sure no fracture had occurred. Tetanus immunizations were more common among adults, perhaps because children are more likely to have had a recent tetanus series. Prophylactic antibiotics (antibiotics given to prevent the possibility of developing an infection) were not frequently used (only about 0.1 per ep-

TABLE 7.28. Number and Per-episode Rates of Services and Drugs in Episodes of Acute Sprains and Strains: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 164)
Visits	[201]	[1.23]
Procedures	[172]	[1.05]
Manipulation and physical medicine visits	31	0.19
X-rays of spine or pelvis	8	0.05
X-rays of extremities	106	0.65
Purchased drugs	[65]	[0.40]
Mild analgesics and anti-inflammatory agents	47	0.29

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

isode); this is in line with current recommendations.

Vision Examinations and Refractions (Tables 7.32 and 7.33). As a matter of coverage policy, the HIE reimbursed for only one routine vision examination and refraction per year per person and for only one set of corrective lenses. Hence, the per-episode visit rate of one is not surprising, although it is doubtful that it would have been much higher in any case. Among enrollees who had a routine vision examination,‖ adults were more likely to acquire corrective lenses than were children (0.45 and 0.30 per-episode rates).

TABLE 7.29. Number and Per-episode Rates of Services and Drugs in Episodes of Acute Strains and Sprains: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 57)
Visits	[51]	[0.89]
Procedures	[56]	[0.98]
Physical medicine visits	1	0.02
X-rays of spine or pelvis	1	0.02
X-rays of extremities	47	0.82
Purchased Drugs	[2]	[0.04]
Mild analgesics	2	0.04

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

TABLE 7.30. Number and Per-episode Rates of Services and Drugs in Episodes of Lacerations, Contusions, and Abrasions: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 329)
Visits	[369]	[1.12]
Procedures	[195]	[0.59]
X-rays of spine or pelvis	12	0.04
X-rays of extremities	92	0.28
X-rays of skull or face	16	0.05
X-rays of ribs	11	0.03
Injected Drugs	[68]	[0.21]
Tetanus immunization	62	0.19
Purchased drugs	[121]	[0.37]
Mild analgesics and anti-inflammatory agents	59	0.18
Penicillins and erythromycins	14	0.04
Amoxicillin and ampicillin	4	0.01
Cephalosporins	7	0.02
Sulfonamides	2	0.01
All other antimicrobials	2	0.01

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

General Medical Examinations (Tables 7.34 and 7.35). Visits for general medical examinations averaged about one per episode; this is expected, given the periodicity (generally annual) and preventive nature of this reason for obtaining care and that all routine services usually can be accomplished in a single visit. The procedure rate for adults was double that for children (about 2.0 vs. 1.0 per episode). The major tests and procedures differed considerably between the two age groups, of course: urinalyses and blood

‖ These could be to a physician (e.g., ophthalmologist) or to an optometrist.

TABLE 7.31. Number and Per-episode Rates of Services and Drugs in Episodes of Lacerations, Contusions, and Abrasions: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 242)
Visits	[304]	[1.26]
Procedures	[133]	[0.55]
X-rays of spine or pelvis	3	0.01
X-rays of extremities	67	0.28
X-rays of skull or face	18	0.07
X-rays of ribs	2	0.01
Injected drugs	[29]	[0.12]
Tetanus immunization	26	0.11
Purchased drugs	[39]	[0.16]
Mild analgesics and anti-inflammatory agents	5	0.02
Penicillins and erythromycins	13	0.05
Amoxicillin and ampicillin	7	0.03
All other antimicrobials	3	0.01

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

chemistries were most prominent for adults; urinalyses, blood cell counts, and tuberculosis skin tests were most frequent for children.

Immunizations (except for influenza) were common for children (almost 0.8 per-episode rate), as would be expected. Filled prescriptions were fairly common for adults (0.40 per-episode rate). Because no one class of medications was prominent, it appears that the general medical examination was used as a good opportunity for stocking up on a wide variety of drugs.#

Gynecologic Examinations (Table 7.36).

For adults, 33 different drug categories were represented. These included medications for chronic disease, such as hypertension; pain medications; psychotropic drugs; preventive agents, such as vitamins or contraceptives; and antimicrobials. For children, 23 categories were represented, of which vitamins, fluoride-containing agents, and cold remedies were most often prescribed.

TABLE 7.32. Number and Per-episode Rates of Services and Drugs in Episodes of Vision Examination: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 721)
Visits	[724]	[1.00]
Procedures	[32]	[0.04]
Special eye examinations	32	0.04
Supplies	[599]	[0.83]
Lenses (includes contact lenses)	327	0.45
Frames	269	0.37

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.
Includes routine refractions.

The per-episode visit rate for gynecologic examinations for women (14 years of age and older) was just greater than 1.1, suggesting that these are annual checkups involving return follow-up for only a small minority of women. Almost 9 in 10 episodes involved Pap smears; about 1 in 3 included urinalysis. More than one-half of the episodes resulted in a filled prescription for birth control pills (per-episode rate of 0.6). In fact, the need to obtain a prescription for contraceptives may have prompted many of these visits.

Discussion

We interpret these disease profiles cautiously because we have not taken into ac-

TABLE 7.33. Number and Per-episode Rates of Services and Drugs in Episodes of Vision Examination: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 220)
Visits	[221]	[1.00]
Procedures	[4]	[0.02]
Special eye examinations	4	0.02
Supplies	[125]	[0.57]
Lenses	66	0.30
Frames	59	0.27

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.
Includes routine refractions.

TABLE 7.34. Number and Per-episode Rates of Services and Drugs in Episodes of General Medical Examination: Adults, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 534)
Visits	[543]	[1.02]
Procedures	[1,144]	[2.14]
Vision, hearing, lung tests		
Chest x-rays	32	0.06
All other x-rays	70	0.13
Urinalyses	15	0.03
Cholesterol and lipid tests[a]	188	0.35
Thyroid tests[a]	51	0.10
Glucose tests[a]	45	0.08
Multichannel and all other blood chemistries	22	0.04
Cell counts	135	0.25
Sedimentation rate	79	0.15
Tuberculosis tests	20	0.04
Syphilis tests	33	0.06
All cultures	35	0.07
Injected drugs	16	0.03
Influenza immunizations	[115]	[0.22]
All other immunizations	43	0.08
Purchased drugs[b]	68	0.13
Birth control pills and other contraceptives	[214]	[0.40]
	69	0.13

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

[a] Excludes tests included in multichannel blood chemistries.

[b] Covers 33 different drug categories; all other categories had per-episode rates of 0.02 or lower.

TABLE 7.35. Number and Per-episode Rates of Services and Drugs in Episodes of General Medical Examination: Children, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 589)
Visits	[703]	[1.19]
Procedures	[588]	[1.00]
Vision, hearing, lung tests	31	0.05
Chest x-rays	4	0.01
All other x-rays	7	0.01
Urinalyses	191	0.32
Thyroid tests	3	0.01
Glucose tests	8	0.01
Cell counts	147	0.25
Sedimentation rate	4	0.01
Tuberculosis tests	140	0.24
All other blood chemistries	8	0.01
All cultures	8	0.01
Injected drugs	[454]	[0.77]
Immunizations	453	0.77
Purchased drugs[a]	[125]	[0.21]
Vitamins	23	0.04
Fluoride-containing agents	21	0.04
Cold remedies	15	0.03

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

[a] Covers 23 different drug categories; all other categories had per-episode rates of 0.01 or lower.

count any possible skewness in the per-person use of services (i.e., the phenomenon in which some individuals may have multiple uses of a service and others may have none). However, we have a high degree of confidence in the assignment of tests and medications to diagnosis. Further, these data reflect clinical practices from 1976 through 1980 (although only 1 year in any given HIE site). For these common conditions, diagnostic and treatment modalities were unlikely to have changed appreciably; for that matter, they are unlikely to have changed much in the few years since then. Thus we believe that our comments from both a utilization perspective and a quality-of-care perspective are justified.

First, we saw relatively little evidence of any excessive application of the diagnostic

TABLE 7.36. Number and Per-episode Rates of Services and Drugs in Episodes of Gynecologic Examination: Women, Year 2

Selected Services and Drugs	Total Number of Services or Drugs	Per-episode Rate (N = 232)
Visits	[260]	[1.12]
Procedures	[358]	[1.54]
Urinalyses	68	0.29
Pap smears	204	0.88
Cell counts	41	0.18
Purchased drugs	[191]	[0.82]
Estrogens	17	0.07
Birth control pills	140	0.60

Note: Totals for major categories are shown in brackets; other entries are selected services or drugs considered clinically significant and may not sum to total.

process. Most of these disease or symptom categories had relatively low per-episode rates of procedures; even visits per episode approached minimal levels for most of the conditions profiled.

For some conditions, specific procedures may have appeared more frequently than generally accepted concepts of good quality of care would dictate (e.g., thyroid tests in obesity, chest x-rays in acute URI, manipulation and physical medicine visits as a therapy for headaches). In other instances, however, the use of particular diagnostic tests or other services appeared to be rather low (e.g., bacterial cultures in urinary tract infection or in acute pharyngitis; follow-up visits for otitis media).

This suggests that attempts to reduce the number of diagnostic tests and procedures (i.e., trying to make the diagnostic process more efficient) are not likely to have much overall impact on costs or expenditures for outpatient care. Efforts to raise standards of care may be just as likely to raise as to lower the use of any given test or procedure. This might be especially true of follow-up visits, diagnostic or follow-up cultures, and generally more diagnostic testing before definitive therapy is instituted.

The effect of cost-sharing was to deter access to the medical system, not to reduce the intensity or "size" of an episode of care once contact with the system had been made (Chapter 4). Moreover, we found no evidence (Chapter 5) that cost-sharing selectively reduced enrollees' seeking care that was likely to be ineffective or unproductive. Thus a cost-containment strategy aimed at patients (as contrasted with one targeted on providers) can be expected to reduce expenditures on ambulatory care, but it may not improve the effectiveness of ambulatory health care.

Second, in terms of billable services, much of what was happening in these episodes of care involved the therapeutic process, specifically, prescription drugs. Even here, however, the rates of use of injected or oral medications for some diagnostic groups look quite reasonable (e.g., the musculoskeletal problems) and the rates for others (e.g., for obesity, headache, acute URI) less reasonable, so that generalizations about appropriateness across the diagnoses examined is probably unwarranted.

The use of psychotropic agents during a year was also high for some conditions among adults, reflecting their high ranking among drug classes used in ambulatory practice.[68,69] Disregarding the anxiety and depressive neuroses, for which use was, of course, widespread, we saw that from one-fifth to two-fifths of common chronic ailments (high blood pressure, obesity, peptic disease, headaches) involved use of anxiolytic (tranquilizing) agents or antidepressants during a year. Many physicians might call into question the utility of such agents in controlling or improving the manifestations of these specific illnesses.

Use of antimicrobials was of special interest, given that they constitute one of the top two or three classes of prescription drugs used in the United States.[68,69] Use of antibiotics for conditions that are most likely viral in origin was very high, given that their utility in these circumstances is highly questionable. However, the rates of use of such agents for diseases in which their role is not in question, such as urinary tract infection, acne, or otitis media, appear to have been quite reasonable.

Among the diagnoses for which antibiotics are an expected therapy, the distributions by classes of antibiotics seemed to reflect choices appropriate to the likely bacterial entity or the known efficacy of the drug (e.g., penicillins and erythromycins for acute pharyngitis and streptococcal sore throat, ampicillin and amoxicillin for otitis media, tetracycline for acne). Although the use of injected antibiotics was generally low, some powerful and dangerous antimicrobials that have little or no place in the care for common ambulatory problems (notably lincomycin and clindamycin) appeared more frequently than might be considered acceptable on quality-of-care grounds.

Chapter 8

Executive Summary: Results, Conclusions, and Discussion

In the Rand Health Insurance Experiment, cost-sharing reduced the probability of using medical care across a wide spectrum of individual conditions and reasons for seeking care, perhaps somewhat more for acute illnesses and preventive care than for chronic disease. It had equivalent effects in curtailing use of highly effective and only rarely effective medical care, suggesting that it did not have an especially selective impact. Finally, it influenced care-seeking behaviors for persons of low income more than for persons of greater means, and it especially deterred the use of medical care by poor children. In interpreting these findings on the use of ambulatory care in the context of previously reported health status results from the Health Insurance Experiment, one important explanation of why we detected so few adverse effects of cost-sharing may be certain offsetting effects of the additional services received by persons with free care. That is, at the margin, the negative effects of unnecessary or inappropriate care tend to balance the beneficial effects of appropriate care. This supposition leads us to consider several research and policy implications in the areas of measuring patient outcomes, improving the nature and dissemination of information to patients, improving quality-of-care assessment and assurance techniques, and assessing several health care financing options for the disadvantaged.

The first section of this executive summary recaps the purposes and methods of the work, and the second summarizes the results reported in previous chapters. Readers who are familiar with the material in Chapters 1–7 may wish to skip directly to the third section, which discusses the implications of our findings for health services research and health policy.

Introduction

Background

This monograph presents analyses from the Rand Health Insurance Experiment (HIE) concerning the effect of cost-sharing on the use of outpatient medical care for specific diagnoses. The HIE was a large-scale randomized controlled trial of alternative forms of health care financing that ran for 3 or 5 years (between November 1974 and January 1982) in six sites around the country. It enrolled more than 7,700 nonaged persons (in more than 2,700 families) in one of several experimental health insurance plans that differed either in the amount of cost-sharing borne by the families or in the organization through which they received their care.

These analyses highlight two important topics not previously reported by the HIE in any detail:

1. Use of medical care for specific diagnoses or problems.
2. The content of medical practice for specific conditions or reasons for seeking care.

We describe for the first time the impact that cost-sharing had on the probability that an HIE participant would have at least one episode of care in a year for a variety of sep-

arate chronic and acute conditions and several categories of preventive care. Thus, we can see whether the effects of cost-sharing apply more or less indiscriminately across many diagnoses or whether they are concentrated mainly on particular types of problems or reasons for seeking care. Further, we explore whether cost-sharing affected children more than adults and low-income individuals more than persons of average or above-average income. Hence, we can begin to draw some inferences as to whether cost-sharing in public or private health insurance programs might alter care-seeking behaviors differently for different population groups.

From a set of independent studies, we also provide here the first comprehensive descriptions (i.e., disease profiles) of the content of medical practice as experienced by a general population representative of the four U.S. census regions. These data help to clarify whether certain types of services, such as routine laboratory tests or common prescription drugs, are being overused in ordinary ambulatory practice.

Overall, we used these diagnosis-specific analyses to explore the question of what types of care, for what conditions, might persons on the cost-sharing plans have forgone. From this, we can extend our understanding of the impacts of cost-sharing on use and on health status and attempt to explain why we detected so few adverse effects of cost-sharing on patient outcomes.

Methods

These analyses were based on all insurance claims filed as part of the fee-for-service (FFS) portion of the HIE for the entire second year of the experiment (year 2, the year closest to steady state). Special attention was given to two age groups and two income groups. We defined adults as persons 14 years of age and older; children, 0–13 years. Our measure of income accounted for differences in the cost of living in the various HIE sites and for the size and composition of the family (numbers of adults and children); we used it to define a low-income (poor) group who were at or below the 33rd percentile of the HIE income distribution and an average-to-high-income (nonpoor) group. This cutoff placed persons with family incomes roughly twice the poverty level in our "poor" group, which thus includes a substantial number of near-poor individuals.

This monograph covered four separate investigations: 1) the probability of obtaining care for individual diagnoses or preventive services, 2) the probability of using highly effective and rarely effective medical care, 3) the probability of use of common medications and diagnostic or therapeutic procedures, and 4) disease profiles or patterns of care for specific conditions. For the first three, the effects of cost-sharing were the principal topic, and we compared probabilities on the free plan (the one with no cost-sharing) with those on all cost-sharing plans combined.

All investigations except those relating to drugs and procedures were done using an "episode of care" methodology. All visits, procedures and tests, other diagnostic or therapeutic services, and prescribed or injected drugs were linked into diagnosis-specific episodes for up to 150 different diagnostic categories.

The investigations concerning probability of a diagnosis-specific episode of care and probability of using highly or rarely effective care were based initially on calculating the percentages of persons on the free and on the cost-sharing plans who had had at least one episode of care in year 2. The findings from these "observed" probabilities were then more fully explored with "predicted" probabilities based on logistic regression techniques. Regression methods control for covariates associated with likely incidence of illness or need for care and improve the precision of our estimates. For these analyses, the dependent variable was the probability of a diagnosis-specific episode of care in year 2 predicted for each individual on the two

plans. Explanatory variables included age, sex, race, HIE site, a global measure of health status (the General Health Ratings Index), income, and insurance plan (free or cost-sharing).

The investigations concerning use of procedures and drugs across diagnoses were confined to observed probabilities for two groups: average (over the entire income range) adults and children, and low-income participants. Altogether, we studied 21 types of procedures (e.g., chest x-rays, blood sugar tests, Pap smears, nose and throat cultures) and 24 classes of medications (e.g., antihypertensives, tranquilizers, pain remedies, various antibiotics).

The disease profiles aggregated data across all insurance plans for the two age groups (adults and children). We calculated "per-episode" rates of use of visits, of specific tests and procedures of particular interest for a given diagnostic category, and of specific drugs important to that category.

Synopsis of Results

Medical Care Contact (Chapter 4)

When compared with free care, cost-sharing reduced the probability of any medical contact during a year across a wide spectrum of ambulatory care diagnoses. The effect may have been somewhat stronger for acute or preventive diagnostic categories than for chronic conditions. The strongest effect of cost-sharing occurred for poor children and the weakest for nonpoor children. Overall, adults showed less of a response to cost-sharing than did children, and they had less of a differential response across income groups than did children.

We used logistic regression techniques to predict the probability of an episode of care in a year for each of 14 different diagnostic categories for disadvantaged and nondisadvantaged adults and children. The more prominent and significant ($P < 0.10$) plan differences from these predictions occurred in the diagnostic categories and subsamples indicated in Table 8.1, in which plan differences are defined as cost-sharing probabilities as a percentage of free-plan probabilities.

TABLE 8.1. Summary of the Significant Differences Between Plans in the Predicted Probability of an Episode of Care for Preventive Services, Chronic Conditions, and Acute Conditions

Condition	Cost-sharing Probability as a Percent of Free Plan[a]	Group Affected by Cost-sharing
General medical examination	54	Poor adults
	71	Nonpoor adults
	68	Poor children
	79	Nonpoor children
Vision examinations	58	Poor adults
	61[b]	Poor children
Hay fever	39	Poor adults
Obesity	49	Nonpoor adults
Acute upper respiratory infection	49	Poor children
	65	Nonpoor children
Acute pharyngitis	54	Poor adults
	68	Nonpoor adults
	56	Poor children
	82	Nonpoor children
Otitis media	45[b]	Poor adults
	68[b]	Poor children
Diarrhea and gastroenteritis	37	Poor children
Vaginitis and cervicitis	50	Poor women
	54	Nonpoor women
Skin rashes and other noninfectious skin diseases	57	Poor adults
	69	Nonpoor adults
	60[b]	Poor children
Lacerations, contusions, and abrasions	58	Poor adults
	72	Nonpoor adults
	46	Poor children
Acute sprains and strains	33	Poor children
Other injuries and adverse effects	72	Nonpoor adults
	44	Poor children

[a] Effect of cost-sharing significant at $P < 0.05$.
[b] Significant at $P < 0.10$.

Cost-sharing had a statistically significant effect in reducing the probability of an episode of care for more than half of the diseases studied. Chronic, acute, and preventive care conditions were all represented. The cost-sharing impact was stronger for poor than for nonpoor participants, especially among children. For example, the probability

that an adult from a poor family who was on a cost-sharing plan would have one (or more) general medical examination(s) in a year was only slightly more than half (54%) of the probability for an otherwise equivalent adult with free care. As another example, for poor children on the cost-sharing plans, the probability of an episode of outpatient care for diarrhea and gastroenteritis was 37% of that for low-income children with free care.

Appropriateness of Care (Chapter 5)

None of the previous findings permitted us to infer anything directly about whether cost-sharing deterred inappropriate or unnecessary use of medical care more than, or less than, it forestalled appropriate or needed use. Thus, we turned to a set of analyses that calculated the probability of an episode of care in year 2 for seven diagnostic groups defined in terms of the presumed effectiveness of medical care. We concluded that cost-sharing exerted a nonselective effect in reducing use of medical care. In particular, for the average child or adult, cost-sharing did not act as a greater deterrent to care as one moved "down" the effectiveness ranking.

Among all adults, the likelihood of receiving outpatient care for at least one condition in each medical effectiveness category was usually one-quarter to one-third lower on the cost-sharing plan. The only exception (where the plans did not differ significantly) was for "highly effective care for chronic conditions." The effect of cost-sharing extended to both poor and nonpoor adults and appeared stronger for the former.

Among all children, care seeking tended to be from one-fifth to almost one-half lower with cost-sharing across the seven effectiveness categories. By income group, however, cost-sharing had different impacts. For the rarely effective category, it significantly reduced care seeking for both income groups, and rather more so for the poor. However, while it reduced care seeking for *highly effective* care among poor children, it did not do so among nonpoor children. The free-to-cost-sharing differential was greater for disadvantaged children than for any other group, and this was especially true for the category labeled "highly effective for acute conditions."

TABLE 8.2. Summary of the Significant Differences Between Plans in the Predicted Probability of an Episode of Highly and Rarely Effective Care

Effectiveness Category	Cost-sharing Probability as a Percent of Free Plan[a]	Group Affected by Cost-sharing
Medical care highly effective for acute conditions	59	Poor Adults
	71	Nonpoor Adults
	56	Poor Children
Medical care rarely effective (mainly acute conditions)	70	Poor Adults
	78	Nonpoor Adults
	54	Poor Children
	76	Nonpoor Children

[a] Effect of cost-sharing significant at $P < 0.05$.

Table 8.2 summarizes the effects of cost-sharing for the predicted probabilities of care within the highly effective (acute conditions) and rarely effective categories. It shows, for instance, the substantial impact of cost-sharing on poor children and poor adults. At both ends of the effectiveness spectrum, the drop in care seeking among poor children with less generous insurance was better than 40% relative to having free care.

Procedures and Drugs (Chapter 6)

Cost-sharing was associated with lower probabilities of use during a year for numerous tests and medications; this was especially true for the classes of procedures and drugs indicated for diagnoses that themselves were seen less often on the cost-sharing plans. Insurance plan affected care seeking for various chronic conditions less than for other conditions, and it also had less influence on the likelihood of related diagnostic or follow-up tests or medications

for these conditions. Conversely, we found that cost-sharing had a greater-than-average impact on care seeking for acute complaints and on the use of diagnostic procedures and remedies appropriate for these problems. Cost-sharing, in short, did not seem to reduce the use of specific ambulatory services or medications independent of the reductions it brought in rates of disease-specific episodes.

Procedures. Overall, the rates of use of common procedures and diagnostic tests were not especially high. For instance, across all plans approximately 4% of adults received at least one nose or throat culture in a year, 9% a glucose test, 11% a chest x-ray, 21% a urinalysis, and 33% of women received a Pap smear. The deterrent effect of cost-sharing was pervasive and statistically significant for the following procedures: chest x-rays, x-rays of the spine or pelvis, x-rays of all extremities, radiologic studies of the gastrointestinal tract, urinalyses, hemoglobins, and various bacteriologic cultures. For these, cost-sharing participants had about one-half to three-quarters as much use as free-plan enrollees. Generally, cost-sharing appeared to be more of a deterrent for low-income than for average-to-high-income persons, especially for Pap smears.

The most frequently observed tests or procedures for children included x-rays of the extremities (in approximately 8% of children), tuberculosis (TB) skin tests (9%), nose and throat cultures (10%), hemoglobins (15%), and urinalyses (16%). Cost-sharing produced significantly lower rates for all these services except TB tests; for x-rays, hemoglobins, and urinalyses, use on the cost-sharing plans was about two-thirds that on the free plan.

When only disadvantaged children were analyzed, the effects of cost-sharing on the use of most procedures and tests were usually stronger than for children across all incomes, but their absolute levels of use were lower. One major "reversal" by income group was observed: The probability of an x-ray of the extremities was markedly higher among poor children on the free plan than among all (or non-poor) children with free care. However, the probability of such x-rays among poor children with cost-sharing was the lowest of all.

Drugs. For nearly all 24 categories of medications, cost-sharing produced a lower probability of any use in a year among adults. The likelihood of at least one prescription or injection was significantly lower for the following: mild analgesics and narcotic analgesics; cold remedies; and several antibiotics (all penicillins, including ampicillin or amoxicillin; erythromycins; and tetracyclines). For these, the proportions of all adults who had at least one drug use on the cost-sharing plans were typically about one-half to two-thirds of the proportions on the free plan. Results were similar for low-income adults.

Only 16 of 24 main drug categories were observed with any frequency among children; of these, mild analgesics, various drugs for acute conditions, and fluoride-containing products were the more common. As with adults, the rates of use with cost-sharing were about one-half to two-thirds of those with free care. The probability of any use was significantly lower with cost-sharing for cold remedies, penicillins, and erythromycins. Plan differentials were even greater among low-income children: for instance, for cold remedies and erythromycins, use rates with cost-sharing were less than one-third of free-care rates.

Disease Profiles (Chapter 7)

Two main findings stood out from the disease profiles analyses, in which we examined the per-episode rates of visits, of all procedures combined, of purchased drugs, and of injected drugs. First, most of the disease or symptom categories profiled had relatively low per-episode rates of procedures. Even visits per episode approached minimal levels for most of the conditions profiled. In

a few cases, specific procedures may have been over-provided (e.g., chest x-rays in acute upper respiratory infection [URI], or manipulation and physical medicine visits as a therapy for headache). In others, however, the use of particular services appeared to be rather low (e.g., cultures in urinary tract infection; follow-up visits for otitis media).

Second, much of the content of these episodes concerned the therapeutic (rather than diagnostic) process, and much of that involved prescription drugs. Rates of use of some medications for some diseases looked quite reasonable (e.g., for the musculoskeletal problems) but for others seemed less so (e.g., medications that were prescribed for obesity or acute URI). Psychotropic drugs appeared frequently in episodes of several chronic conditions of adults. Use of antibiotics for conditions that probably are caused by a virus was excessive, but their use for diseases with a likely bacterial origin appeared appropriate.

Conclusions and Discussion

Episodes of Care

Our efforts to define clinically homogeneous episodes of care from claims data were relatively elaborate (see Chapter 3). The HIE claims data for ambulatory care were considerably more complete and clinically detailed than is usual in private or public sector databases; this permitted us to link drugs and procedures to visits, and visits into episodes, more readily than might be possible with other computerized claims data systems. Further, apart from certain over-the-counter drugs, we had an essentially complete enumeration of purchased prescriptions, a factor that is crucial to analyzing comprehensive episodes of care.

In some cases, the effort to group claims data into episodes of this sort had little additional payoff relative to just examining visits. Most acute episodes (as well as the routine medical, gynecological, and vision examinations) involved on average only a little more than one visit. For research purposes, studying the content of single visits for each problem (assuming that all related procedures and medications can be associated appropriately with the visit) might produce about as good a snapshot of the current practice of medicine as would following patients over time for the relatively few times that there are second or subsequent visits.

This is not true for the chronic problems that we studied. For these, where the norm was better than 1.5 visits per episode and perhaps as many as three or four, the risk of missing important details if only a single visit is studied is high. Here, then, the effort to define episodes of care is quite important.

Such an effort, however, requires tracking patients over time. One difficult way to do this is to gain access to the medical records of private practice physicians. An easier alternative, which we employed, is to use so-called administrative data, such as insurance claims. Our experience has left us, as well as other researchers,[30,70] optimistic about employing claims data to study many features of medical care. In the case of ambulatory care, however, using insurance data in this way requires that all relevant services (especially including prescription drugs) be covered and that services can be linked for individuals, not just families.

Efficiency of Medical Practice

We could find little or no evidence of gross overuse of office visits, diagnostic tests, procedures, and the like in the production of an ambulatory episode of care. On average, relatively common, "little ticket" tests and services were not being markedly over-provided. Use of some classes of drugs, such as antibiotics and psychotropic agents, was appreciable; given the diagnoses for which they were sometimes prescribed, we can reasonably infer that some of this use was inappropriate. Nevertheless, there did not appear to be much "slack" in ambulatory care, cer-

tainly not enough to suggest that efforts to improve the efficiency of medical practice along these lines would have much effect on overall medical costs.

Cost-sharing reduced outpatient medical use principally by deterring people from seeking any care at all. It did not decrease the intensity or "size" of an episode of care for a given diagnosis, measured by the number or amount of services provided per episode once people entered the medical care system. Physicians evidently did not adjust their practice patterns to their patients' insurance status. Whether this occurred because physicians do not respond to insurance or because they gear their treatment to the typical insurance in the community—the latter a factor left unchanged by the small scale of the experiment in any one site—is something that cannot be answered by our data. We conclude that insurance that requires patients to share in the costs of their care will not necessarily change the *per-episode* use of outpatient services but will importantly influence the number of episodes for which care is sought.

Use of Care for Specific Diagnoses

Cost-sharing deterred contact with the medical system across the entire spectrum of illnesses and problems seen in the outpatient setting. Thus, these disease-specific analyses confirm and extend earlier HIE results done at higher levels of aggregation about the degree to which cost-sharing reduced use (and expenditures). We found no evidence that the imposition of cost-sharing led individuals to make appropriately selective decisions about the problems for which they will seek care.

Not all complaints and symptoms require medical attention, so cost-sharing does reduce ostensibly inappropriate use of ambulatory care. For some problems, such as a cold, medical care may bring little, if any, tangible benefit because self-care would be equally effective. This favorable outcome of cost-sharing comes at the price, however, of reductions in appropriate care; that is, it appears to invoke a considerable risk of foreclosing medical diagnosis and treatment for conditions in which such intervention can be expected to be effective and to benefit the patient. How this correlates with our previously reported health status results we take up below.

Effects on the Disadvantaged

These risks of cost-sharing are not uniformly distributed across socioeconomic strata of the population. Almost always in these analyses, disadvantaged individuals had less use than more well-off persons. Cost-sharing appeared to exert its greatest impact on poor children.

This was quite apparent for some accident-related problems among children, where the interaction between income group and insurance plan was significant. For several other diseases and routine preventive examinations, the effects of cost-sharing were larger for those of low income, even if we could not detect a statistically significant interaction when each condition was studied alone. Our power to demonstrate real differences was often attenuated because of small samples at this level of disaggregation, but a pattern of larger impacts of cost-sharing on persons of low income was predominant.

This was especially true among children. In the analyses of episodes of care for specific diagnoses, significant differences by plan were essentially absent among higher-income children but were detected (even in the face of very small samples) in several subanalyses among low-income children. A particularly striking illustration of this was the differential effect of cost-sharing (vs. free care) experienced by poor children on their use of "highly effective" ambulatory care for acute conditions.

Generalizing from HIE Plans

To consider the degree to which our findings can be generalized to groups covered

by various insurance plans, one must compare the benefit package and levels of cost-sharing in the HIE with current public and private insurance. Three dimensions of the HIE insurance plans are important: the services included as covered benefits, the "stop-loss" mechanism, and the provisions invoked for reimbursing providers.

First, the services covered by the HIE were comprehensive; they included care for virtually all outpatient problems and preventive examinations and services. Apart from over-the-counter medications for acute conditions, nearly all drugs were covered. Thus, no major element of care was omitted from the HIE insurance package.

Neither for Medicaid nor for many private plans is this true. In Medicaid, many HIE-covered services such as eyeglasses, prescription drugs, and, for that matter, dental care, are optional rather than mandatory, and states differ in whether they elect these options and whether they impose limits on the number or extent of these (or other) benefits.[71–74] Similarly, many private plans are not as comprehensive as the HIE plans.

Second, cost-sharing in the HIE was directly tied to family income and was capped for everyone. The tie to income limited the effect of cost-sharing for poor families, who were more likely to exceed the maximum out-of-pocket expenditure in a year. This in turn induced consumption of medical care that would not otherwise have occurred, thereby attentuating the free-versus-cost-sharing comparisons for the poor.

Third, the HIE paid physicians their billed charges (with rare exceptions), which Medicaid in general does not do but which private health insurance has tended to do. In addition, HIE enrollees in FFS plans had essentially full freedom of choice of provider, whereas several state Medicaid programs have begun to restrict beneficiaries' choice of provider through mechanisms such as contracting. These two aspects of provider choice in Medicaid (restrictions on physician reimbursement and contracting) mean that low-income participants in the HIE almost certainly had wider access to a full range of practitioners and providers than did the Medicaid population; whether the HIE participants also had access to better physicians depends importantly on the providers with which states might choose to contract.

Despite the first two differences, our results should apply to the population covered by most group health insurance plans. The additional services covered by the HIE plans, such as vision examinations, probably have little effect for other medical services that would be covered under such plans. Furthermore, although the HIE plans capped out-of-pocket expenditures, which not all private plans do, the average level of cost-sharing for all services under private plans is within the range of cost-sharing under the HIE plans.

To be specific: using information on the provisions of insurance policies held by HIE participants prior to their enrollment in the experiment, we estimated mean coinsurance rates for the services used during the experiment (the out-of-pocket payments imputed on the basis of the previous policy as a percentage of total expenditures during the experiment).[75] For all medical services, the estimated mean coinsurance rate was 21%. The actual HIE plans had average coinsurance rates of 16%, 24%, and 31% for the 25%, 50%, and 95% plans, respectively. Thus, insurance coverage in the late 1970s was somewhere between the 25% and 50% plans. We believe that the HIE plans still approximate the provisions of many insurance plans today, even with increases since the early 1980s in the likelihood of some initial cost-sharing and of stop-loss or catastrophic provisions in such policies.[76]

The degree to which we can apply our findings to the population covered by current Medicaid programs is problematic. The differences in reimbursement rates and access noted above impair direct generalization. Moreover, not all the services covered by the HIE are included in Medicaid benefit pack-

ages. These two differences make Medicaid less generous than our cost-sharing plans. However, cost-sharing in Medicaid for covered benefits is nominal, when it exists at all (e.g., it is currently proscribed for individuals younger than 19), and it is clearly much less than in our cost-sharing plans.

We cannot generalize directly to the sizable portion of the population that is uninsured,[71,77–83] because all our participants had some insurance. As noted above, the average coinsurance rate in the 95% plan was only 31%, because of the stop-loss feature of the HIE plans. Thus, having no insurance (i.e., essentially 100% coinsurance) is considerably outside the range we studied. Similarly, we cannot generalize to the Medicare population, because we did not sample from the population over 65.

Interpreting Use Results in the Context of Health Status Effects

Our studies of health outcomes showed at most negligible effects of cost-sharing on general measures of health for both adults and children.[9,84,85] Among adults, we did detect disease-specific effects for high blood pressure (and a related risk-of-dying index) and corrected far vision; the effect was concentrated among the poor.[9] In addition, we saw a significant effect for anemia among low-income children (see Table 10 of Valdez[84]). If cost-sharing reduced the use of appropriate ambulatory services, why did we not see more adverse effects on health outcomes?

There are three logical possibilities to explain why we did not see greater outcome effects:

First, our definitions and measures of appropriate ambulatory care and of diagnosis-specific use might be flawed, and hence no true effect on health would be expected from the reductions in use reported here. Based on the face and content validity of what was defined as appropriate care, and considering the evidence in the medical literature about the conditions that we so classified,[42–45] we believe that a decrease in care for these conditions would cause a decrease in health. Some cases may have been misclassified because we relied on the physician's diagnosis. However, the data used in these analyses came from a specially designed problem-oriented claim form; when independently recoded by a physician, the forms were found to yield reliable information. In addition, when claim forms were incomplete, physicians' offices were called to obtain the data, thus further enhancing the soundness of the claims data base. Finally, even if some cases had been misclassified, the large decreases in use across almost all diagnostic categories make it implausible that cost-sharing produced no reductions in effective care. Therefore, this first explanation does not seem very promising.

Second, our measures of patient outcomes might be flawed, and hence we might have failed to detect important true benefits of the additional services received by persons on the free care plan. It also seems unlikely that this is the principal explanation. Even transient improvements in health associated with care for acute conditions did not seem to be affected by insurance coverage. In analyses not yet published, neither the rate of school-loss days nor that of work-loss days during the experiment was lower on the free-care plan. Moreoever, we saw no evidence that the additional services associated with free care led to greater symptomatic relief, such as less worry on the part of parents about their children's health, or less bother from hay fever, or reductions in anxiety.[11,84,85]

Another possibility is that we missed long-term health effects. In fact, we may have missed such effects among groups with very small numbers, such as children with congenital defects or severe handicaps or individuals with rare diseases; however, we consider it unlikely that we missed any widespread, long-lasting impacts. Measures of general health, which are sensitive to a variety of chronic conditions, were reasonably precisely estimated among adults, including the sick poor; the estimated confi-

dence intervals virtually rule out large effects.[9] Even the confidence intervals among poor children for the general health index were reasonably tight.[84] Further evidence against this interpretation is that the large changes in appropriate use described in this monograph were for prevalent acute conditions and cut across all age ranges. Hence, even if we did not find an effect among a small subgroup with a rare condition, that fact could not readily be used to reconcile our interpretation of the results in this paper with those in our earlier reports.

Third, the additional services used on the free plan may have produced offsetting effects. That is, some persons on the free plan received benefits (in the form of improved health status) from care for various conditions for which medicine has effective interventions to offer; others on the same plan, however, may have suffered adverse effects from the additional care they used. These offsetting effects might even have occurred in the same individuals receiving care for different conditions over time. With regard to potentially negative effects, for instance, they may have been labeled as sick or disabled when receiving medical care for conditions for which medicine has relatively little to offer; this may prompt some sick role behavior such as staying home from school or work that would otherwise not have happened. In this same vein, they may have been given diagnostic procedures that, when used on a predominantly healthy population, yield more false-positive than true-positive results. Or, they may have been excessively exposed to antibiotics or minor tranquilizers and other psychotropic agents, thereby running a higher risk of adverse effects of care (e.g., allergic drug reactions or sensitization) than did persons on the cost-sharing plans.

The balance of appropriate and inappropriate care and subsequent effects for the disadvantaged may have differed from that for the middle class, given the generally lower levels of health status of the former group.[7,52,64,86–92] As a result, the odds that any particular episode of care was beneficial may well be higher for the poor. (There were more ill people whom medicine can benefit, and fewer well people whom it can harm.) Moreover, it appears that the deterrent effects of cost-sharing on care seeking in the HIE were greater among the poor, and this is consistent with the stronger indications of adverse health outcomes among the poor.

Other studies of the effects of losing insurance coverage lend support to the notion that the health of the poor may be damaged by reductions in insurance. Termination of coverage is, of course, a much greater change than the variation in income-related levels of cost-sharing in the HIE. Nonetheless, it has been shown to have deleterious, even catastrophic, effects on the health of indigent adults (e.g., those with high blood pressure), as use of ambulatory care and prescription drugs drops precipitously.[93,94]

Research and Policy Implications

If offsetting effects are the primary explanation of why we did not see greater health effects with cost-sharing, then we see a number of implications for further research and policy making. Broadly speaking, these concern measuring patient outcomes, improving the nature and dissemination of information to patients, improving quality-of-care assessment and assurance techniques, and assessing more fully various health care financing options, especially for the disadvantaged.

First, this entire discussion highlights the importance of collecting direct measures of patient outcomes in addition to claims data. Had we relied solely on claims data, we might have concluded that health status had been damaged by the reductions in use occasioned by cost-sharing. When data on use and outcomes are considered together, as here, we gain a better understanding of the value of the additional services prompted by free care.

Second, it suggests that thought be given to improving patients' abilities to distinguish

circumstances in which seeking medical care is indicated from those when it is less appropriate. Many people may simply lack sufficient information to help them distinguish when care seeking is likely to be beneficial. Hence, they are at a disadvantage in deciding whether to seek care or to forgo it. This may be a particular problem for persons who make the care seeking decisions for children in lower-income families.

Information about appropriately using the medical care system, versus relying on self-care, is available in a variety of forms too extensive for us to review here, although it may be more readily accessible to affluent families. Can more be done to help the economically disadvantaged discriminate better between situations when medical care would be useful and those when it would be less so?

Improved patient or parent education and information dissemination might be carried out through activities that do not directly involve physicians, i.e., efforts centered in the schools, in youth groups, or other lay organizations. It might also be done through informational systems that do require physician participation, e.g., educational brochures or videotapes made available through physicians' offices or clinics to help patients become better users of care. We know comparatively little about the degree to which these approaches can be implemented successfully, especially among the poor. Our results suggest that new ideas and tools for effective patient education on how best to use the medical system might have an appreciable payoff, and special attention needs to be directed at population groups that are not well served by traditional means of gaining such information.

Third, another set of inferences can be drawn about quality-of-care assessment and quality assurance. Much of what we have posited about potential negative effects of care seems to us to reflect situations in which physicians or other care-givers knew, or could reasonably have been expected to know, the appropriate diagnostic or therapeutic steps to take. If this supposition is true, then quality assurance continues to be an area of concern.

Both better methods for monitoring quality of care and more effective quality-assurance programs are needed. This is especially true of programs targeted on ambulatory care, which tend to lag the quality-assurance mechanisms applied to inpatient care. Further, being able to identify potential "outlier" providers who may render inadequate or inappropriate care and to offer practical assistance in improving their skills and competencies are critical aspects of a well-functioning quality assurance program. If restrictive reimbursement and provider-choice policies cause beneficiaries to rely more heavily on such providers, these points are particularly relevant for publicly funded programs.

A second-order issue relating to quality of care concerns situations in which it might not be easy to define, a priori, appropriate or inappropriate care. Research that addresses the many uncertainties often facing physicians in deciding when and where to use the diagnostic and therapeutic tools available to them is needed.[95,96] One area of particular importance is improving the decision-analysis skills of physicians; related to that is a need to develop ways by which physicians can more quickly and efficiently obtain information concerning the sensitivity and specificity of common tests in differing clinical circumstances. In addition, innovative work is needed along several other lines:

- Clarifying the efficacy and effectiveness of tests, procedures, and drugs—emerging technologies as well as existing ones; alone and in combination—in combating the acute and chronic conditions that constitute the majority of problems for which people seek care;
- Refining available methods for medical technology assessment, so as eventually to improve the quality of data on which quality-of-care judgments are made; and
- Making more practical and more readily

available the information derived from such assessments.

Fourth, with respect to health care financing, our findings warrant considerable further attention from both the medical and policy-making communities about how to overcome or mitigate the deleterious effects of cost-sharing while preserving its useful impacts on care seeking behaviors of the average person. We place our principal emphasis in the following discussion, however, on issues relating to the financing of health care for the indigent and the uninsured, largely because their care is in the domain of public policy.

Previously reported results suggest that among the disadvantaged, cost-sharing within a traditional FFS system causes some adverse outcomes for those who have health problems. One option that some observers believe will lead to better outcomes for these individuals are capitated programs, such as health maintenance organizations, independent practice associations, or prepaid arrangements based on "gatekeeper" or "case-manager" concepts. Throughout the country, these innovative systems of medical delivery are growing[71,97,98]; a number of states are imposing mandatory prepaid arrangements for their Medicaid programs.[71,99]

Some of these capitated arrangements are sufficiently new that comprehensive evaluations, including health outcomes, have yet to be completed. Unfortunately, it is doubtful that funds will ever be available to evaluate many of these programs. However, for low-income adults in the HIE who began the experiment with health problems, enrollment in one health maintenance organization (that employed no outreach effort for the HIE population) was apparently associated with worse outcomes of care.[100] (These effects were not found for other groups of enrollees at the HMO.) Research into the relative advantages and limitations of capitated systems, particularly for the poor, is thus of special concern. This work should emphasize how these organizations can best care for the sick poor, e.g., how their outreach and information dissemination activities can be most effectively targeted.

Of course, many alternatives other than capitation can be advanced as mechanisms for providing care for the indigent. We cannot consider here in any detail the options that might be explored, especially because they differ depending on what we might assume about the economic circumstances within which they would be implemented. For example, in light of the national budget deficit and the constraints of the Public Debt Limit—Balanced Budget and Emergency Deficit Control Act of 1985 (P.L. 99–177, and better known as the Gramm–Rudman–Hollings Act), one might expect little or no new monies becoming available for health programs for the poor in the immediate future. Taking a longer view, however, and assuming some reasonably steady level of economic growth, additional resources may well be available. What do our results imply in these two instances?

One inference that might be drawn from our findings and others is that the differential health outcomes among HIE participants, *all of whom had some insurance,* are less worrisome than the differential that might be expected between individuals with some insurance and those with none. In the absence of any new resources becoming available for health care, then, we would put higher priority on finding ways to bring some insurance coverage to the poor and near poor who are not now covered, even if this might mean reducing benefits.

Information on the current size and composition, and especially the health status, of the uninsured and underinsured populations would permit estimation of the costs at the local, state, and federal levels of covering these individuals by expanding Medicaid eligibility or by other means. In the context of few or no new resources for existing programs, looking carefully at which services in Medicaid could be subjected to some cost-sharing and which could continue to be pro-

tected from cost-sharing is desirable. In the short run at least, reducing demand for some less critical services among present Medicaid beneficiaries might enable these programs to expand eligibility for more crucial services. Finally, because resources are limited, we might ask whether public interventions would be better targeted on the poor who are also sick than on all the poor. This implies a considerable research agenda into developing reliable and valid indicators of "sickness" (as contrasted with "poverty") that might be used to define eligibility for such programs.

Over the longer term, as the resources that can be devoted to health care become less constrained, the tradeoff between thresholds for eligibility and generosity of benefit packages should become less acute. Eliminating cost-sharing for selected portions of the Medicaid population (e.g., for patients with serious chronic illness) beyond contemporary provisions of these programs may then be possible.

In conclusion, if our interpretation about offsetting effects is generally accurate, then it implies a payoff for either private or public programs related to reducing the amount of inappropriate care and increasing the delivery of appropriate and effective care. A minimal goal is that, at the margin, more good than harm is done; a more reasonable goal from society's perspective is that, at the margin, the expected benefits of care equal its costs. Attaining these goals will require economic and clinical measures that address both patient and physician behaviors, and among these surely lie novel approaches to patient education and quality assurance.

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Appendix A

Definitions of Groups of Diagnoses, Procedures and Tests, and Drugs

This appendix presents additional detail on our diagnostic groups, procedures and tests, and medications. Table A.1 lists the 150 diagnostic categories we defined, in three broad groupings (chronic, acute, and either acute or chronic). Also given are the HIE diagnosis category numbers (used solely for identification); contiguous numbers often refer to conditions in the same or related organ system or set of problems. For instance, numbers 9–11 refer to thyroid disease, and numbers 123–126 refer to trauma- or accident-related complaints.

These categories correspond to the main sets of rules by which episodes were defined (Chapter 3). Some, however, were later reaggregated with respect to diagnostic groups highlighted in this monograph. The aggregations include: 42 and 43—vision examination and refraction; 57 and 58—hypertension and abnormal blood pressure; 86 and 87—ulcer and nonulcer peptic disease; and 111–115—skin rashes, which includes viral warts, eczema, dermatitis, and other dermatologic diseases. Also, for some analyses, some "either" groupings were arbitrarily reassigned to be chronic, and these are footnoted.

Table A.2 shows the major procedure groups and the CRVS codes for each grouping.[101] Office visits were initially split into 16 different groups, corresponding to the usual CRVS divisions (e.g., new patient vs. established patient; brief, limited, comprehensive, etc., visits). For analytic purposes, however, this proved too disaggregated, and all visits to physicians' offices were combined for the work reported in this monograph.

Table A.3 gives the major HIE therapeutic classes of drugs used in these analyses. They are based on the main chapter headings of the Second Edition of *AMA Drug Evaluations.*[102] Many of these, too, were originally disaggregated into 5–10 separate drug subcategories. As with procedures, however, that was too detailed for these analyses, and the main investigations were done on the categories as shown.

TABLE A.1. Diagnostic Groups Used in Ambulatory Care Analyses

Chronic conditions
- 9. Hyperthyroidism
- 10. Hypothyroidism
- 11. Other thyroid disease
- 12. Diabetes mellitus
- 15. Hypercholesterolemia
- 16. Hyperlipidemia
- 17. Obesity
- 53. Otitis media, chronic
- 57. Hypertension
- 58. Abnormal blood pressure
- 59. Ischemic heart disease and angina
- 60. Cardiac arrhythmia
- 61. Congestive heart failure
- 62. Heart disease, other
- 82. Chronic bronchitis, chronic obstructive pulmonary disease
- 83. Asthma
- 108. Acne
- 116. Rheumatic disease (mainly rheumatoid, including rheumatoid arthritis)
- 117. Degenerative joint disorders
- 121. Disc displacement and derangement

Acute conditions
- 2. Influenza (viral)
- 3. Diarrhea or gastroenteritis (infectious)
- 45. Eyes—conjunctivitis
- 52. Otitis media, acute
- 54. Ears—other (not hearing impairment)
- 69. Chest pain
- 75. Acute upper respiratory infection
- 76. Acute pharyngitis and tonsillitis
- 77. Streptococcal sore throat
- 79. Acute middle respiratory infections (laryngitis, tracheitis)
- 80. Acute lower respiratory infections (acute bronchitis)
- 81. Pneumonia
- 92. Abdominal pain
- 103. Vaginitis, cervicitis, or vulvitis
- 109. Nonfungal skin infection
- 123. Trauma—fractures
- 124. Trauma—dislocations
- 125. Trauma—acute sprains and strains
- 126. Trauma—lacerations, contusions, abrasions

Either acute or chronic conditions
- 1. Viral exanthems
- 4. Sexually transmitted disease and pelvic inflammatory disease
- 5. Fever
- 6. Other infectious diseases
- 7. Benign and unspecified neoplasm
- 8. Malignant neoplasm (includes skin)[a]
- 13. Hypoglycemia[a]
- 14. Gout[a]
- 18. Other endocrine disease[a]
- 19. Anemia, iron deficiency[a]
- 20. Anemia, B_{12} or folate deficiency[a]
- 21. Anemia, all other[a]
- 22. Other hematologic disease
- 23. Mental retardation[a]
- 24. Other psychoses[a]
- 25. Alcoholism[a]
- 26. Drug dependence[a]
- 27. Schizophrenia and affective psychoses[a]
- 28. Major affective disorders[a]
- 29. Anxiety neurosis[a]
- 30. Depressive neurosis[a]
- 31. Other neurosis[a]
- 32. Personality disorders[a]
- 33. Social conflict
- 34. Child mental health problems[a]
- 35. Adolescent mental health problems[a]
- 36. Psychosomatic disorders[a]
- 37. Enuresis[a]
- 38. Other emotional disturbances
- 39. Seizure disorders[a]
- 40. Peripheral neuropathy, neuritis, and sciatica[a]
- 41. Headache (includes migraine)
- 42. Eyes—vision examination[a]
- 43. Eyes—refraction[a]
- 44. Eyes—strabismus[a]
- 46. Eyes—glaucoma[a]
- 47. Eyes—cataracts[a]
- 48. Eyes—other
- 49. Ears—hearing examination
- 50. Ears—deafness[a]
- 51. Otitis media, not otherwise specified
- 55. Vertiginous syndromes
- 56. Other neurologic disease
- 63. Edema
- 64. Cerebrovascular disease[a]
- 65. Thrombophlebitis
- 66. Varicose veins[a]
- 67. Hemorrhoids[a]
- 68. Other cardiovascular disease
- 70. Shortness of breath
- 71. Cough
- 72. Hay fever (chronic rhinitis)[a]
- 73. Acute sinusitis
- 74. Chronic sinusitis[a]
- 78. Throat pain
- 84. Hypertrophy of tonsils and/or adenoids[a]
- 85. Other respiratory disease
- 86. Peptic ulcer[a]
- 87. Nonulcer peptic disease[a]
- 88. Gastrointestinal—chronic enteritis, colitis[a]
- 89. Irritable colon (bowel syndrome)[a]
- 90. Perirectal conditions
- 91. Hernia
- 93. Nausea or vomiting
- 94. Constipation[a]
- 95. Other gastrointestinal disease
- 96. Dental disease
- 97. Urinary tract infection
- 98. Other kidney disease[a]
- 99. Prostatic disease[a]
- 100. Menstrual disorders[a]
- 101. Menopausal disorders[a]
- 102. Obstetrical disease
- 104. Other cervical disease

TABLE A.1. Continued.

105. Chronic cystic breast disease[a]
106. Other breast disease
107. Other genitourinary disease
110. Skin—dermatophytoses
111. Viral warts and chronic skin disease[a]
112. Pigmented nevus[a]
113. Eczema and dermatitis[a]
114. Contact dermatitis and other rashes[a]
115. Other dermatologic disease[a]
118. Low back pain diseases and syndromes[a]
119. Bursitis, synovitis and tenosynovitis
120. Fibrositis, myalgia, arthralgia
122. Spine curvature[a]
127. Muscle problems
128. Other musculoskeletal disease
129. Congenital anomalies[a]
130. Perinatal disease
131. Lymphadenopathy
132. Debility (malaise) and fatigue
133. Other signs and symptoms
134. Allergic reaction, not otherwise specified
135. Adverse effects of medicinal agents
136. General medical examination
137. Gynecological examination
138. Pre- and postnatal care
139. Perinatal status
140. Medical and surgical aftercare
141. Post-operative status
142. Family planning
143. Special examinations
144. Tuberculosis test
145. Cancer screening
146. Miscellaneous screening
147. Abnormal findings
148. Vehicular accidents
149. Other injuries and adverse effects
150. Other operations and treatments

[a] For some analyses, these were arbitrarily considered chronic, and an episode lasted the entire year.

TABLE A.2. Major Procedure Groups for Ambulatory Care Analyses

Name of Procedure Group	CRVS codes[a]
Office visits[b]	90000-90098
Emergency care facility services	90500-90599
Well child care	90751-90778
Consultations	90600-90645
Immunizations	90710-90729
Injections, therapeutic	90730-90749
Special medical services	99026-99999
Psychiatric services—individual therapy	90803-90814
Psychiatric services—group therapy	90815-90824
Psychiatric services—marriage/family counseling	90825-90834, 90839
Psychiatric services—other	90835-90838, 90840-90899
Diagnostic services—vision—general	92001-92014
Diagnostic services—vision—special	92018-92499
Diagnostic services—audiometry	92551-92589
Diagnostic services—allergy tests	95005-95199
Diagnostic services—pulmonary	94000-94699
Diagnostic services—EKG—all types	93000-93279
Diagnostic services—other	91000-92199, 92504-92534, 92601-92999, 93501-93799, 95819-95999
Therapeutic services—manipulation	97260, 97261
Therapeutic services—physical medicine visit	97740-97741, 97000-97241
Therapeutic services—other	96000-96920, 97500-97721, 97750-97799
Anesthesia	00001-00199, 62274-62279, 64100, 64400-64599,
Surgery—skin—acne	10040
Surgery—skin—wound repair	12000-13999
Surgery—skin—other	10000-10039, 10041-11999, 14000-17999
Surgery—arthrocentesis	20550-20610
Surgery—obstetrical	59000-59889
Surgery—other	18000-20549, 20650-58999, 60000-62273, 62280-64099, 64101-64399, 64600-69999

TABLE A.2. Continued.

Name of Procedure Group	CRVS codes[a]
Radiology—x-rays—chest	71000-71034
Radiology—x-rays—spine or pelvis	72010-72999
Radiology—x-rays—extremities	73000-73999
Radiology—x-rays—gastrointestinal contrast	74210-74280
Radiology—x-rays—other	70002-70999, 71036-71199, 74000-74020, 74290-76499
Radiology—other	76500-79999
Laboratory tests—preparation and handling	99007-99023
Urinalysis	81000-81099
Blood chemistry—multichannel	80100-80199
Blood chemistry—cholesterol, lipids, triglycerides	82465-82475, 83700-83717, 84475
Blood chemistry—thyroid tests	83533-83539, 84250, 84251, 84442-84445
Blood chemistry—glucose tests	82947-82954
Blood chemistry—other	82000-82464, 82480-82944, 82955-83532, 83540-83699, 83718-84249, 84252-84441, 84446-84474, 84476-84999
Hematology—complete blood count with differential	85022
Hematology—other cell counts	85005-85021, 85023-85048, 85580-85584
Hematology—sedimentation rate	85650-85651
Hematology—other	85000-85004, 85049-85579, 85585-85649, 85652-85999
Immunology—pregnancy tests	86006
Immunology—tuberculosis tests	86580, 86585
Immunology—other	86000-86005, 86007-86579, 86581-86584, 86586-86999
Microbiology—nose or throat culture	87060
Microbiology—other cultures	87040-87055, 87070-87163
Microbiology—sensitivity tests	87181-87190
Microbiology—smears or stains	87204-87211
Microbiology—other	87001-87015, 87165-87180, 87250-87999
Pathology—Pap smears	88150-88155
Pathology—other	88000-88140, 88160-89999
Home visits	90100-90195
Hospital visits	90200-90289
Critical care services	90290-90297
Extended care facility services	90301-90370
Nursing home services	90400-90470
Hemodialysis services	90900-90999
Other services for which no charge was made[c]	HIE-specific codes
Other services not covered in the HIE[d]	HIE-specific codes

[a] California Relative Value Studies (CRVS) codes.[101]
[b] Initially, office visits were subdivided into 16 different groups.
[c] This included four separate groups, such as presurgical visits and "interpretation only" of tests.
[d] This included seven separate groups, such as orthodontia or supplies and drugs that were not covered, as well as all other services not otherwise classified.

TABLE A.3. Major Drug (HIE Therapeutic) Classes for Ambulatory Care Analyses

Cardiovascular-renal agents
- Digitalis glycosides
- Antiarrhythmic agents
- Antianginal agents
- Peripheral vasodilators
- Agents used in hypotension and shock
- Antihypertensive agents
- Diuretics

Agents affecting blood formation, volume, and coagulability
- Agents used to treat deficiency anemias
- Anticoagulants
- Blood, blood components, and blood substitutes
- Hemostatics

TABLE A.3. Continued.

- Homeostatic and nutrient agents
  - Agents used to treat hyperglycemia
  - Agents used to treat hyperlipidemia
  - Vitamins and sources of vitamins
  - Miscellaneous nutritional agents
  - Replenishers and regulators of water, electrolytes, and nutrients
  - Blood calcium regulators
- Drugs used in anesthesia
  - Local anesthetics
  - General anesthetics
  - Adjuncts to anesthesia
- Analgesics, narcotic antagonists, and agents used to treat specific painful disorders
  - Strong analgesics
  - Mild analgesics
  - Narcotic antagonists
  - Agents used to treat migraine
  - Agents used in gout
  - Antirheumatic agents
- Drugs affecting the central nervous system
  - Sedatives and hypnotics
  - Antianxiety agents
  - Antipsychotic agents
  - Centrally acting skeletal muscle relaxants
  - Anticonvulsants
  - Antidepressants
  - Anorexiants
  - Analeptics
- Steroids, hormones, and agents affecting hormonal mechanisms
  - Adrenal corticosteroids
  - Androgens and anabolic steroids
  - Estrogens, progestagens, oral contraceptives, and ovulatory agents
  - Anterior pituitary and hypothalamic hormones
  - Thyroid hormones and antithyroid agents
  - Antidiuretics
- Drugs used in respiratory and allergic disorders
  - Bronchodilators
  - Nasal decongestants
  - Expectorants and inhalants
  - Antitussive agents
  - Antihistamines
  - Cold remedies
  - Therapeutic gases
- Antimicrobial agents
  - Penicillins
  - Cephalosporins
  - Erythromycin and derivatives
  - Lincomycin and clindamycin
  - Polymyxins
  - Tetracyclines
  - Chloramphenicol and derivatives
  - Sulfonamides
  - Nitrofurans
  - Aminoglycoside antibacterial agents and miscellaneous antimicrobials
  - Antituberculous agents
  - Antileprosy agents
  - Antifungal agents
- Parasiticidal agents
  - Antimalarial agents
  - Amebicides
  - Antitrypanosomal agents
  - Antitrichomonal agents
  - Anthelmintics
  - Scabicides and pediculicides
- Agents applied locally
  - Antiseptics and disinfectants
  - Dermatologic agents
- Drugs used in ophthalmology
  - Agents used to treat glaucoma
  - Mydriatics and cycloplegics
  - Antiinfective and antiinflammatory agents used in ophthalmology
  - Miscellaneous ophthalmic preparations
- Otologic agents
  - Topical otic preparations
- Drugs used in neuromuscular disorders
  - Antiparkinsonism agents
  - Agents used in myasthenia gravis
- Diagnostic agents
  - Radiopaque media
  - Miscellaneous diagnostic aids
- Gastrointestinal agents
  - Antispasmodics
  - Antacids
  - Antidiarrheals
  - Laxatives and agents affecting fecal consistency
  - Anorectal preparations
  - Miscellaneous gastrointestinal agents
  - Emetics
  - Antiemetics
- Smooth muscle stimulants
  - Stimulants of gastrointestinal and urinary tracts
  - Oxytocics
- Oncolytic agents
  - Antineoplastic agents
- Immunologic agents
  - Vaccines, toxoids, and serologic agents
- Other agents
  - Chelating agents
  - Enzymes used as drugs
  - Miscellaneous drugs
  - Other and unclassified drugs

Based on the classification system (by chapter) used by the American Medical Association for the second edition of the *AMA Drug Evaluations.*[102]

Appendix B

Rules for Creating Episodes of Care From HIE Claims Data

This appendix documents two sets of rules used in creating clinical episodes of care from the HIE insurance claim files. We used two types of insurance forms, or Medical Expense Reports (MERs): a Physicians' Outpatient MER and a Pharmacy MER. The first section shows the rules for linking prescription drugs (billed on a Pharmacy MER) to a physician office visit or other outpatient setting (billed on the Physicians' MER); this ultimately led to a diagnosis being assigned to the drug prescription (Chapter 3). The second section describes the rules for linking all types of services into a single episode.

Linking Drugs to Outpatient Visits

Table B.1 outlines the data elements involved in a match type between a Pharmacy MER and a Physicians' Outpatient MER for linking drugs to visits as part of the episode-building process. Items on the same line within each match type (numbered in the first column) must match exactly or at least with the qualification shown (e.g., within plus or minus 2 days). NDC refers to the National Drug Code.

The following are rules adapted to information available on HIE insurance claims to form episodes of care. They are based on five basic diagnostic types. First, we divided the 150 HIE outpatient diagnostic categories* into three basic types: acute conditions; chronic conditions; and conditions that could be either acute or chronic. (See Table A.1 for the full list of 150 outpatient categories.)

We then created some basic rules using Treatment History Codes (THCs, Table B.2) to cover the majority of episodes. These rules used both THCs and time span between visits made for the same condition (same diagnosis, or different diagnosis but still within the same diagnostic grouping). We further designated all visits with THC = 6 as a fourth category: well care.

Some diagnostic categories had been intentionally omitted from the original four types; we called them "unspecified." These conditions took on the rules created for the "either" conditions. Hence, because episodes for "either" and "unspecified" conditions are formed according to the same rules, there is a total of four episode formation schemes for the five types of diagnoses.

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* The 150 diagnostic categories are a modification of the 92 "diagnosis clusters" developed by Schneeweiss et al.[41]

TABLE B.1. Match Types Between Pharmacy Claims and Physician Outpatient Claims

Match Type	Data From Pharmacy MER	Data From Physicians' Outpatient MER	Qualifications
1	Date of prescription Prescribing physician NDC code	Date of service/visit Billing physician NDC code	
2	Date of prescription Prescribing physician NDC code	Date of service/visit Billing physician NDC code	±2 days
3	Date of prescription Prescribing physician NDC code	Date of service/visit Billing physician NDC code	±14 days
4	Date of prescription NDC code	Date of service/visit NDC code	
5	Date of prescription NDC code	Date of service/visit NDC code	±2 days
6	Date of prescription NDC code	Date of service/visit NDC code	±14 days
7–12	Repeated the data elements and rules for match types 1–6, but matched on HIE therapeutic code rather than NDC.		
13	Date of prescription Prescribing physician	Date of service/visit Billing physician	
14	Date of prescription Prescribing physician	Date of service/visit Billing physician	±2 days
15	Date of prescription Prescribing physician	Date of service/visit Billing physician	±14 days
16	If the HIE therapeutic code was one of a set of specific "chronic drug codes" and the patient had had a Physicians' Outpatient MER with a diagnosis appropriate for the therapeutic code (e.g., HIE therapeutic code of antianginal agents and a MER listing angina pectoris), then the drug was assigned the diagnosis from the claim.		
17	Not used		
18	Date of purchase	Date of service/visit	
19	Date of prescription	Date of service/visit	
20	Prescribing physician NDC code	Billing physician NDC code	For closest visit

The second step in development and analysis of episodes was to "dump for review" by a physician all cases not handled by the original rules. When possible, we then created still more rules to cover these exceptions. In some instances, we established definite rules for certain time spans but dumped other time spans for a physician overread. For example, with an either diagnosis, if a visit with THC = 5 was followed by a visit with THC = 1 (noted 5-1 in all further examples), the following occurred: If the 1 appeared 0–30 days after the 5, it was the same episode; if it appeared 61 or more days after the 5, it was a new episode. We dumped all instances where the time between the visit with a 5 and the subsequent visit with a 1 was

TABLE B.2. Treatment History Codes (THCs)

1. Initial visit for acute condition
2. Initial visit for chronic condition
3. Repeat visit for acute condition
4. Repeat visit for chronic condition (routine)
5. Initial visit for flareup of a chronic condition
6. Well care or pregnancy-related
7. Repeat visit for flareup of a chronic condition
8. Acute; not specified as initial or repeat
9. Chronic; not specified as initial or repeat

The THC describes the patient's previous treatment, if any, for the diagnosis or problem. It is a composite of two factors, and it states: (1) whether the problem was acute, chronic, a chronic flareup, or well care or pregnancy-related; and (2) in the case of an acute or chronic problem, whether this was the initial visit or a repeat visit for the diagnosis or problem. This information was furnished by the provider's office.

31–60 days; these cases were examined individually by a physician who defined the specific episode. That is, the physician determined if the two visits were part of the same medical episode of care, or if the second visit initiated a new episode of care.

In some cases, alternate rules were established if a consistent pattern of physician's determinations appeared for the cases overread by the physician. In other instances, we used the original dump rules each time, so that there would be an opportunity to examine each borderline case individually.

Creating the Episodes

Preliminary Rules

We first created some preliminary rules to take precedence over the episode rules.

1. Any diagnosis with the THC = 6 was specified as a well-care visit, and the episode was defined as follows:

   6-6 One episode, no matter what time is between the visits†
   x-6 0–180 days: same episode; else, new episode
   .-6 >180 days: new episode
   6-x 0–180 days: same episode; else, new episode
   6-. >180 days, dump for examination

The following are based on diagnosis alone. (The visit must be in the same diagnosis grouping as the previous visit.)

2. If DXGRP = 51: <30 days, same episode; else, new episode.
3. If DXGRP = 111–115, 100–101, 124, 72: ≤60 days, same episode; else, new episode.
4. If DXGRP = 29–38, 133: ≤90 days, same episode; else, new episode.
5. If DXGRP = 69 or 124: If THC = 1, 3, 8, the diagnosis is acute.
   If THC = 2, 4, 5, 7, 9,., the diagnosis is either.

† A period indicates "missing"; x indicates any other THC.

6. If CRVS procedure category = 77 (no-charge surgical pre/postop visits), ≤60 days, same episode; else, new episode.

Episodes Created From Diagnosis and THC

The diagnostic groupings were first typed as acute, chronic, either, unspecified, and well care, and the last was specified first if they contained a THC = 6. Episode rules were then applied to each of the remaining four diagnostic types based on the THC and on the time between consecutive visits for the same diagnosis.

Acute Conditions

The following diagnostic categories were defined as acute conditions: 2, 3, 45, 52, 54, 69, 75, 76, 77, 79, 80, 81, 92, 103, 109, and 123–126.

The following are the 21 acute-condition rules (e.g., 1-1 with ≤ 14 days constitutes one rule):

THC	Rule
1 alone	single episode
1-1, 3-1, .-., .-1, 1-.	≤14 days, same episode >14 days, new episode
1-3, 3-3, 8-3, .-3, 3-.	≤30 days, same episode >30 days, new episode

If the following THCs appeared with an acute condition, they were changed as follows:

2 changed to 1
4 changed to 3
5 changed to 1
7 changed to 3
9 changed to 3

Either Conditions‡

The following were defined as "either" conditions because they can be either acute or chronic: 5, 14, 19–21, 29, 30, 39, 40, 41, 51, 65, 67, 71, 72, 73, 74, 86, 87, 88, 89, 91, 97, 99, 100, 101, 111, 113, 114, 118, 119, and 120. There are well over 100 possible rules (e.g., "THC 5-1 with 0–30 days = same episode" constitutes a single rule and "THC 5-1 with 61+ days = new episode" is a different rule). However, many were only rarely, if ever, encountered and are shown essentially for completeness.

THC	Rule
4s only 2-4 9-4	Recategorized as a chronic condition

‡ As noted in Appendix A (Table A.1), for some analyses certain of these conditions were arbitrarily created as chronic.

5 alone	Single episode
5-4	Episode ends with the 5
5-7-4	Episode ends with the 7
5-1, 3-7, 7-3, 7-4, 8-5, 1-2, 2-3, 3-5, 1-5, 1-7, 3-7, 7-1	0–30 days, same episode 31–60 days, dump for examination 61+ days, new episode
x-., 7-7, 3-3, 2-7, 5-7, 9-7, 4-4, .-., 3-4, 1-4	0–90 days, same episode 91+ days, new episode
1-1, 1-8, 8-1, 8-8	0–14 days, same episode 15+ days, new episode
.-2, .-4, .-5, .-7, .-8, .-9, 1-4, 4-1, 4-2, 5-2, 5-3, 5-9, 9-5, 9-9, 4-7, 2-1, 2-2, 2-3, 2-5	0–30 days, same episode 31–90 days, dump for examination 91+ days, new episode
4-7, .-3, 1-3, 3-1, 4-3, 5-5, 8-3, .-1	0–60 days, same episode 61+ days, new episode
Any remaining combination	0–14, same episode 15–90, dump for examination 91+, new episode

Chronic Conditions

The following were defined as chronic conditions: 9–11, 12, 15, 16, 17, 53, 57, 58, 59, 60–62, 82, 83, 108, 116, 117, 121.

An episode for a chronic condition is the entire study period.

Unspecified Conditions

The following were defined as "unspecified" diagnostic categories: 1, 4, 6, 7, 8, 13, 18, 22–28, 31–38, 42–44, 46–50, 55, 56, 63, 64, 66, 68, 70, 78, 84, 85, 90, 93–96, 98, 102, 104–107, 110, 112, 115, 122, and 127–150.

The episode rules for the "either" conditions (above) were applied to the "unspecified" conditions.

Appendix C

Observed Probabilities of an Episode of Care

This appendix contains 12 tables that present the number and percentages of individuals on the free and cost-sharing plans who had at least one episode of care for the diagnostic groups shown. These are "observed" probabilities (expressed as percentages) based on the individual's having filed at least one claim in year 2 for a visit or service for a given diagnosis or reason for care. Only those diagnostic categories for which a total of 2% of the subsample in question had received care in year 2 are shown

(i.e., only those categories that met the 2% sample size threshold mentioned in Chapter 4).

The tables also give the free:cost-sharing differential (cost-sharing as a percentage of free) and results of the *t*-test of the differences between plans. Footnoted values for *t*-statistics are those that remained significant (at $P < 0.10$, two-tailed test) even after the modified Bonferroni multiple comparisons correction was applied.[48] The largest number of comparisons for any one sample (which governs the starting point for calculating the modified correction) was the total number of diagnostic categories meeting the 2% threshold for that sample; it is equivalent to the sum of the individual diagnostic categories shown on any pair of tables. For instance, the largest number of comparisons made for all adults was 42, summing across Tables C.1 and C.2.

TABLE C.1. Number and Percentage of Adults With Any Episode of Care for Chronic Conditions and Well Care

Condition	Free Plan (N = 1,255)		Cost-sharing (N = 2,441)		Cost-sharing as % of Free	*t*-statistic
	N	%	N	%		
Diabetes	30	2.4	58	2.4	99	0.03
Hypertension	99	7.9	167	6.8	87	1.15
Peptic disease	30	2.4	48	2.0	82	0.83
Hay fever	47	3.7	65	2.7	71	1.73
Obesity	43	3.4	62	2.5	74	1.47
Anxiety neurosis	52	4.1	56	2.3	55	2.90
Depressive neurosis	47	3.7	62	2.5	68	1.94
Peripheral neuropathy and sciatica	40	3.2	35	1.4	45	3.18[a]
Headaches	53	4.2	74	3.0	72	1.79
Degenerative joint disease	45	3.6	50	2.0	57	2.57
Disc displacement	51	4.1	47	1.9	47	3.44[a]
Low back pain	64	5.1	75	3.1	60	2.85
Bursitis and fibrositis	82	6.5	126	5.2	79	1.66
Dislocations	44	3.5	59	2.4	69	1.80
Acute sprains and strains	58	4.6	87	3.6	77	1.51
Lacerations and contusions	130	10.4	161	6.6	64	3.78[a]
Other musculoskeletal diseases	76	6.1	104	4.3	70	2.28
Vision examination	281	22.4	440	18.0	81	3.10[a]
General medical examination	232	18.5	300	12.3	66	4.84[a]
Gynecologic examination[b]	81	12.3	150	11.3	92	0.62
Pre- and postnatal care[b]	60	9.1	104	7.8	86	0.95
Family planning	48	3.8	73	3.0	78	1.30
Cancer screening	29	2.3	59	2.4	105	−0.20

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 42).
[b] Data refer to women only.

TABLE C.2. Number and Percentage of Adults With Any Episode of Care for Acute and Other Conditions

Condition	Free Plan (N = 1,255) N	Free Plan (N = 1,255) %	Cost-sharing (N = 2,441) N	Cost-sharing (N = 2,441) %	Cost-sharing as % of Free	*t*-statistic
Influenza	47	3.7	44	1.8	48	3.24[a]
Acute URI	92	7.3	131	5.4	73	2.27
Acute pharyngitis	87	6.9	114	4.7	67	2.72
Acute bronchitis	53	4.2	80	3.3	78	1.41
Chest pain	60	4.8	61	2.5	52	3.36[a]
Abdominal pain	69	5.5	57	2.3	42	4.44[a]
Diarrhea and gastroenteritis	28	2.2	33	1.4	61	1.84
Nonfungal skin infections	46	3.7	46	1.9	51	2.98[a]
Rashes and other skin diseases	180	14.3	230	9.4	66	4.28[a]
Vaginitis and cervicitis[b]	87	13.2	95	7.2	54	4.37[a]
Urinary tract infection	68	5.4	80	3.3	60	2.92
Menstrual and menopausal disorders[b]	80	12.1	122	9.2	76	2.02
Other genitourinary diseases	32	2.5	56	2.3	90	1.11
Other eye diseases	45	3.6	87	3.6	99	0.04
Other ear diseases	46	3.7	74	3.0	83	1.00
Other gastrointestinal diseases	61	4.9	78	3.2	66	2.37
Other signs and symptoms	133	10.6	200	8.2	77	2.34
Other injuries and adverse effects	149	11.9	207	8.4	71	3.17[a]
Other operations and treatments	37	2.9	54	2.2	75	1.31

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 42).
[b] Data refer to women only.

TABLE C.3. Number and Percentage of Low-income Adults With Any Episode of Care for Chronic Conditions and Well Care

Condition	Free Plan (N = 476) N	Free Plan (N = 476) %	Cost-sharing (N = 846) N	Cost-sharing (N = 846) %	Cost-sharing as % of Free	*t*-statistic
Diabetes	8	1.7	20	2.4	141	−0.87
Hypertension	30	6.3	47	5.6	88	1.13
Peptic disease	7	1.5	20	2.4	161	−1.18
Hay fever	19	4.0	12	1.4	36	2.61
Obesity	11	2.3	27	3.2	138	−0.96
Anxiety neurosis	24	5.0	13	1.5	30	3.22[a]
Depressive neurosis	21	4.4	22	2.6	59	1.66
Other emotional disturbances	13	2.7	15	1.8	65	1.10
Chronic sinusitis	18	3.8	8	0.9	25	3.03[a]
Headaches	19	4.0	25	3.0	74	0.97
Vision examination	92	19.3	100	11.8	61	3.54[a]
General medical examination	81	17.0	77	9.1	53	3.99[a]
Gynecologic examination[b]	28	10.7	35	7.0	65	1.79
Pre- and postnatal care[b]	38	14.6	45	9.0	62	2.36
Family planning	18	3.8	30	3.5	94	1.09

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 39).
[b] Data refer to women only.

TABLE C.4. Number and Percentage of Low-income Adults With Any Episode of Care for Acute and Other Conditions

Condition	Free Plan (N = 476) N	Free Plan (N = 476) %	Cost-sharing (N = 846) N	Cost-sharing (N = 846) %	Cost-sharing as % of Free	*t*-statistic
Influenza	14	2.9	13	1.5	52	1.59
Acute URI	31	6.5	36	4.3	65	1.70
Acute pharyngitis	33	6.9	33	3.9	56	2.26
Acute bronchitis	19	4.0	19	2.2	56	1.69
Chest pain	21	4.4	15	1.8	40	2.53
Abdominal pain	31	6.5	23	2.7	52	3.01[a]
Nonfungal skin infections	14	2.9	12	1.4	48	1.74
Rashes and other skin diseases	61	12.8	62	7.3	57	3.09[a]
Vaginitis and cervicitis[b]	34	13.0	33	6.6	55	2.39
Urinary tract infection	24	5.0	26	3.1	61	1.69
Menstrual and menopausal disorders[b]	33	12.6	42	8.4	66	1.88
Degenerative joint disease	11	2.3	16	1.9	82	0.50
Low back pain	17	3.6	26	3.1	86	0.48
Bursitis and fibrositis	30	6.3	31	3.7	58	2.05
Dislocations	13	2.7	16	1.9	69	0.95
Acute sprains and strains	22	4.6	31	3.7	79	0.83
Lacerations and contusions	60	12.6	60	7.1	56	3.13[a]
Other musculoskeletal diseases	20	4.2	29	3.4	82	0.70
Other eye diseases	11	2.3	22	2.6	113	−0.33
Other ear diseases	14	2.9	24	2.8	96	0.11
Other gastrointestinal diseases	17	3.6	23	2.7	76	0.84
Other signs and symptoms	56	11.8	63	7.4	63	2.49
Other injuries	53	11.1	70	8.3	74	1.66
Other operations and treatments	11	2.3	14	1.7	72	0.80

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 39).
[b] Data refer to women only.

TABLE C.5. Number and Percentage of Nonpoor Adults With Any Episode of Care for Chronic Conditions and Well Care

Condition	Free Plan (N = 779) N	Free Plan (N = 779) %	Cost-sharing (N = 1,595) N	Cost-sharing (N = 1,595) %	Cost-sharing as % of Free	*t*-statistic
Diabetes	22	2.8	38	2.4	84	0.63
Hypertension	69	8.9	120	7.5	85	1.10
Peptic disease	23	3.0	28	1.8	59	1.74
Hay fever	28	3.6	53	3.3	92	0.34
Obesity	32	4.1	35	2.2	53	2.39
Thyroid disease	23	3.0	32	2.0	68	1.35
Anxiety neurosis	28	3.6	42	2.6	73	1.24
Depressive neurosis	26	3.3	40	2.5	75	1.10
Headaches	34	4.4	49	3.1	70	1.52
Peripheral neuropathy and sciatica	29	3.7	27	1.7	45	2.70
Vision examination	188	24.1	338	21.1	88	1.60
General medical examination	149	19.1	221	13.9	72	3.19[a]
Gynecologic examination[b]	53	13.3	114	13.8	104	−0.27
Pre- and postnatal care[b]	22	5.5	57	6.9	126	−0.94
Family planning	30	3.9	42	2.6	68	1.53
Cancer screening program	22	2.8	47	2.9	104	−0.17

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 45).
[b] Data refer to women only.

TABLE C.6. Number and Percentage of Nonpoor Adults With Any Episode of Care for Acute and Other Conditions

Condition	Free Plan (N = 779) N	Free Plan (N = 779) %	Cost-sharing (N = 1,595) N	Cost-sharing (N = 1,595) %	Cost-sharing as % of Free	t-statistic
Influenza	33	2.8	31	1.9	46	2.87
Acute URI	61	7.8	95	6.0	76	1.66
Acute pharyngitis	54	6.9	81	5.1	73	1.74
Acute bronchitis	34	4.4	61	3.8	88	0.62
Chest pain	37	4.7	46	2.9	61	2.15
Abdominal pain	38	4.9	34	2.1	44	3.22[a]
Acne	30	3.9	25	1.6	41	3.02
Nonfungal skin infections	32	4.1	34	2.1	52	2.48
Rashes and other skin diseases	118	15.1	166	10.4	69	3.17[a]
Vaginitis and cervicitis[b]	53	13.3	62	7.5	57	2.23
Urinary tract infection	44	5.6	54	3.4	60	2.40
Menstrual and menopausal disorders[b]	47	11.8	80	9.7	82	1.10
Other genitourinary diseases	20	2.6	43	2.7	105	−0.18
Degenerative joint disease	34	4.4	33	2.1	47	2.82
Disc displacement	35	4.5	36	2.3	50	2.69
Low back pain	45	5.8	46	2.9	50	3.09[a]
Bursitis and fibrositis	50	6.4	90	5.6	88	0.74
Dislocations	31	4.0	42	2.6	66	1.67
Acute sprains and strains	35	4.5	52	3.3	73	1.42
Lacerations and contusions	64	8.2	91	5.7	69	2.20
Fractures	25	3.2	27	1.7	53	2.14
Other musculoskeletal diseases	51	6.5	74	4.6	71	1.85
Other eye diseases	34	4.4	63	3.9	90	0.47
Other ear diseases	32	4.1	50	3.1	76	1.17
Other gastrointestinal diseases	43	5.5	55	3.4	62	2.21
Other signs and symptoms	74	9.5	137	8.6	90	0.72
Other injuries and adverse effects	90	11.6	130	8.2	71	2.55
Other operations and treatments	26	3.3	39	2.4	73	1.19
Benign and unspecified neoplasm	18	2.3	34	2.1	92	0.28

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 45).
[b] Data refer to women only.

TABLE C.7. Number and Percentage of Children With Any Episode of Care for Chronic Conditions and Well Care

Condition	Free Plan (N = 626) N	Free Plan (N = 626) %	Cost-sharing (N = 1,232) N	Cost-sharing (N = 1,232) %	Cost-sharing as % of Free	t-statistic
Hay fever	30	4.8	55	4.5	93	0.32
Child mental health programs	17	2.7	25	2.0	75	0.90
Congenital anomalies	13	2.1	27	2.2	106	−0.16
Viral exanthems	20	3.2	19	1.5	48	2.10
Otitis media, chronic	18	2.9	20	1.6	56	1.65
Vision examination	85	13.6	134	10.9	80	1.66
General medical examination	237	37.9	351	28.5	75	4.03[a]

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 24).

TABLE C.8. Number and Percentage of Children With Any Episode of Care for Acute or Other Conditions

Condition	Free Plan (N = 626) N	Free Plan (N = 626) %	Cost-sharing (N = 1,232) N	Cost-sharing (N = 1,232) %	Cost-sharing as % of Free	t-statistic
Otitis media, NOS	82	13.1	134	10.9	83	1.38
Otitis media, acute	39	6.2	39	3.2	51	2.82
Influenza	23	3.7	23	1.9	51	2.14
Acute URI	107	17.1	117	9.5	56	4.41[a]
Acute pharyngitis	86	13.7	135	11.0	80	1.70
Strep throat	33	5.3	32	2.6	49	2.67
Acute bronchitis	32	5.1	34	2.8	54	2.36
Diarrhea and gastroenteritis	26	4.2	25	2.0	49	2.38
Fever	16	2.6	25	2.0	79	0.70
Nonfungal skin infections	32	5.1	39	3.2	62	1.92
Rashes and other skin diseases	70	11.2	93	7.5	68	2.48
Fractures	19	3.0	23	1.9	62	1.49
Acute sprains and strains	18	2.9	36	2.9	102	−0.06
Lacerations and contusions	89	14.2	123	10.0	70	2.59
Other ear diseases	30	4.8	47	3.8	80	0.96
Other signs and symptoms	38	6.1	42	3.4	56	2.45
Other injuries	55	8.8	82	6.7	76	1.59

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 24).

TABLE C.9. Number and Percentage of Low-income Children With Any Episode of Care for Chronic Conditions and Well Care

Condition	Free Plan (N = 297) N	Free Plan (N = 297) %	Cost-sharing (N = 525) N	Cost-sharing (N = 525) %	Cost-sharing as % of Free	t-statistic
Hay fever	12	4.0	20	3.8	85	0.16
Child mental health problems	10	3.4	7	1.3	36	1.75
Viral exanthems	8	2.7	11	2.1	70	0.53
Vision examination	37	12.5	39	7.4	54	2.25
General medical examination	101	34.0	103	19.6	52	4.43[a]

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 20).

TABLE C.10. Number and Percentage of Low-income Children With Any Episode of Care for Acute and Other Conditions

Condition	Free Plan (N = 297) N	Free Plan (N = 297) %	Cost-sharing (N = 525) N	Cost-sharing (N = 525) %	Cost-sharing as % of Free	*t*-statistic
Otitis media, NOS	42	14.1	43	8.2	58	2.53
Otitis media, acute	19	6.4	15	2.9	45	2.22
Influenza	11	3.7	7	1.3	36	1.97
Acute URI	52	17.5	39	7.4	42	4.06[a]
Acute pharyngitis	38	12.8	36	6.9	54	2.66
Strep throat	14	4.7	6	1.1	24	2.72[a]
Acute bronchitis	16	5.4	13	2.5	45	1.97
Diarrhea and gastroenteritis	14	4.7	8	1.5	32	2.38
Nonfungal skin infections	13	4.4	16	3.0	70	0.95
Rashes and other skin diseases	29	9.8	29	5.5	57	2.13
Acute sprains and strains	12	4.0	7	1.3	33	2.17
Lacerations and contusions	57	19.2	40	7.6	40	4.52[a]
Other ear diseases	16	5.4	19	3.6	67	1.15
Other signs and symptoms	16	5.4	14	2.7	50	1.83
Other injuries	30	10.1	22	4.2	41	3.02[a]

[a] Significant at $P < 0.10$, two-tailed test, after multiple comparisons correction (number of comparisons = 20).

TABLE C.11. Number and Percentage of Nonpoor Children With Any Episode of Care for Chronic Conditions and Well Care

Condition	Free Plan (N = 329) N	Free Plan (N = 329) %	Cost-sharing (N = 707) N	Cost-sharing (N = 707) %	Cost-sharing as % of Free	*t*-statistic
Hay fever	18	5.5	35	5.0	90	0.35
Congenital anomalies	10	3.0	24	3.4	112	−0.31
Child mental health problems	7	2.1	18	2.5	120	−0.42
Vision examination	48	14.6	94	13.3	91	0.56
General medical examination	136	41.3	248	35.1	85	1.92

TABLE C.12. Number and Percentage of Nonpoor Children With Any Episode of Care for Acute or Other Conditions

Condition	Free Plan (N = 329) N	Free Plan (N = 329) %	Cost-sharing (N = 707) N	Cost-sharing (N = 707) %	Cost-sharing as % of Free	*t*-statistic
Otitis media, NOS	40	12.2	90	12.7	105	−0.26
Otitis media, acute	20	6.1	24	3.4	56	1.81
Otitis media, chronic	11	3.3	12	1.7	51	1.49
Influenza	12	3.6	16	2.3	62	1.18
Acute URI	55	16.7	78	11.0	66	2.40
Acute pharyngitis	48	14.6	98	13.9	95	0.31
Strep throat	19	5.8	26	3.7	64	1.43
Acute bronchitis	16	4.9	21	3.0	61	1.41
Acute middle respiratory infection	4	1.2	13	1.8	151	−0.79
Pneumonia	12	3.6	14	2.0	54	1.44
Fever	8	2.4	20	2.8	116	−0.37
Conjunctivitis and keratitis	6	1.8	17	2.4	132	−0.62
Diarrhea and gastroenteritis	12	3.6	17	2.4	66	1.05
Nonfungal skin infections	19	5.8	23	3.3	56	1.74
Rashes and other skin diseases	41	12.5	64	9.1	73	1.61
Urinary tract infection	10	3.0	14	2.0	65	0.98
Fractures	9	2.7	19	2.7	98	0.04
Acute sprains and strains	6	1.8	29	4.1	225	−2.17
Lacerations and contusions	32	9.7	82	11.6	119	−0.92
Other musculoskeletal diseases	8	2.4	13	1.8	76	0.60
Other ear diseases	14	4.3	28	4.0	93	0.22
Other eye diseases	6	1.8	16	2.3	124	−0.47
Other gastrointestinal diseases	11	3.3	14	2.0	59	1.22
Other signs and symptoms	22	6.7	28	4.0	59	1.75
Other injuries	25	7.6	58	8.2	108	−0.34

Appendix D

Logistic Regressions

This appendix presents the full logistic regression equations that were used for the predictions in Chapter 4 and Chapter 5. The variables are the same as those defined in Table 4.1, except that the interaction terms are included here (in List D.1). An asterisk (*) indicates multiplication. Specifically, Cost*Low is the interaction of cost-sharing with being of low income; Cost*Adult is the interaction of cost-sharing with being 14 years of age and older; Low*Adult is the interaction of low income with being adult; and Cost*Low*Adult is the full, three-way interaction. Male*Adult is self-explanatory.

The dependent variable in each regression was the probability of an episode of care in year 2 of the study for the specific diagnostic category or effectiveness grouping. The table title gives the diagnostic category; for instance, Table D.1 is the regression for general medical examination. Shown are the logistic coefficients, the standard deviation of the coefficient, the t-statistic related to each variable, and an indication of whether the t-statistic was significant (at $P < 0.05$).

LIST D.1. Names and Definitions of Variables in Logistic Regressions for Specific Diagnoses and Medical Effectiveness Categories

Variable Name	Variable Definition
Cost	An indicator variable equal to 1 if the participant was assigned to one of the cost-sharing plans.
Low	An indicator variable indicating that the person belonged to a poor (low-income) family. Poor was defined as being at or below the 33rd percentile of the distribution of an income variable that was adjusted for family size and composition and for site.
Adult	An indicator variable for participants 14 years of age or older.
Age	The age of the participant at the start of his or her second year of enrollment.
Age-squared	The square of age.
Male	An indicator variable equal to 1 if the participant was male (0 if female).
White	An indicator variable equal to 1 if the participant was white (0 if nonwhite).
GHRI	General Health Ratings Index measured at enrollment. GHRI is a favorably scored 22-item scale for adults (7-item scale for children and completed by parents) that is transformed to a 0–100 scale; higher scores represent a better self-rating of one's health.[50]
Seattle	An indicator variable for participants in the Seattle, Washington site.
Fitchburg	An indicator variable for participants in the Fitchburg, Massachusetts site.
Franklin	An indicator variable for participants in the Franklin County, Massachusetts site.
Charleston	An indicator variable for participants in the Charleston, South Carolina site.
Georgetown	An indicator variable for participants in the Georgetown County, South Carolina site.
Male*Adult	An indicator for the interaction of being male and an adult (14 years of age and older).
Cost*Low	An indicator for the interaction of being of low income and on a cost-sharing plan.
Cost*Adult	An indicator for the interaction of being an adult and on a cost-sharing plan.
Low*Adult	An indicator for the interaction of being of low income and being an adult.
Cost*Low*Adult	An indicator for the three-way interaction of being of low income, an adult, and on a cost-sharing plan.

TABLE D.1. Logistic Regression Data: General Medical Examination

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−5.8836E−01	3.515E−01	−1.67
Cost	−4.1389E−01	1.748E−01	−2.37[a]
Low	−4.3574E−01	2.240E−01	−1.95
Adult	3.7637E−01	2.293E−01	1.64
Cost*Low	−1.6732E−01	2.767E−01	−0.60
Cost*Adult	−1.1943E−02	2.014E−01	−0.06
Low*Adult	3.4299E−01	2.579E−01	1.33
Cost*Low*Adult	−1.4165E−01	3.352E−01	−0.42
Age	−1.1437E−01	1.356E−02	−8.43[a]
Age-squared	1.4943E−03	1.856E−04	8.05[a]
Male	2.0420E−01	1.063E−01	1.92
White	8.0652E−01	1.754E−01	4.60[a]
GHRI	6.0171E−03	2.714E−03	2.22
Seattle	−5.2025E−01	1.328E−01	−3.92[a]
Fitchburg	1.1943E−01	1.529E−01	0.78
Franklin	1.5760E−01	1.380E−01	1.14
Charleston	−3.4251E−01	1.736E−01	−1.97[a]
Georgetown	−7.7045E−01	1.680E−01	−4.59[a]
Male*Adult	−8.4787E−01	1.451E−01	−5.84[a]

[a] Significant at $P < 0.05$.

TABLE D.2. Logistic Regression Data: Vision Examination and Refraction

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−1.7781E+00	3.375E−01	−5.27[a]
Cost	−1.4265E−01	2.230E−01	−0.64
Low	−1.3359E−01	2.827E−01	−0.47
Adult	−5.7360E−01	2.777E−01	−2.07[a]
Cost*Low	−4.1259E−01	3.777E−01	−1.09[a]
Cost*Adult	−3.8857E−02	2.391E−01	−0.16
Low*Adult	6.9663E−02	3.053E−01	0.23
Cost*Low*Adult	−9.0750E−02	4.069E−01	−0.22
Age	8.0918E−02	1.551E−02	5.22[a]
Age-squared	−8.1388E−04	2.035E−04	−4.00[a]
Male	−2.4041E−01	1.441E−01	−1.67
White	2.9285E−01	1.536E−01	1.91
GHRI	−6.0734E−03	2.592E−03	−2.34[a]
Seattle	−3.8075E−01	1.319E−01	−2.89[a]
Fitchburg	−1.0360E−01	1.530E−01	−0.68
Franklin	1.2087E−01	1.405E−01	0.86
Charleston	−4.5388E−01	1.733E−01	−2.62[a]
Georgetown	−4.4225E−01	1.569E−01	−2.82[a]
Male*Adult	−1.5957E−01	1.672E−01	−0.95

[a] Significant at $P < 0.05$.

TABLE D.3. Logistic Regression Data: Hay Fever

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−1.9160E+00	6.615E−01	−2.90[a]
Cost	−1.6722E−01	3.162E−01	−0.53
Low	−1.5380E−01	4.201E−01	−0.37
Adult	3.5602E−01	4.541E−01	0.78
Cost*Low	2.6373E−01	5.148E−01	0.51
Cost*Adult	9.8658E−02	3.743E−01	0.26
Low*Adult	3.8609E−01	5.164E−01	0.75
Cost*Low*Adult	−1.1807E+00	6.803E−01	−1.74
Age	−2.8708E−02	2.607E−02	−1.10
Age-squared	1.1338E−04	3.741E−04	0.30
Male	6.4816E−01	2.359E−01	2.75[a]
White	1.4181E+00	3.901E−01	3.64[a]
GHRI	−2.5719E−02	4.428E−03	−5.81[a]
Seattle	4.1141E−03	2.011E−01	0.02
Fitchburg	−1.0437E+00	3.080E−01	−3.39[a]
Franklin	−1.2617E+00	3.077E−01	−4.10[a]
Charleston	−6.2950E−01	2.966E−01	−2.12[a]
Georgetown	−6.8396E−01	3.299E−01	−2.07[a]
Male*Adult	−8.8633E−01	3.029E−01	−2.93[a]

[a] Significant at $P < 0.05$.

TABLE D.4. Logistic Regression Data: Hypertension

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−4.6682E+00	1.083E+00	−4.31[a]
Cost	−6.7386E−02	1.666E−01	−0.40
Low	−9.0875E−02	2.507E−01	−0.36
Cost*Low	−2.2953E−01	3.146E−01	−0.73
Age	1.2738E−01	4.742E−02	2.69[a]
Age-squared	−4.9880E−04	5.440E−04	−0.92
Male	−2.1294E−01	1.395E−01	−1.53
White	−6.3778E−01	2.044E−01	−3.12[a]
GHRI	−2.2459E−02	4.405E−03	−5.10[a]
Seattle	−1.3858E−01	2.151E−01	−0.64
Fitchburg	1.1456E−01	2.495E−01	0.46
Franklin	6.0114E−02	2.480E−01	0.24
Charleston	2.8953E−02	2.439E−01	0.12
Georgetown	2.5185E−01	2.188E−01	1.15

[a] Significant at $P < 0.05$.

TABLE D.5. Logistic Regression Data: Obesity

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−3.9377E+00	1.285E+00	−3.06[a]
Cost	−7.4128E−01	2.519E−01	−2.94[a]
Low	−5.3008E−01	4.153E−01	−1.28
Cost*Low	1.1445E+00	4.852E−01	2.36[a]
Age	1.6112E−01	5.654E−02	2.85[a]
Age-squared	−2.1391E−03	7.549E−04	−2.83[a]
Male	−8.4813E−01	2.202E−01	−3.85[a]
White	2.3644E−01	4.016E−01	0.59
GHRI	−1.7449E−02	6.675E−03	−2.61[a]
Seattle	−5.0501E−01	2.870E−01	−1.76
Fitchburg	−6.6024E−01	3.545E−01	−1.86
Franklin	−1.0658E+00	3.925E−01	−2.72[a]
Charleston	−5.4612E−01	3.730E−01	−1.46
Georgetown	−2.1641E+00	5.653E−01	−3.83[a]

[a] Significant at $P < 0.05$.

TABLE D.6. Logistic Regression Data: Skin Rashes and Other Skin Diseases

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−1.3198E+00	3.982E−01	−3.31[a]
Cost	−3.5375E−01	2.316E−01	−1.53
Low	−1.6808E−01	2.809E−01	−0.60
Adult	3.4189E−01	3.087E−01	1.11
Cost*Low	−2.0818E−01	3.827E−01	−0.54
Cost*Adult	−7.4328E−02	2.599E−01	−0.29
Low*Adult	1.1211E−01	3.315E−01	0.34
Cost*Low*Adult	−1.3070E−02	4.421E−01	−0.03
Age	−1.0358E−02	1.757E−02	−0.59
Age-squared	1.2462E−04	2.376E−04	0.52
Male	−1.8350E−01	1.704E−01	−1.08
White	6.1362E−01	1.806E−01	3.40[a]
GHRI	−1.1669E−02	3.040E−03	−3.84[a]
Seattle	1.9999E−01	1.345E−01	1.49
Fitchburg	−6.5040E−03	1.662E−01	−0.04
Franklin	−1.7792E−01	1.578E−01	−1.13
Charleston	−3.9061E−01	1.820E−01	−2.15[a]
Georgetown	−6.3917E−01	1.797E−01	−3.56[a]
Male*Adult	−3.1891E−01	2.007E−01	−1.59

[a] Significant at $P < 0.05$.

TABLE D.7. Logistic Regression Data: Acute Upper Respiratory Infection

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	3.3762E−01	3.949E−01	0.85
Cost	−5.2245E−01	2.113E−01	−2.47[a]
Low	3.6608E−02	2.604E−01	0.14
Adult	4.5461E−01	2.858E−01	1.59
Cost*Low	−3.3789E−01	3.345E−01	−1.01
Cost*Adult	2.6222E−01	2.722E−01	0.96
Low*Adult	−1.7192E−01	3.368E−01	−0.51
Cost*Low*Adult	1.4270E−01	4.417E−01	0.32
Age	−1.2693E−01	1.869E−02	−6.79[a]
Age-squared	1.5287E−03	2.594E−04	5.89[a]
Male	−1.5585E−01	1.486E−01	−1.05
White	7.7097E−01	1.850E−01	4.17[a]
GHRI	−1.8542E−02	3.315E−03	−5.59[a]
Seattle	−2.7258E−01	1.729E−01	−1.58
Fitchburg	−6.9201E−01	2.199E−01	−3.15[a]
Franklin	−8.9223E−01	2.185E−01	−4.08[a]
Charleston	−3.5885E−01	2.002E−01	−1.79
Georgetown	−4.4876E−02	1.838E−01	−0.24
Male*Adult	−1.5683E−01	2.091E−01	−0.75

[a] Significant at $P < 0.05$.

TABLE D.8. Logistic Regression Data: Acute Pharyngitis

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−6.0883E−01	4.199E−01	−1.45
Cost	−2.4338E−01	2.031E−01	−1.20
Low	−2.1299E−01	2.710E−01	−0.79
Adult	3.2196E−01	2.839E−01	1.13
Cost*Low	−4.3317E−01	3.446E−01	−1.26
Cost*Adult	−1.7565E−01	2.525E−01	−0.70
Low*Adult	1.7791E−01	3.329E−01	0.53
Cost*Low*Adult	1.8051E−01	4.450E−01	0.41
Age	−7.6941E−02	1.744E−02	−4.41[a]
Age-squared	5.2152E−04	2.659E−04	1.96
Male	−1.6870E−01	1.453E−01	−1.16
White	1.0147E+00	2.181E−01	4.65[a]
GHRI	−1.1845E−02	3.435E−03	−3.45[a]
Seattle	−2.6649E−02	1.574E−01	−0.17
Fitchburg	−1.8947E−01	1.984E−01	−0.96
Franklin	−5.3229E−01	1.900E−01	−2.80[a]
Charleston	−3.5173E−01	2.232E−01	−1.58
Georgetown	−2.2351E−01	1.881E−01	−1.19
Male*Adult	−1.8673E−01	1.936E−01	−0.96

[a] Significant at $P < 0.05$.

TABLE D.9. Logistic Regression Data: Otitis Media

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−1.3272E+00	5.415E−01	−2.45[a]
Cost	−7.4803E−02	2.091E−01	−0.36
Low	8.1379E−02	2.495E−01	0.33
Adult	−2.8605E−02	4.108E−01	−0.07
Cost*Low	−4.2715E−01	3.262E−01	−1.31
Cost*Adult	2.8380E−01	3.783E−01	0.75
Low*Adult	5.9263E−01	4.875E−01	1.22
Cost*Low*Adult	−6.0665E−01	6.215E−01	−0.98
Age	−2.2289E−01	1.998E−02	−11.16[a]
Age-squared	2.7991E−03	2.916E−04	9.60[a]
Male	−5.0740E−02	1.437E−01	−0.35
White	2.1443E+00	3.294E−01	6.51[a]
GHRI	−1.4342E−02	4.217E−03	−3.40[a]
Seattle	1.6117E−01	2.084E−01	0.77
Fitchburg	4.0441E−02	2.390E−01	0.17
Franklin	−1.8421E−01	2.340E−01	−0.79
Charleston	2.1841E−01	2.608E−01	0.84
Georgetown	3.5081E−01	2.334E−01	1.50
Male*Adult	−4.3165E−02	2.898E−01	−0.15

[a] Significant at $P < 0.05$.

TABLE D.10. Logistic Regression Data: Diarrhea and Gastroenteritis

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−9.0150E−01	9.210E−01	−0.98
Cost	−4.0510E−01	3.888E−01	−1.04
Low	2.4515E−01	3.894E−01	0.63
Cost*Low	−6.4576E−01	6.474E−01	−1.00
Age	−4.0430E−01	1.181E−01	−3.42[a]
Age-squared	1.6780E−02	8.434E−03	1.99[a]
Male	−1.3110E−01	2.824E−01	−0.46
White	5.7391E−01	5.900E−01	0.97
GHRI	−1.3153E−02	8.332E−03	−1.58
Seattle	−4.1463E−01	4.443E−01	−0.93
Fitchburg	−5.3262E−01	6.198E−01	−0.86
Franklin	−8.0627E−01	5.208E−01	−1.55
Charleston	−3.2971E−03	4.658E−01	−0.01
Georgetown	−3.4001E−01	5.184E−01	−0.66

[a] Significant at $P < 0.05$.

TABLE D.11. Logistic Regression Data: Vaginitis and Cervicitis

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−2.5525E+00	8.526E−01	−2.99[a]
Cost	−7.1594E−01	2.040E−01	−3.51[a]
Low	5.7992E−02	2.649E−01	0.22
Cost*Low	−9.9312E−02	3.498E−01	−0.28
Age	1.2218E−01	4.513E−02	2.71[a]
Age-squared	−2.3685E−03	6.939E−04	−3.41[a]
White	6.7357E−01	2.712E−01	2.48[a]
GHRI	−1.0555E−02	5.360E−03	−1.97[a]
Seattle	1.4000E−01	2.164E−01	0.65
Fitchburg	−1.1274E+00	3.453E−01	−3.26[a]
Franklin	−1.0621E+00	3.098E−01	−3.43[a]
Charleston	−7.2331E−01	3.149E−01	−2.30[a]
Georgetown	−1.9401E−01	2.551E−01	−0.76

[a] Significant at $P < 0.05$.

TABLE D.12. Logistic Regression Data: Lacerations, Contusions, and Abrasions

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−2.5436E+00	4.370E−01	−5.82[a]
Cost	1.5883E−01	2.326E−01	0.68
Low	8.0542E−01	2.481E−01	3.25[a]
Adult	3.8923E−01	3.204E−01	1.21
Cost*Low	−1.0867E+00	3.241E−01	−3.35[a]
Cost*Adult	−5.2480E−01	2.747E−01	−1.91
Low*Adult	−3.2641E−01	3.047E−01	−1.07
Cost*Low*Adult	8.3187E−01	4.034E−01	2.06[a]
Age	−3.0313E−02	1.745E−02	−1.74
Age-squared	2.4463E−04	2.490E−04	0.98
Male	4.5196E−01	1.533E−01	2.95[a]
White	1.1315E+00	2.099E−01	5.39[a]
GHRI	−1.0070E−02	3.261E−03	−3.09[a]
Seattle	1.0562E−01	1.576E−01	0.67
Fitchburg	5.4251E−01	1.674E−01	3.24[a]
Franklin	2.1773E−01	1.666E−01	1.31
Charleston	−2.3062E−01	2.077E−01	−1.11
Georgetown	−2.5383E−01	2.027E−01	−1.25
Male*Adult	−2.5365E−01	1.927E−01	−1.32

[a] Significant at $P < 0.05$.

TABLE D.13. Logistic Regression Data: Acute Sprains and Strains

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−4.3930E+00	6.838E−01	−6.42[a]
Cost	8.0804E−01	4.558E−01	1.77
Low	8.6101E−01	5.076E−01	1.70
Adult	4.6660E−01	5.757E−01	0.81
Cost*Low	−1.9394E+00	6.598E−01	−2.94[a]
Cost*Adult	−1.0823E+00	5.045E−01	−2.15[a]
Low*Adult	−8.2106E−01	5.657E−01	−1.45
Cost*Low*Adult	1.9679E+00	7.444E−01	2.64[a]
Age	5.4356E−02	3.302E−02	1.65
Age-squared	−9.2758E−04	4.615E−04	−2.01[a]
Male	−6.9437E−02	2.739E−01	−0.25
White	2.7095E−01	2.651E−01	1.02
GHRI	−2.6746E−03	5.647E−03	−0.47
Seattle	−5.4556E−04	2.335E−01	−0.00
Fitchburg	4.9275E−01	2.509E−01	1.96
Franklin	3.1486E−01	2.295E−01	1.37
Charleston	−2.6038E−01	3.046E−01	−0.85
Georgetown	−5.8587E−02	2.729E−01	−0.21
Male*Adult	2.6569E−01	3.209E−01	0.83

[a] Significant at $P < 0.05$.

TABLE D.14. Logistic Regression Data: Other Injuries and Adverse Effects

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−3.1954E+00	4.441E−01	−7.20[a]
Cost	1.4471E−01	2.628E−01	0.55
Low	3.7274E−01	2.969E−01	1.26
Adult	5.7748E−01	3.389E−01	1.70
Cost*Low	−1.0404E+00	4.028E−01	−2.58[a]
Cost*Adult	−5.1954E−01	2.827E−01	−1.84
Low*Adult	−4.0119E−01	3.311E−01	−1.21
Cost*Low*Adult	1.1349E+00	4.509E−01	2.52[a]
Age	4.5323E−03	1.913E−02	0.24
Age-squared	−1.2119E−04	2.642E−04	−0.46
Male	3.5186E−01	1.836E−01	1.92
White	1.0815E+00	2.265E−01	4.78[a]
GHRI	−9.5657E−03	3.289E−03	−2.91[a]
Seattle	2.8834E−01	1.612E−01	1.79
Fitchburg	5.9485E−01	1.705E−01	3.49[a]
Franklin	3.0971E−01	1.745E−01	1.78
Charleston	−2.6461E−01	2.293E−01	−1.15
Georgetown	3.6800E−01	2.056E−01	1.79
Male*Adult	−1.9378E−01	2.111E−01	−0.92

[a] Significant at $P < 0.05$.

TABLE D.15. Logistic Regression Data: Medical Care Highly Effective for Acute Conditions

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	1.8777E−01	3.024E−01	0.62
Cost	−2.4192E−01	1.653E−01	−1.46
Low	1.9318E−01	2.004E−01	0.96
Adult	8.0207E−01	2.094E−01	3.83[a]
Cost*Low	−5.9172E−01	2.554E−01	−2.32[a]
Cost*Adult	−2.2112E−01	1.836E−01	−1.20
Low*Adult	−1.1822E−01	2.317E−01	−0.51
Cost*Low*Adult	3.4427E−01	2.994E−01	1.15
Age	−6.4983E−02	1.241E−02	−5.24[a]
Age-squared	6.5790E−04	1.710E−04	3.85[a]
Male	1.9027E−01	1.131E−01	1.68
White	9.4341E−01	1.336E−01	7.06[a]
GHRI	−1.6139E−02	2.396E−03	−6.74[a]
Seattle	4.8936E−02	1.057E−01	0.46
Fitchburg	−1.9760E−02	1.264E−01	−0.16
Franklin	−3.6847E−01	1.282E−01	−2.87[a]
Charleston	−5.7018E−01	1.437E−01	−3.97[a]
Georgetown	−3.7137E−01	1.277E−01	−2.91[a]
Male*Adult	−6.2219E−01	1.418E−01	−4.39[a]

[a] Significant at $P < 0.05$.

TABLE D.16. Logistic Regression Data: Medical Care Highly Effective for Acute or Chronic Conditions

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	5.3006E−01	3.113E−01	1.70
Cost	−1.2008E−01	1.804E−01	−0.67
Low	4.5068E−02	2.263E−01	0.20
Adult	7.7353E−01	2.317E−01	3.34[a]
Cost*Low	−2.9168E−01	2.944E−01	−0.99
Cost*Adult	−7.3216E−02	2.060E−01	−0.36
Low*Adult	1.2661E−01	2.725E−01	0.46
Cost*Low*Adult	−8.8639E−03	3.499E−01	−0.03
Age	−1.1399E−01	1.359E−02	−8.39[a]
Age-squared	1.6023E−03	1.826E−04	8.77[a]
Male	−1.7209E−01	1.346E−01	−1.28
White	7.4918E−01	1.495E−01	5.01[a]
GHRI	−2.0458E−02	2.518E−03	−8.13[a]
Seattle	−7.1591E−02	1.209E−01	−0.59
Fitchburg	−5.1711E−01	1.487E−01	−3.48[a]
Franklin	−5.6458E−01	1.467E−01	−3.85[a]
Charleston	−3.5320E−01	1.640E−01	−2.15[a]
Georgetown	−2.7579E−02	1.437E−01	−0.19
Male*Adult	−4.3017E−01	1.670E−01	−2.58[a]

[a] Significant at $P < 0.05$.

TABLE D.17. Logistic Regression Data: Medical Care Highly Effective for Chronic Conditions

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−7.2720E−01	4.697E−01	−1.55
Cost	−9.4208E−01	3.672E−01	−2.57[a]
Low	−5.1470E−01	4.750E−01	−1.08
Adult	−5.4035E−01	4.125E−01	−1.31
Cost*Low	6.1990E−01	6.092E−01	1.02
Cost*Adult	7.5946E−01	3.907E−01	1.94
Low*Adult	4.2246E−01	4.933E−01	0.86
Cost*Low*Adult	−7.5766E−01	6.440E−01	−1.18
Age	2.5542E−02	2.364E−02	1.08
Age-squared	4.8677E−04	2.948E−04	1.65
Male	1.5681E−01	2.845E−01	0.55
White	−2.3712E−01	1.669E−01	−1.42
GHRI	−2.6426E−02	3.230E−03	−8.18[a]
Seattle	−8.4453E−02	1.645E−01	−0.51
Fitchburg	−3.6750E−01	1.894E−01	−1.94
Franklin	−4.6621E−01	1.927E−01	−2.42[a]
Charleston	−5.5865E−01	1.917E−01	−2.91[a]
Georgetown	−8.6007E−02	1.688E−01	−0.51
Male*Adult	−5.4967E−01	3.057E−01	−1.80

[a] Significant at $P < 0.05$.

TABLE D.18. Logistic Regression Data: Medical Care Quite Effective

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−3.9863E−01	3.074E−01	−1.30
Cost	−1.4698E−01	1.785E−01	−0.82
Low	−3.8592E−02	2.347E−01	−0.16
Adult	9.1546E−01	2.363E−01	3.87[a]
Cost*Low	−4.3927E−01	2.925E−01	−1.50
Cost*Adult	−8.8897E−02	2.082E−01	−0.43
Low*Adult	8.5512E−02	2.836E−01	0.30
Cost*Low*Adult	−1.0765E−03	3.501E−01	−0.00
Age	−4.8744E−02	1.315E−02	−3.71[a]
Age-squared	5.1465E−04	1.804E−04	2.85[a]
Male	2.8114E−02	1.243E−01	0.23
White	8.8762E−01	1.452E−01	6.11[a]
GHRI	−1.3778E−02	2.490E−03	−5.53[a]
Seattle	1.5593E−01	1.112E−01	1.40
Fitchburg	−4.2793E−01	1.362E−01	−3.14[a]
Franklin	−4.0749E−01	1.302E−01	−3.13[a]
Charleston	−4.0568E−01	1.554E−01	−2.61[a]
Georgetown	−1.9536E−01	1.388E−01	−1.41
Male*Adult	−1.0076E+00	1.550E−01	−6.50[a]

[a] Significant at $P < 0.05$.

TABLE D.19. Logistic Regression Data: Medical Care Less Effective

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−1.6855E+00	3.510E−01	−4.80[a]
Cost	−9.4334E−03	2.201E−01	−0.04
Low	2.3949E−01	2.512E−01	0.95
Adult	8.0083E−01	2.659E−01	3.01[a]
Cost*Low	−8.2012E−01	3.319E−01	−2.47[a]
Cost*Adult	−3.5239E−01	2.297E−01	−1.53
Low*Adult	−3.5725E−01	2.787E−01	−1.28
Cost*Low*Adult	7.4516E−01	3.705E−01	2.01[a]
Age	−7.9195E−03	1.456E−02	−0.54
Age-squared	2.4074E−04	1.933E−04	1.25
Male	4.4987E−01	1.576E−01	2.85[a]
White	7.9178E−01	1.662E−01	4.76[a]
GHRI	−1.5116E−02	2.455E−03	−6.16[a]
Seattle	1.1361E−01	1.236E−01	0.92
Fitchburg	1.3427E−01	1.453E−01	0.92
Franklin	1.4781E−03	1.389E−01	0.01
Charleston	−4.2984E−01	1.648E−01	−2.61[a]
Georgetown	−3.2004E−02	1.489E−01	−0.21
Male*Adult	−4.3393E−01	1.758E−01	−2.47[a]

[a] Significant at $P < 0.05$.

TABLE D.20. Logistic Regression Data: Medical Care Rarely Effective

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	−1.0789E+00	4.459E−01	−2.42[a]
Cost	−5.8411E−01	3.081E−01	−1.90
Low	−4.0755E−01	3.955E−01	−1.03
Adult	3.6698E−01	3.907E−01	0.94
Cost*Low	4.0848E−01	5.158E−01	0.79
Cost*Adult	2.1427E−01	3.341E−01	0.64
Low*Adult	4.8827E−01	3.995E−01	1.22
Cost*Low*Adult	−5.3246E−01	5.388E−01	−0.99
Age	2.7465E−03	2.131E−02	0.13
Age-squared	1.4537E−04	2.802E−04	0.52
Male	−3.9415E−01	2.498E−01	−1.58
White	2.0910E−01	1.964E−01	1.06
GHRI	−1.6954E−02	3.249E−03	−5.22[a]
Seattle	−2.7147E−01	1.562E−01	−1.74
Fitchburg	−7.4789E−01	1.884E−01	−3.97[a]
Franklin	−6.5093E−01	1.952E−01	−3.33[a]
Charleston	−9.9361E−01	2.349E−01	−4.23[a]
Georgetown	−2.2117E−01	1.802E−01	−1.23
Male*Adult	−2.8236E−01	2.774E−01	−1.02

[a] Significant at $P < 0.05$.

TABLE D.21. Logistic Regression Data: Medical Care Rarely Effective But Self-care Effective

Variable	Coefficient	Standard Deviation	*t*-statistic
Intercept	9.5084E−01	2.780E−01	3.42
Cost	−4.2377E−01	1.661E−01	−2.55
Low	−2.0358E−02	2.080E−01	−0.10
Adult	4.0228E−01	1.988E−01	2.02
Cost*Low	−4.4572E−01	2.579E−01	−1.73
Cost*Adult	1.6419E−02	1.847E−01	0.09
Low*Adult	1.6804E−02	2.299E−01	0.07
Cost*Low*Adult	3.0271E−01	2.893E−01	1.05
Age	−4.6044E−02	1.186E−02	−3.88
Age-squared	6.7283E−04	1.606E−04	4.19
Male	−1.1114E−01	1.128E−01	−0.99
White	7.5947E−01	1.177E−01	6.46
GHRI	−1.9470E−02	2.073E−03	−9.39
Seattle	−9.4931E−02	1.047E−01	−0.91
Fitchburg	−3.5293E−01	1.240E−01	−2.85
Franklin	−4.0132E−01	1.169E−01	−3.43
Charleston	−4.7406E−01	1.323E−01	−3.58
Georgetown	−3.2756E−01	1.228E−01	−2.67
Male*Adult	−3.2225E−01	1.310E−01	−2.46

Appendix E

Episode Size for Selected Diagnoses by Plan

The six tables in this appendix present data on episode size or intensity by insurance plan. They were compiled to determine whether cost-sharing affected the amount of care the HIE participant received for a particular condition or reason for visit, once he or she had gained access to the medical system and thus initiated an episode of care.

Methods

As before, the data base is year 2 HIE claims across all six sites. Here, per-episode rates are given separately by plan for adults and children and poor and nonpoor.

These tables feature conditions for which 2% or more of the subsample of interest (e.g., low-income children) sought care *and* for which the difference between the free and cost-sharing plans in the observed (not predicted) probabilities of medical contact was statistically significant ($P < 0.05$). In all but one case, these differences favored the free plan; the only departure is for high-income children, for whom the probability of

an episode of care for acute sprains and strains was significantly higher on the nonfree plans. For cross-reference, they are the conditions listed in Tables 4.3 and 4.4 of the text and highlighted in Appendix C.

Included are office visits, procedures and tests, and drugs; the latter are split into purchased (prescription) drugs, shown as the main entry, and injected drugs, shown in brackets. In these tables, any entry of 0.0 means that the per-episode rate was positive but less than 0.05; a dash (—) indicates that no service of that type was observed.

For two conditions, office visits per se appear unexpectedly low because of coding conventions. For anxiety neuroses, "procedures" are mainly counseling visits. For vision examinations, "procedures" are mainly office visits with vision examinations and refractions. In addition, "drugs" for vision examination are actually "supplies" (lenses and frames).

As throughout this monograph, we compare the per-episode rates of the free plan with those for all cost-sharing plans combined. Significant differences are based on a *t*-test of independent samples, with no multiple comparisons correction (as so few *t*-tests were significant even at conventional levels).

Findings

Table E.1 gives per-episode rates for all adults for 18 conditions (e.g., anxiety neurosis) or reasons for visit (e.g., general medical examination) that met the criteria noted above. (That is, for all 18 categories, adults on the free plan had had significantly higher probabilities of at least one episode in year 2 than had adults on the cost-sharing plans.) In only two cases was the intensity of service, measured as the per-episode rate, significantly different between the plans. Specifically, the rate of office visits for acute upper respiratory infection was higher on the free plan, as was the rate of use of prescription drugs for urinary tract infection.

Among low-income adults (Table E.2), service intensity was higher on the free plan only for all procedures for abdominal pain and for office visits for skin rashes; the use of prescription drugs for anxiety neurosis was higher for individuals on the cost-sharing plans. Regarding higher-income adults, for chest pain the rate of office visits was higher for individuals with free care (Table E.3).

For low-income children (Table E.5), six different conditions showed significant differences in per-episode rates for various services. For four of these the rate was higher on the cost-sharing plan: visits for acute otitis media; drugs for streptococcal sore throat; visits for acute sprains and strains; and procedures in vision examinations. The other two differences favored the free plan: drugs in acute pharyngitis and visits for general medical examinations.

In sum, we detected very few instances of significant differences between the free and cost-sharing plans in per-episode intensity. The ones seen were largely confined to low-income individuals, mainly children. Just over one-half of these (significant) differences showed higher intensity on the free plan. There was no obvious pattern to the few large differences shown

in the tables; for instance, they were not confined to just one type of service or to any particular type of illness or preventive care.

This could be the result of two opposite effects. The seriousness of conditions for persons on the cost-sharing plans may be higher, leading to higher-than-average episode size. Conversely, the size of episodes on the free plan may be lower than average because the average levels of severity of illness are lower. However, this pattern would not be entirely consistent with the results reported on the nonselective effect of cost-sharing on appropriate and inappropriate care. Hence, we conclude that cost-sharing had little consistent effect on episode size, once individuals had accessed the care system.

TABLE E.1. Per-episode Rates of Use of Services for Selected Conditions, Year 2, All Sites, All Adults

	Office Visits		Procedures		Drugs	
Condition	Free	Cost-sharing	Free	Cost-sharing	Free	Cost-sharing
Anxiety neurosis	1.1	0.9	4.6	6.4	3.7 [0.0]	3.1 [0.0]
Peripheral neuropathy, neuritis, and sciatica	2.0	2.1	7.8	3.4	1.3 [0.2]	0.8 [0.4]
Degenerative joint disease	1.7	1.7	3.3	2.6	3.5 [0.2]	3.1 [0.6]
Disc displacement and derangement	1.2	1.0	8.0	8.8	0.9 [0.0]	0.4 [0.0]
Low back pain diseases and syndromes	1.2	1.1	4.1	4.3	3.0 [0.2]	2.3 [0.0]
Influenza	1.2	1.0	1.1	0.7	1.8 [0.4]	1.8 [0.2]
Acute URI	1.3	1.2[a]	0.8	0.6	2.5 [0.4]	2.1 [0.3]
Acute pharyngitis	1.1	1.2	1.0	1.0	1.4 [0.3]	1.2 [0.3]
Chest pain	1.6	1.3	3.1	1.4	1.3 [0.1]	2.1 [0.2]
Abdominal pain	2.1	1.4	3.9	2.4	0.8 [1.3]	0.8 [0.1]
Nonfungal skin infections	1.5	1.9	0.6	0.9	1.6 [0.2]	1.4 [0.2]
Skin rashes and other skin diseases	2.3	2.1	1.0	0.8	2.1 [0.4]	1.4 [0.1]
Vaginitis and cervicitis	1.7	1.7	1.6	1.6	1.3 [0.0]	1.4 [0.0]
Urinary tract infection	1.6	1.4	2.7	2.2	3.5 [0.2]	2.2[b] [0.1]
Lacerations, contusions and abrasions	1.4	1.2	1.3	1.2	0.6 [0.2]	0.3 [0.2]
Other musculoskeletal diseases	1.7	1.7	2.3	2.1	1.3 [0.1]	0.5 [0.2]
Vision examination	0.0	0.0	1.1	1.1	[0.0]	[0.0][c]
General medical examination	1.0	1.1	2.5	2.5	0.5 [0.3]	0.3 [0.2]

[a] $t = 4.01$.
[b] $t = 2.61$.
[c] For vision examination, "drugs" means "supplies."

TABLE E.2. Per-episode Rates of Use of Services for Selected Conditions, Year 2, All Sites, Low-income Adults

Condition	Office Visits		Procedures		Drugs	
	Free	Cost-sharing	Free	Cost-sharing	Free	Cost-sharing
Hay fever	4.1	3.9	2.3	1.5	2.5 [2.9]	1.6 [3.1]
Chronic sinusitis	1.3	1.1	1.4	0.6	1.6	2.5
Anxiety neurosis	1.1	1.4	5.8	4.4	2.0	4.8[a]
Disc displacement and derangement	0.9	0.8	6.3	5.1	0.7	0.2
Bursitis and fibrositis	1.6	1.9	1.2	1.5	1.2 [0.1]	0.8 [0.2]
Acute pharyngitis	1.0	1.2	0.7	1.2	1.2 [0.2]	0.9 [0.2]
Chest pain	1.9	1.8	4.0	3.5	1.1 [0.2]	0.7 [0.2]
Abdominal pain	3.0	1.5	5.5	1.8[b]	0.9	0.5
Skin rashes and other skin diseases	1.8	1.5[c]	0.7	0.8	1.8 [0.2]	1.3 [0.4]
Vaginitis and cervicitis	1.9	1.9	1.9	1.9	1.1	1.1
Lacerations, contusions, and abrasions	1.3	1.3	1.4	1.1	0.8 [0.2]	0.3 [0.2]
Other signs and symptoms	1.8	1.3	1.8	2.9	1.3 [0.0]	0.8 [0.1]

[a] $t = -2.07$.
[b] $t = 2.12$.
[c] $t = 2.35$.

TABLE E.3. Per-episode Rates of Use of Services for Selected Conditions, Year 2, All Sites, High-income Adults

Condition	Office Visits		Procedures		Drugs	
	Free	Cost-sharing	Free	Cost-sharing	Free	Cost-sharing
Obesity	4.0	5.5	2.7	2.4	4.8 [0.8]	2.7 [2.4]
Peripheral neuropathy, neuritis, and sciatica	2.3	1.9	8.8	3.4	1.0 [0.2]	0.9 [0.4]
Disc displacement and derangement	1.3	1.0	8.7	9.9	1.0 [0.0]	0.5 [0.1]
Degenerative joint disease	1.5	1.8	3.1	1.8	3.1 [0.2]	3.2 [0.3]
Low back pain diseases and syndromes	1.2	1.3	4.4	4.3	2.9 [0.2]	1.9 [0.0]
Influenza	1.3	1.1	1.2	0.7	2.0 [0.5]	1.8 [0.3]
Acne	2.7	2.6	0.5	0.8	4.1	5.1
Nonfungal skin infections	1.6	2.1	0.6	1.0	1.6 [0.2]	1.2 [0.3]
Skin rashes and other skin diseases	2.6	2.4	1.2	0.8	2.2 [0.5]	1.5 [0.3]
Vaginitis and cervicitis	1.5	1.6	1.4	1.4	1.4 [0.0]	1.5 [0.0]
Chest pain	1.5	1.2[a]	3.7	2.7	1.5 [0.1]	2.5 [0.1]

TABLE E.3. Continued.

Condition	Office Visits		Procedures		Drugs	
	Free	Cost-sharing	Free	Cost-sharing	Free	Cost-sharing
Abdominal pain	1.4	1.4	2.6	2.8	0.7	1.1
					[0.1]	[0.1]
Lacerations, contusions, and abrasions	1.5	1.2	1.1	1.0	0.5	0.3
					[0.3]	[0.3]
Fractures	2.8	2.4	2.0	2.2	0.6	0.3
					[0.2]	[0.1]
Other gastrointestinal disease	1.5	1.3	2.7	2.3	2.2	1.2
					[0.1]	[0.1]
Other injuries and adverse effects	1.6	1.2	4.1	2.8	1.1	0.6
					[0.2]	[0.2]
General medical examination	1.0	1.0	2.5	2.5	0.4	0.4
					[0.3]	[0.2]

[a] $t = 2.08$.

TABLE E.4. Per-episode Rates of Use of Services for Selected Conditions, Year 2, All Sites, All Children

Condition	Office Visits		Procedures		Drugs	
	Free	Cost-sharing	Free	Cost-sharing	Free	Cost-sharing
Viral exanthems	1.1	1.5	0.2	0.1	0.7	1.0
Otitis media, acute	1.4	1.6	0.3	0.5	1.3	1.5
					[0.0]	[0.0]
Influenza	1.2	1.4	0.3	0.2	0.7	0.9
Acute URI	1.6	1.4	0.4	0.6	1.6	1.6
					[0.1]	[0.1]
Strep throat	1.2	1.1	1.5	1.5	1.1	1.2
					[0.1]	[0.1]
Acute bronchitis	1.4	1.4	0.4	0.8	3.0	2.0
					[0.1]	[0.1]
Diarrhea and gastroenteritis	1.2	1.4	0.3	0.2	0.6	1.1
					[0.1]	[0.0]
Skin rashes and other skin diseases	1.6	1.8	0.5	0.5	1.0	1.2
					[0.0]	[0.1]
Lacerations, contusions, and abrasions	1.5	1.4	1.1	0.8	0.3	0.1
					[0.2]	[0.1]
Other signs and symptoms	1.4	1.2	1.8	0.9	0.7	0.6
					[0.1]	[0.0]
General medical examination	1.2	1.2	1.8	1.8	0.2	0.2
					[0.7]	[0.8]

TABLE E.5. Per-episode Rates of Use of Services for Selected Conditions, Year 2, All Sites, Low-income Children

Condition	Office Visits		Procedures		Drugs	
	Free	Cost-sharing	Free	Cost-sharing	Free	Cost-sharing
Otitis media, NOS	2.8	2.2	0.8	0.9	2.4 [0.0]	2.1 [0.1]
Otitis media, acute	1.2	1.5[a]	0.2	0.5	1.3	1.1
Influenza	1.1	1.1	0.5	0.6	0.9	0.1
Acute URI	1.5	1.5	0.4	0.5	1.6 [0.1]	1.4 [0.0]
Acute pharyngitis	1.4	1.4	0.9	0.9	2.1 [0.1]	1.1[b] [0.2]
Strep throat	1.1	1.0	1.1	1.0	0.9 [0.1]	1.5[c] [0.2]
Acute bronchitis	1.3	1.9	0.6	1.5	3.0 [0.2]	2.0 [0.2]
Diarrhea and gastroenteritis	1.1	1.3	0.2	—	0.5 [0.1]	2.1 [—]
Acute sprains and strains	0.8	1.3[d]	1.4	1.1	0.1	—
Lacerations, contusions, and abrasions	1.5	1.5	1.1	0.8	0.3 [0.1]	0.1 [0.1]
Other injuries and adverse effects	1.2	1.9	1.5	1.7	0.3 [0.2]	0.2 [1.4]
Vision examination	0.8	0.3	0.9	1.1[e]	0.5	0.6
General medical examination	1.2	1.1[f]	1.7	1.6	0.1 [0.8]	0.2 [0.8]

[a] $t = -2.44$.
[b] $t = 3.85$.
[c] $t = -2.29$.
[d] $t = -2.34$.
[e] $t = -3.66$.
[f] $t = 1.96$.

TABLE E.6. Per-episode Rates of Use of Services for Selected Conditions, Year 2, All Sites, High-income Children

Condition	Office Visits		Procedures		Drugs	
	Free	Cost-sharing	Free	Cost-sharing	Free	Cost-sharing
Acute URI	1.6	1.4	0.5	0.6	1.5 [0.0]	1.7 [0.2]
Acute sprains and strains	1.5	1.4	1.1	0.7	[—]	[0.0]

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