DISSERTATION

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Demand for Episodes of Care in the China Health Insurance Experiment

Jeffrey J. Sine

RAND Graduate School

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Jeffrey J. Sine

RGSD-110

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The original version of this study was prepared as a dissertation in December 1993 in partial fulfillment of the requirements of the doctoral degree in public policy analysis at the RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of Shan Cretin (Chairperson), Lynn Karoly, and Dean Jamison.

PREFACE

This report investigates the impact of health insurance on health care demand in the People's Republic of China. It also contributes to the understanding of other correlates of health care demand in developing countries. This research should be of interest to those interested in assessing the merits of promoting health insurance as a financing mechanism for developing countries. It will also be useful to those who are interested comparisons of health care demand across different social and cultural contexts. This document was accepted by the RAND Graduate School of Policy Studies in partial fulfillment of the requirements for the degree of Doctor of Philosophy in policy analysis.

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SUMMARY

Before implementation of the "responsibility system" agricultural reforms in the late 1970s, rural health care was financed primarily through locally administered rural cooperative insurance (RCI) schemes. Decollectivization of agricultural production eroded the communal source of financing for these schemes and the proportion of the rural population covered by an RCI scheme dropped from over 90 percent to less than 50 percent. The two-year China Health Insurance Experiment (CHIE) was one of a number of policy initiatives to examine alternatives for rural health care financing.

Twenty-six villages in rural Sichuan Province were grouped into six experimental groups. Six different insurance plans were assigned to these village groups in 1989, the first year. Each group switched to a new plan in 1990. Two pairs of these groups participated in a cross over design. Insurance plans differed according to a schedule of outpatient and inpatient coinsurance rates. Utilization of plan-covered health services was monitored for the two-year experimental period. Basic socio-demographic information was also collected on participants during a preexperimental baseline survey. Information on attitudes toward insurance and health services, as well as out-of-plan health services utilization, was also collected during a Satisfaction Survey at the conclusion of the experiment.

This study examines the effect of coinsurance and other factors on demand for episodes of care. Episodes of care was used as the measure of utilization in order to isolate the decisions most under the control of CHIE enrollees. Outpatient and inpatient demand functions were estimated using data from 7,333 panel sample enrollees (those who enrolled late or dropped out early were excluded). Separate demand functions were also estimated for adults, children, and those in poor health. Variables from the Satisfaction Survey were tested in separate models to examine the impact of attitudes and out-of-plan use on demand for plan-covered services.

Episodes of care are Poisson distributed (count data) and negative binomial

regression (NBR) was used as the principal method for statistical analyses. Coinsurance effects were also estimated using a fixed effects model in which data for the two experimental years were differenced for each individual. For this model, the dependent variable was *change* in the number of episodes of care demanded. Elasticities from NBR and fixed effects models were compared. Interactions between coinsurance and other independent variables were tested in all models.

The principal findings of this research are (1) in rural China coinsurance exerts a significant and negative effect on demand for episodes of care (2) coinsurance effects are similar for different population subgroups and for different episodes of care (3) elasticities of demand varied according to whether or not the person's village had a functioning village health station (VHS) and (4) patterns of sociodemographic effects on demand were similar to those reported by other researchers using data from North American populations.

Over the coinsurance range of 40 to 70 percent, the elasticity of outpatient demand estimated in the NBR model (-0.22) was similar to that estimated in the fixed effects model (-0.19). This result is similar to the elasticity of demand found in the RAND Health Insurance Experiment on a sample of the U.S. population. Elasticities were similar for adults, children, and those in poor health. No interactions were found between coinsurance and age, income, or health status. This finding provides some support for proponents of health insurance as a primary means of financing rural health services even in low income developing countries. However, even though the *amount* of care demanded by "vulnerable" groups may not be disproportionately affected by coinsurance, there may be differences in the *types* of care received that have important health effects. This study did not address that issue.

Findings for inpatient episodes are less conclusive. The estimated elasticity of demand (-0.18) was only slightly lower than the elasticity for outpatient episodes; however, 95-percent confidence intervals around inpatient estimates were wide.

Two interactions with coinsurance were identified in the models of demand

for outpatient episodes. None were identified in inpatient models. People who lived in a village without a functioning VHS were more responsive to coinsurance than those who lived in a village with a VHS (-0.42 and -0.14, respectively). This interaction was found in both NBR and fixed effects analyses, and this appears to contradict time-price theory of demand, since travel distances to the nearest health care facility are generally greater in villages with no VHS. This finding may be explained by at least two factors. Two of these six villages with no VHS were township centers; a township hospital was located in these villages instead and travel distances were in fact not greater. For the other four villages, costs of care at alternative facilities (higher levels of care) were greater and may have deterred care seeking.

Coinsurance effects on the number of episodes of care demanded were greater for people from Danling villages (four remote villages on the western fringe of Guangji Township). This interaction was found only in the NBR outpatient model. Failure to find it in the fixed-effects model raises the possibility that it is a statistical artifact. The direction of outpatient coinsurance rate change from 1989 to 1990 was the same (decreased) in these villages, while access to care improved. Both of these changes would be expected to lead to increased demand, and it is not possible to separate coinsurance from secular effects. Still, the finding suggests that insurance planners should consider distribution of health care facilities and utilization patterns when designing insurance plans. Coverage according to administrative boundaries may be counter productive to certain health policy objectives.

Consistent and strong secular trends toward increased utilization were found in all estimated outpatient models. Demand was about 16 percent higher in 1990 than in 1989. Rising rural incomes in China probably played an important role in this trend, although learning may also have contributed. A secular trend was not consistently identified in inpatient models, indicating that inpatient care is less prone to secular influence.

The effects of other factors generally included in health care demand models were found to be similar to those reported by researchers from other

studies of health care demand. Poor health increased demand considerably for both outpatient and inpatient episodes of care. The effects of education and income on outpatient demand were both monotonic and increasing. Education effects were concentrated among children while income effects were more important among adults. Education and income effects were not significant in inpatient models. Family size did not affect demand in any of the estimated models.

The demand curve across age groups for outpatient episodes followed a backward j-shape for both males and females. Demand was highest in the youngest age group (0 to 4) and declined through childhood. In all adult age groups, demand among women was higher than demand among men.

The effect of age on inpatient demand was even greater, and gender differentials were larger. These patterns are generally consistent with those reported for western populations, with the notable exception that demand for outpatient care does not rise nearly as much as might be expected among older Chinese.

For each of the three measures of access used, effects were as expected. Better access increased demand. Outpatient utilization rates were two to three times greater among those who lived in a village with a VHS. Inpatient utilization rates were *lower* among people living where there was a VHS, indicating that outpatient and inpatient care were substitutes in the CHIE. After controlling for all other variables in the model, utilization rates among residents of Danling villages were much lower compared to residents from the other villages. The Danling effect was also significant - but not as large - for inpatient demand. Greater distance to the nearest health care facility was associated with lower utilization rates. The impact of distance was greatest among people in poor health.

In summary, results from the CHIE generally show that much of what is known about health care demand is also true in rural China. In this study, coinsurance and access barriers did not disproportionately affect more vulnerable groups (children, the poor, and those in poor health), also no evidence was found to suggest that more essential care (such as inpatient care) is more affected by

coinsurance. Based on these results, promotion of insurance as a financing mechanism for rural health care in developing countries is warranted. Caution should be exercised in generalizing these results to other developing countries or even to other parts of China, where living standards and economic systems are different. In addition, this research did not address the health effects of demand response to coinsurance provisions; more research in this area is advised.

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GLOSSARY

CCP	Chinese Communist Party
CHIE	China Health Insurance Experiment
CMS	Cooperative Medical System
EPS	Epidemic Prevention Station
GIS	Government Insurance Scheme
LIS	Labor Insurance Scheme
NBR	Negative Binomial Regression
OLS	Ordinary Least Squares
RCI	Rural Cooperative Insurance
RHIE	RAND Health Insurance Experiment
VHS	Village Health Station
WCMU	West China Medical University

CHAPTER 1

INTRODUCTION

Achievements in health care in the People's Republic of China (hereafter referred to as "China") have been widely extolled as an example of what can be accomplished in low income developing countries. Near universal access to primary health care, dramatic reduction in the incidence of infant mortality and many infectious and communicable diseases, and eradication of some disease vectors were accomplished without high levels of government spending. More recently, as China has undergone dramatic social and economic changes, problems in its health sector have begun to resemble those of other developing countries.

Disparities in access to health services between rural and urban areas have been growing since major economic reforms were initiated in the late 1970s (Jamison et al., 1984; Lewis and Diamond-Kim, 1987). Policies intended to improve the quality of health services have also reduced the emphasis on basic, low cost primary health care. Constraints on government budgets prevent policy-makers from closing these rural/urban gaps with increased allocations for health care. Instead, policymakers have had to consider alternative financing sources to meet changing needs.

The China Health Insurance Experiment (CHIE) was conceived and conducted within this context. As part of the experiment, social insurance pools were constituted in rural villages, administered at the township level, and funded almost entirely by premiums levied on households. In a manner, these insurance schemes reestablished the village-based health insurance cooperatives that predominated in rural China before the late 1970s when major social reforms began to take effect. The CHIE plans differed from the earlier cooperatives in that they provided coverage for a broad range of services, linked premiums and coverage on an actuarially sound basis, and pooled risk widely. This report examines the effect of differing coinsurance conditions on the demand for health care among residents in 26 participating villages. Effects of sociodemographic characteristics and access conditions on demand are also examined.

Historical Context: An Overview

The history of health insurance in the People's Republic of China dates back to 1951 (two years after the People's Republic of China was formed by the Chinese Communist Party [CCP]) when the Government and Labor Insurance schemes (GIS and LIS) were established (Hu, 1981). These schemes covered government employees, college teachers and students (GIS), workers in large state industrial enterprises (LIS), and to some extent, dependents of these beneficiaries. Most of those covered by GIS and LIS were urban residents; few rural residents benefitted. Since about 80 percent of all Chinese lived in rural areas, most of the nation's population was uninsured.

Limited experimentation with village-based insurance financing mechanisms in rural areas was carried out by the CCP in "liberated" areas of China before the end of the revolution. Experimentation continued in the 1950s and 1960s, but it was not until the mid-1970s that coverage for the rural population became widespread through a network of independent Cooperative Medical Systems (CMS), which almost always included a financing component known as Rural Cooperative Insurance (RCI) schemes. At the peak of the CMS movement, between 85 and 90 percent of China's rural population was covered by one of these cooperative schemes (Prescott et al., 1983; Young, 1989). While these schemes typically provided limited coverage, they at least provided nearly everyone in China with access to basic primary and preventive care.

Beginning in the late 1970s, the CMS/RCI system of rural health care delivery and financing began to disintegrate. While there is debate as to the precise causes of this decline, most agree that agricultural reforms introduced in the late 1970s were an important contributing factor. These reforms had a disruptive impact on village welfare funds, the source of support for the CMS and RCI systems. Increasing proportions of China's vast rural population were left uninsured as the prereform mechanism continued to decline throughout the 1980s. At the same time, fee-for-service organizations became increasingly more common, replacing cooperative services at the village level.

Several policy initiatives grew out of national concern over this rural

financing debacle, one of which was to promote experimentation with alternative financing mechanisms. One such experiment, the CHIE, was conducted in two rural counties in Sichuan Province in Southwestern China.

Policy Significance

In broad terms, two issues of policy significance are addressed in this study: the question of how health insurance affects health care demand and the more specific issue of the interaction of insurance with certain subpopulation characteristics such as income, age, gender, education, health status, and geographic access. With respect to how insurance affects demand, there have been few studies in developing countries.

Insurance may affect demand through at least three mechanisms:

1. The decision to seek or not to seek care
2. Choice of provider
3. Amount of resources used for a particular episode of care.

This research focuses on the first mechanism; namely, how insurance affects the total number of times a person decides to seek care annually. It provides policymakers, both in China and elsewhere, with better information with which to consider options for reforming rural health care and with estimates to improve their predictions of demand under different alternatives. These are key elements in designing sustainable health financing policies. The unique panel characteristic of the CHIE data will permit much greater precision in estimating demand than has been previously possible. To date, most research has used either cross-sectional data or data pooled across different studies.

Apart from shedding light on the broader issue of insurance effects in a developing country, the setting of the CHIE in a socialist political and economic system also provides an opportunity to determine whether or not people behave similarly in market and nonmarket economies. (Markets in China were still largely undeveloped at the time of the experiment.)

The second set of issues, differences in insurance effects on different subgroups, are equity rather than efficiency issues. The trend toward shifting more of the burden of health care costs to users of services is occurring in many

developing nations. China, like other nations, is faced with a dual dilemma of needing to "mobilize" resources to improve access to care in the under served rural sector and having insufficient public funds to achieve this goal. As CMS organizations broke down, imposition of user fees for basic care at village health stations (which had previously been provided essentially at no cost to users) became widespread. Central and provincial governments also invested heavily in improving health care manpower and facilities in rural areas in the 1980s. Although there is considerable public subsidization, standardized user fees are an important component of sustaining these services.

User fees, however, place people at greater risk for financial loss. Financial access, even when RCI coverage was widespread, was often poor or entirely lacking for care above the village health station level. While insurance does alleviate much of the concern about potential catastrophic expenses, it also increases the potential for moral hazard. Coinsurance is a key lever used to control this hazard. This tool must be used judiciously. Rates that are too low may not be effective in containing demand, thereby risking financial solvency of the plans. Rates that are too high may impose additional barriers to care, a particular concern for groups considered to be more vulnerable.

There is an extensive body of literature pertaining to demand for health services and consumer response to health insurance. Much of the sound empirical research resulted from analysis of data from the RAND Health Insurance Experiment (RHIE). This literature can serve as a guide to policymakers as they consider health care financing options. However, nearly all available theoretical and empirical work is based on the experience in market-oriented, industrialized nations (mostly the United States). There is reason to believe that there may be differences in consumer behavior in different social contexts. China has only recently begun experimenting with free markets; however, the health sector is still heavily controlled by central planning structures. Consumers have had little experience with free markets; consequently, they may not respond according to theory based on assumptions of well-informed, rational consumers responding

to free markets.

Although relying on literature from the RHIE as a base, this study seeks to investigate similarities and differences in the behavioral response to health insurance by peasants in rural China. Specifically, this research seeks to explain the effects of coinsurance on demand for health services, since coinsurance was the primary differentiating factor in the CHIE plans.

Document Map

A more detailed description of health care delivery and financing systems in rural China is provided in Chapter two. It begins with a brief historical perspective on the evolution of these systems from about 1950 to the late 1980s when the CHIE commenced. The focus of this chapter, however, is on the organization of the CMS and RCI schemes and changes in these systems beginning in the late 1970s. Chapter three summarizes what is known about insurance effects on people's use of health services. Much of the information in this chapter is based on evidence from market economies like the United States; literature is sparse from developing countries and nonmarket economies. These two chapters lay the foundation for hypotheses to be tested in this study.

A detailed description of the CHIE, its design and procedures, is given in Chapter four. Chapter five contains information about the data used in this study, including some details of the data cleaning process, sample descriptions, and variable definitions. Analytic methods used for hypothesis testing are described in Chapter six. Multivariate analysis results are presented in Chapter seven. The final chapter interprets these results and discusses their policy significance.

CHAPTER 2

HEALTH CARE DELIVERY AND FINANCE IN CHINA

On the eve of the proclamation of the People's Republic of China in 1949, health conditions were described as the "worst in the world" (Taylor, 1988). Infectious diseases were rampant, life expectancy was low (35 years), and the infant mortality was high (250 per 1000 live births) (Hsiao, 1984). Access to Western medicine was almost entirely confined to urban areas, leaving 80 percent of population reliant on traditional and folk medicine (Horn, 1972). Even in urban areas, health care facilities were few, health care manpower training was poor, and financial access was limited.

Recognizing the severe limitation of government intervention to address the immense health needs of the new nation, China's new leaders choose an unusual and unique course. The four principal elements of its strategy in the health sector were

- A focus on prevention
- Development of a "barefoot doctor" corps
- Redistribution of urban health care manpower to rural areas
- Development of cooperative medical systems, which included mechanisms for both delivery and financing of rural services.

The first section of this chapter traces the modern history of health care in rural China. This history is divided into four periods: the immediate post-revolution period to the Great Leap Forward (1949-1958); the period from the late 1950s to the Cultural Revolution (1959-1966); the decade of the Cultural Revolution (1966-1976); and the post-Cultural Revolution reform period (1976-mid 1980s). Sources of information on China's health care system and its history are compromised by the fact that few Western (or Chinese) observers have had access to national data. Many conclusions are thus based on either regional information or on information selectively provided by the Chinese government.

The second section focuses on the development of Cooperative Medical Systems (CMS) and parallel rural insurance schemes. The final section examines the economic reforms of the late 1970s and the 1980s and their impact on rural

health services, particularly the CMS and financing issues. These issues produced interest among Chinese policymakers in examining alternative non-governmental financing strategies and created the context within which the CHIE occurred. A historical perspective, along with a basic understanding of the health care system, will provide a basis for understanding utilization patterns. It may also provide insights useful in interpreting results from the analysis of CHIE data.

Brief History of Health Care in China

Government interest in health care is a relatively recent development in China. Throughout most of its long history, health care was seen as an individual responsibility. Health care was never a right. "Being sick was an admission of being frail and weak and was deemed to be the fault of the individual" (Wen, 1976). Roots of the modern Chinese (post-revolution) public policy emphasis on prevention have been attributed to such attitudes (Sidel and Sidel, 1982). The search for alternatives to these traditions, however, had begun even earlier. Dr. C.C. Chen pioneered the concept of minimally trained village health workers who provided basic first aide, preventive, and sanitation services at little cost in a village in Hebei Province in the early 1930s (Chen, 1989). The CCP was implementing experiments of their own in "liberated" areas of China in the 1930s and 1940s.

Apart from the havoc imposed by war and turmoil in the first half of the twentieth century, cultural attitudes probably explain much of the deficiencies in the health care infrastructure that characterized China in 1949. Chairman Mao's view of health care as a right and his particular interest in the welfare of the rural masses represented an important departure from the historical norm. Nonetheless, China's health care system is still highly decentralized, characterized by local initiative with a veneer of central planning (Hu, 1981; Horn, 1972; Cretin, personal communication).

The Early Post-Revolution Period (1949-1958)

In August 1950, Mao proclaimed four basic principles that were to guide the

development of the Chinese health care system (Hu, 1980):

1. Access should be broad (the system should serve workers, peasants, and soldiers)

2. Preventive care should take precedence over curative services (to be accomplished by unification of the two systems)

3. Traditional medicine should be integrated with modern medicine (in recognition of the scarcity of Western drugs and to promote the principle of self-reliance);

4. Health work should be combined with mass movements (to promote local initiative and self-reliance).

Epidemic Prevention Stations (EPS) were established early in this period. The goal was to establish one EPS in each of China's 2,100 counties. These stations were to be the front line in organizing and carrying out mass health campaigns. To address the imbalance in health care resources between urban and rural areas, urban medical personnel were sent to work in rural areas, both as permanent transfers and as mobile medical teams (Hu, 1980). While the roots of the barefoot doctor movement lay in pre-1949 experimentation, it is through this redistributive policy in the 1950s that training of primary health care workers (later known as "barefoot doctors") became widespread (Taylor, 1988).

Collectivization of agricultural production, which occurred during this period, was a key factor in accomplishing the first of Mao's four 1950 principles. Collectivized production brigades (generally equivalent to current day villages) became the unit for organizing Cooperative Medical Systems (CMS, "self-reliant" health care delivery organizations) and Rural Cooperative Insurance (RCI, the financing component of CMS) schemes. The first post-1949 attempts to organize CMS were reported in the late-1950s. By the mid-1970s they became the predominant health care delivery and financing mechanism in rural China (Qui, 1989; Zhu, 1989).

The CMS consisted primarily of a locally organized clinic that was the base of operations for barefoot doctors. These clinics were integrally tied to the collective structure of the brigade. Barefoot doctors were remunerated for their services through the same work point system of distributing collective income that was used for farmers. Administrative supervision of the system was also the responsibility of the brigade.

Commune (now referred to as "township") health centers were the next highest level of care. Most were constructed late in this period. (Communes were administrative organizations that oversaw between 15 and 20 production brigades.) These clinics were initially established to assist EPS staff with mass mobilization campaigns in health. These clinics became responsible for all health activities in the commune, again emphasizing the close link between agricultural production and health services delivery and financing (Rifkin and Kaplinsky,1973).

The Post-Great Leap Forward to mid-1960s Period (1959-1966)

Failures of Great Leap Forward agricultural policies resulted in disastrous famine and turmoil in the late 1950s and early 1960s. As a results of these disasters, technocrats and bureaucrats regained much of the influence they lost during the Great Leap period and emphasis shifted back toward development of curative, Western-oriented services in urban areas. Still, national development emphasis on agriculture remained strong and the network of rural health facilities was greatly expanded. Rifkin and Kaplinsky (1973) reported that by 1965, all of China's 2,100 counties had at least one health center or hospital. However, training of barefoot doctors (primary care workers) lapsed during the period and did not begin to recover from the reemphasis on more highly trained providers until about 1965 (Zhu et al., 1989).

Despite the successes of mass campaigns and infrastructure development of the 1950s and early 1960s, access to health services remained poor for most rural Chinese (Sidel and Sidel, 1982). On June 26, 1965, just before the start of the Cultural Revolution, Mao issued a directive that reestablished the principal that needs of the rural population should take priority in health development work (Hu, 1981; Wen, 1976). This directive was consistent with his 1950 proclamation and was designed to counter the influence gained by technocrats after the Great Leap Forward.

This renewed emphasis on decentralization and self-reliance in rural health care led to revived interest in the CMS and barefoot doctor concepts. Attention to these concepts had lapsed with the post-Great Leap period reascendancy of

technocratic leadership in the health sector. Their reemergence after Mao's 1965 directive laid the foundation for their predominance as cornerstones of rural health development (Hu, 1981; DHHS, 1978).

The Cultural Revolution Period (1966-76)

Despite the massive political and social upheavals that characterized this period, significant progress was made in extending basic health services to rural Chinese. Barefoot doctors emerged as the primary force in service delivery, and CMS became the rule rather than the exception. At one level, the policies of the period reemphasized self-reliance (at the commune level and below). At another level, the national government became involved in promoting CMS and barefoot doctor training as never before. Universalization of coverage was seen as dependent on deprofessionalizing and decentralizing the system.

"Rapid diffusion" of the barefoot doctor concept began in 1968, after initial bureaucratic opposition was overcome (DHHS,1978). By the mid-1970s, an estimated 1.8 million barefoot doctors were providing health services throughout rural China. (It is important to note that training, commitment, and effectiveness were not uniform.) It has been said that this massive expansion of this corps of primary health care workers was only possible because of the concomitant development of local financing mechanisms through the CMS and RCI schemes (Taylor, 1988). These local organizations, while diverse with respect to services and coverage, provided the critical source of nongovernmental development funds. "By the 1970s, the CMS had evolved into a well-developed pre-paid medical service, providing a limited pooling of health risk" (Zhu et al., 1989).

The Post-Cultural Revolution Reform Period (1978-late 1980s)

In December 1978, a new agricultural "responsibility system" was officially adopted by the central government as part of a larger package of economic reforms designed to improve production and to "modernize" China. As the new policies were implemented locally, most agricultural production decisions reverted from the brigade to households (Hsiao, 1984). Other health-specific policies were also adopted to improve competence of medical manpower, to improve facilities and

equipment, and to assist local administrative organizations to find solutions to service delivery and financing problems caused by demise of the collective agricultural production system (Chen and Tuan, 1983).

Rural incomes were rising and demand for health services, in terms of both quantity and quality, was growing (Young, 1989). In-service training programs were organized for barefoot doctors; beginning in 1982, they were required to take a certification exam (Zhu et al., 1989). Those that passed the exam were given the new title of "rural doctor." Some continued under the terms of local CMS structures, where a CMS still survived; others became fee-for-service private practitioners. Many of those who did not qualify as rural doctors stopped providing health services. Others simply left to take advantage of expanded economic opportunities elsewhere. By the mid-1980s, the number practicing barefoot/rural doctors in the nation had dropped about 30 percent (Young, 1989; Taylor, 1988; Hsiao, 1984). According to a World Bank study, by 1984 the percent of medical personnel practicing in rural areas had slipped below 50 percent, eroding the progress that had been made toward rectifying the urban/rural imbalance in health resources (Lewis and Diamond-Kim, 1987).

The most important health system effects in this period pertained to the CMS. Individual families instead of the collective retained most proceeds from surplus production. Deprived of this crucial source of funding, established structures of health care delivery and financing were adversely affected. The proportion of brigades covered by a CMS system declined precipitously from between 80 and 90 percent before the reforms to less than 50 percent by the mid-1980s (Gu et al., 1993; Young, 1989; Prescott & Jamison, 1985; Hsiao, 1984). Gu and colleagues (1993) reported that national data (from the Ministry of Public Health) indicated that the coverage rate had dropped to an astonishingly low 5 percent by the late 1980s.

Moreover, despite more than two decades of official focus on rural health care, by the mid-1980s there was still evidence of a persistent bias toward urban areas in the health system (Prescott & Jamison, 1985; Lewis and Diamond-Kim, 1987). With the established rural health system in decline, it was apparent that

new approaches to financing were needed. Given the immense scope of the input required to serve the China's huge rural population, direct government financing was not a realistic option.

The Health Care Delivery System

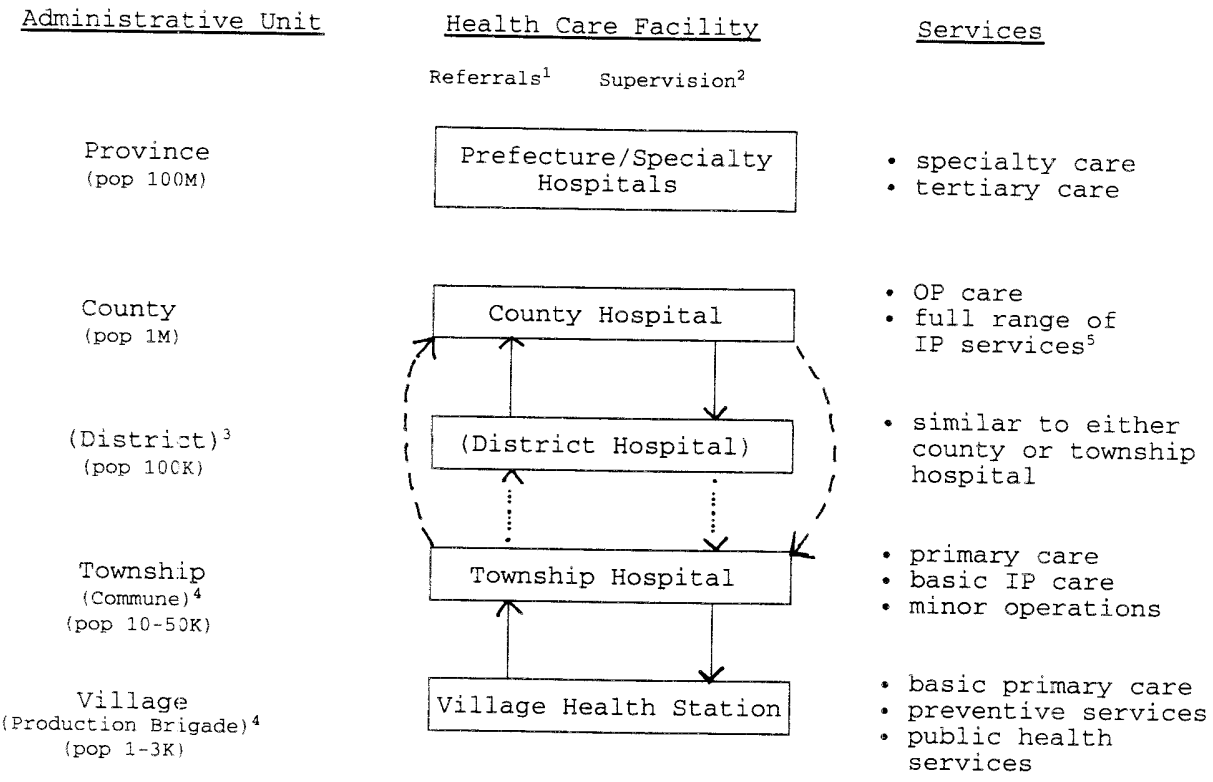
The descriptions in this section pertain to health services in rural areas and are meant to reflect conditions prevalent in the mid- and late-1980s. For consistency, post-reform terminology (the same as the pre-communist traditional labels) is used from here on when referring to facilities and personnel, even when referring to pre-reform events. Figure 2.1 provides an overview of the hierarchical nature of the rural health delivery system as well as pre- and post-reform terminology. China's health delivery system has been described as an integrated three-tiered system in which case referrals occur upward and supervision is directed downward (Zhu et al., 1989). Administratively, it is a highly decentralized system (Hu, 1981; DHHS, 1978); the highest locus of direct control over service delivery is generally the county. Most services are delivered at the village (formerly brigade), township (formerly commune), or county level. Specialty services are provided by a fourth tier, usually in prefecture or university-associated hospitals in the very large urban areas. Rural residents rarely have access to these facilities.

The First Tier: The Village Health Station

The first tier in this system (and theoretically the entry point for most episodes of care) is the village health station (VHS). Most villages in China have one VHS, except where there is a township health center/hospital (DHHS, 1978). Each VHS is usually staffed by two to four rural doctors (Taylor, 1988) and serves its village's population (about 1,500 people). Candidates for rural doctors are chosen locally by the village administration and are usually trained at the township or county hospital. They receive six to twelve months of training after completion of junior high school.

Rural doctors provide basic primary health care, preventive and anti-epidemic work, maternal and child health, family planning, and community

Figure 2.1
Organization of China's Rural Health Care Delivery System



[1] Direction of patient referrals.
[2] Direction of manpower supervision.
[3] District is not a universal administrative unit; district hospitals generally rare.
[4] Prereform terminology.
[5] "Full range" of IP services at county hospitals does not include most sophisticated technology or procedures.

(Adapted from Hu, T.W.; 1980)

sanitation services (Gong and Chao, 1982). Many of the preventive services provided (such as childhood immunizations and other MCH services) are substantially subsidized by the township and county level health authorities; users are either charged a very low fee (or not at all) for these services. In villages with more than one rural doctor, there is usually some division of labor. For example, female rural doctors are more likely to handle family planning and pregnancy-related care. The range of services available in a

village depends on the number of rural doctors and on the training and experience of those doctors, all of which vary greatly (Dobson,1981; Hu,1980).

Professional supervision is nominally provided by township hospital staff; administrative supervision is (also nominally) provided by a village management group (Gong and Chao, 1982). Before the late-1970s reforms, rural doctors were remunerated on the same "work point" basis as others in the village. Each villager accumulated work points by engaging in productive activities; rural doctors accrued work points in part by providing health services. Each person received a portion of the village's total income based on the number of work points accumulated.

This collective system of income distribution was largely abandoned after implementation of the responsibility system reforms. Thereafter, rural doctors' incomes were derived primarily through collection of standardized fees imposed on users of their services. Zhu and colleagues (1989) outlined four types of VHS organizations that evolved in the post-reform period:

1. CMS run jointly by towns and villages
2. Services run by the village alone (similar to the prereform organization)
3. Fee-for-service health clinics run as group practices
4. Clinics owned by private individuals.

Wealthier villages that were able to maintain their collective welfare funds often continued to support CMS-type VHS organizations. Less wealthy villages were more likely to switch to group practice or private ownership-type organizations. Rural doctors' incomes varied by the ability of villagers to pay for services, by the wealth of the village as a whole, and by the type of VHS organization adopted in the village.

The largest proportion of rural health services are delivered at the VHS and, theoretically, episodes of care are begun at the VHS. Those needing care beyond the capacity of the VHS are referred to a second or third tier facility (Hu, 1980). Evidence from the CHIE, however, suggests that either this pattern is changing or that it is not universally true. The proportion of total health care used by CHIE enrollees, which was delivered at VHS facilities in that data,

was only 42 percent. Anecdotal evidence also indicates that wealthier villagers increasingly bypass the VHS to initiate episodes of care at higher level facilities (Cretin, personal communication). It may be that limitations on reimbursement for care at higher level facilities under the former RCI schemes rendered such self-referral rare. Insurance provisions in the CHIE, on the other hand, generally did not require referral by a lower level doctor, except at the county level.

The Second Tier: The Township Hospital

The second tier of the rural health care delivery system is composed of township health centers or hospitals. (Since most of these facilities have at least a few beds for overnight patient care, the term "hospital" will be used from now on.) Formerly known as commune health centers, these facilities were designed to coordinate health activities in the villages (typically 15 to 20, but sometime as few as 5) that comprise a township (Wen, 1976). They are staffed by assistant doctors who have two years of post-high school medical education (Hsiao, 1984; Chen and Tuan, 1983).

In addition to providing health services for self-referred patients and patients referred from VHS, staff at the township hospital also provide technical supervision to rural doctors and other health workers at the village level. Health manpower training is another important function of the township hospital. Both in-service training for existing health workers and training of new workers occurs. (Training programs are also operated at the prefecture and provincial level for VHS and township staff.) Since villages with a township hospital often have no separate VHS, these facilities also carry out preventive and sanitation services for the local village population that would otherwise be conducted by VHS staff (Taylor, 1988; Wen, 1976).

Usually township hospitals are community owned and have between 15 and 40 beds and a staff of between 25 and 50, one-third of which are "middle-level" doctors with three years of post-junior high school medical training (DHHS,1978; Wen,1976). The township government is financially responsible for the hospital. Patients are charged standardized user fees that are set by the provincial

government (Taylor, 1988; Prescott et al, 1983). Financial arrangements have not changed significantly since reforms were implemented.

The Third Tier: District and County Hospitals

The third tier in this system is usually represented by a county hospital, a county Epidemic Control Station, and a Maternal and Child Health Center. (In some places, district hospitals may also exist, though they are typically more similar to township hospitals.) All of China's 2,100 counties had a county hospital by the mid-1970s (DHHS, 1978).

The focus of county services depends on the needs of its service area, which consists of the population in 10 to 15 townships. Staff at county hospitals are mostly physicians with five years of medical school training, comparable to the training provided at British (or U.S.) medical schools (Chen and Tuan, 1983; DHHS, 1978). County governments are responsible for staffing and finances at the hospital, and "moderate" fees are charged to users (Taylor, 1988). These are generally full service hospitals, providing a full range of outpatient and inpatient services. Although there are provincial and specialty hospitals, as well as hospitals associated with medical schools, these are generally not accessible to rural residents. For most people then, the county hospital generally represents the top of the referral chain in the rural health care delivery system.

The Health Care Financing System

In 1981, early in the reform period, total health spending in China accounted for about 3.3 percent of the gross domestic product. Private spending accounted for 32 percent of this total. Another 61 percent was spent by the Government Insurance Scheme and the Labor Insurance Scheme. Seven percent was spent by village RCI schemes (Prescott et al., 1983). These numbers, while impressive from the point of view of the large percent mediated through insurance (high by developing nation standards), underscore a great imbalance in urban versus rural health spending. Almost 90 percent of total insurance spending benefitted urban workers and their families who comprise only 20 percent of the

population. Only about 10 percent of insurance spending occurred among the rural population (80 percent of the country).

Given the decline in the proportion of the rural population covered by Rural Cooperative insurance schemes throughout the 1980s, it is likely that this imbalance has grown worse. In 1981, private spending accounted for more than 50 percent of total rural health spending (Prescott et al.,1983); this proportion has probably grown as the uninsured rural population increased.

In this section, we first focus on the organization of rural cooperative insurance schemes (RCI), which were an integral component of the CMS systems. Then, we examine the impact of the reforms on these financial arrangements and, briefly, on demand for health services.

Cooperative Medical Service

Cooperative Medical Services were established both as a village-level delivery service and, through a RCI component, as a financing mechanism. Coverage provided by RCI schemes varied widely.

At the village level, the CMS amounted to a prepaid health plan. Once a village decided to establish a CMS, everyone in the village belonged (Hu, 1980). The CMS was expected to be financially self-sufficient. A portion of the village's total earnings were set aside before distribution among workers. In wealthier villages, the CMS may have been supported entirely by the welfare fund. In less wealthy villages, the welfare fund was often supplemented by premiums charged to members (Wen, 1976). On average, premiums accounted for about one-third of CMS operating funds. The remaining two-thirds were derived from the village welfare fund and from township subsidies (Mechanic and Kleinman, 1980; Zhu et al., 1989). Annual membership fees (including contributions from the Welfare Fund and from member premiums) were determined on the basis of the previous year's medical expenses within the village. Premiums, where levied, averaged about 1.5 percent of disposable household income (Hu, 1981).

Membership in the CMS guaranteed free health services (apart from a small "registration" fee) at the VHS. Drugs, which account for between 50 and 75 percent of outpatient visit costs (Chao, Gong and Gu, 1982; Gu et al., 1993) were

often not covered. Services provided at a second or third tier health facility were typically covered only if the patient was referred by a VHS rural doctor. The proportion of charges covered varied by level of care, wealth of the village, and financial status of the welfare fund. Some CMS plans imposed benefit ceilings on individual members, effectively precluding catastrophic coverage (Dobson, 1981; Wen, 1976). There are also reports that funds were sometimes depleted before the year's end and coverage eliminated for the remainder of that year (Cretin, personal communication).

Welfare funds often collapsed in villages that abandoned collective farming after 1978, depriving the CMS of its most important funding source. The work point system of income distribution was likewise widely abandoned and new means of paying rural doctors had to be devised. Subsidies from township and county funds became increasingly prevalent as a means of covering shortfalls in welfare funds (Mechanic & Kleinman, 1980). These subsidies varied by location and need.

Decline of the CMS System

To review information presented earlier, estimates of the extent to which CMS organizations had diffused throughout China by the end of the 1970s vary, but it is generally put at around 90 percent of all villages. Within the first few years after central government support for decollectivization of agricultural production, a decline in the proportion of villages with an operating CMS was reported. Central government documents indicate that a decade later, as few as 5 percent of rural villages had an operating CMS.

Decollectivization of agricultural production is most often cited as the reason for the collapse of CMS organization. Zhu and colleagues (1989), however, present evidence that decollectivization need not necessarily have resulted in disbanding of the CMS in a village. They proposed other contributing factors:

- The system, with its heavy emphasis on basic primary and preventive care provided by poorly trained rural doctors outgrew its usefulness once preventable diseases had been controlled.
- Development of the CMS structure, which occurred rapidly during the Cultural Revolution, was as much a political as an organizational phenomenon. It was, therefore, discarded along with other aspects of the discredited movements of the Cultural Revolution.

Young (1989) also discussed changing patterns of demand for care as

impacting the established delivery and financing systems. She writes that "the rapidly increasing prevalence of chronic and disabling diseases and the increased value now placed upon the health of children because of the one child family policy" played a role in the decline of the system.

Regardless of the reason, it is clear that alternatives were required to replace CMS organizations where they disbanded and to correct eroding access to health care in rural China. New organizational forms that developed in place of the original village-administered CMS plans have been mentioned above. Two common aspects of these new approaches to health services delivery and finance are fee-for-service provision of care, even at VHS that previously had few charges apart from drugs; and lack of an insurance component, which therefore put villagers at greater financial risk. A policy interest in trials of alternative financing mechanisms was borne out of this environment. The CHIE was one of those trials.

CHAPTER 3

DEMAND FOR HEALTH CARE: A Review of Theory and Literature

The principal purpose of health insurance is to reduce the risk of financial loss due to the illness (Zeckhauser, 1970; Newhouse, 1979, Feldstein, 1972). In theory, insurance is best suited for goods that meet the following three criteria (Pauly, 1968):

1. There is a low price elasticity for the good being insured
2. The event triggering consumption of the good is randomly distributed
3. Individuals are risk-averse with respect to financial loss.

Assumptions 2 and 3 seem reasonable. Ill-health (the event) is mostly random, and most individuals are risk averse to the financial loss associated with spending for health care (the good; Arrow, 1963).

There has been considerably more debate about the price elasticity of demand for health care. Published own-price elasticities for outpatient and for inpatient care, although nearly always negative, vary considerably. There has been even greater variation in published estimates of cross-price elasticities. Some researchers report outpatient and inpatient care to be complements, while others report them to be substitutes. Results from the RHIE, a carefully controlled experiment, did much to resolve these controversies, at least as they apply in nations with well-developed market economies. The question of generalizability to non-Western, less market-oriented contexts remains open.

Insurance lowers the price of care faced by the consumer, thereby affecting demand. Moral hazard (the tendency for people to consume more health care when insured) is a well-recognized consequence of health insurance. Coinsurance provisions require that the insured pay a portion of the costs of their care and are designed to inhibit this propensity for increased consumption, particularly care considered to be of low value. Coinsurance provisions, however, offset the risk-spreading benefits of insurance. As Manning and Marquis (1989) have noted, "the choice of an economically optimal health insurance plan involves a trade-off between the utility gains from a reduction in the risks born by individuals and

the deadweight losses from the purchase of too much care."

The theory of demand for health care is based on the assumption that consumers have a utility function defined by money remaining after medical spending and health. In Grossman's (1972) investment model, health care is valued for its contribution to health, which in turn contributes to utility. Alternately, in the consumption model health care contributes directly to utility. The problem facing the consumer is to select that amount of health care that places him on the highest possible indifference curve (Newhouse, 1978a).

In theory, price plays an important role in consumption decisions. The theory also assumes that the consumer is well-informed (or gets good advice from physicians) about the ramifications of his choices, an assumption whose validity is open to question. Newhouse (1978a) points out that even if these assumptions are not valid, the theory is still useful because "it does predict a number of phenomena that are, in fact, observed." Economic theory, then, is the basic approach used in this study of health care demand in rural China.

The first section of this chapter presents an overview of the theory of health insurance effects on demand for health care. Some possible limitations of this theory in the Chinese social and economic context are also suggested. The next section critically reviews past research attempts to establish price elasticities of health care and the reported impact of sociodemographic variables. Although most published findings are based on U.S. populations, these results will be used to guide hypothesis generation and selection of analytic models for the China Health Insurance Experiment.

Reports from developing nation populations are generally less rigorous and less useful in this regard. The last section of this chapter is a summary of several recent reports on health insurance in developing countries. In 1981, Newhouse wrote that "analysis of price and income elasticities tend to be less significant outside the U.S. because other countries have historically had little or no interest in patient cost sharing." This is changing. The World Bank has been promoting insurance as the health care financing mechanism of choice, at least as a long term objective. Examination of the generalizability of what we

know from "the West" to populations in lesser developed nations is timely.

Theory of Health Insurance Effects on the Demand for Health Care

If health care is a normal good, conventional economic theory predicts that "the more extensive the insurance . . . the higher will be the demand for medical care" (Newhouse, 1978a). More generous insurance lowers the effective price of care. The additional health care consumed as a result of lower patient-borne costs is of lower value than the goods that otherwise would have been consumed (under full price conditions). The consumer faces a consequent welfare loss (Pauly, 1986; Arrow, 1973). This substitution effect is a potential source of distortion or inefficiency in the market for health care.

The insurance effect operates by "blunting" the patient's incentive to shop for cheaper health care. As price becomes less important in determining demand for health care, other factors (e.g., location and perceived quality) become more important (Newhouse, 1982; Pauly, 1986). Insurance may also indirectly promote moral hazard by removing some of the incentives for individuals to engage in health promoting and preventive behaviors because insurance insulates against the consequences of ill-health by reducing financial barriers to care. This is doubly true when the insurance specifically excludes coverage for preventive care.

Economic theory of demand for health care relies heavily on the assumption that demand for health care is price elastic (Feldstein, 1972). The greater the price elasticity, the more insurance can be expected to induce purchases of low-value care, and the more coinsurance can mitigate this over utilization. The higher the level of coinsurance imposed, the greater the restraining effect it will have on demand. Theory also suggests that insurance will have a different impact on different types of care. Those services for which demand is less elastic (such as in-patient care) will be less affected by insurance than services with a higher elasticity of demand (Newhouse, 1979).

The important policy issue related to this study of insurance effects on demand for health care in rural China is as follows. If the demand curve for

health care is known (i.e., if price elasticities can be estimated accurately), then the effect of different cost-sharing arrangements can be predicted (Pauly, 1986). The problem for policymakers is then a matter of choice between holding down "inefficient use" and risk spreading. Coinsurance is one mechanism available to help policymakers achieve a balance between these competing policy ideals (Feldstein, 1972).

Marquis and Holmer (1986) stress the importance of finding an optimal coinsurance rate early on. They assert that there is "inertia in the choice of insurance plan" and that "individuals are more responsive to decreases than to increases in the price of insurance." In other words, if the initial coinsurance rate is set too low, some of the increase in demand stimulated by generous coverage may become permanent; raising coinsurance rates later may offset some of this increased demand but not all. (Note, however, that the notion of finding an "optimal" coinsurance rate implies that the value as well as the cost of particular services can be known.)

Possible Limitations of Insurance Theory in the China Context

One important potential limitation of conventional economic theory in China is that its markets are poorly developed. Competitive markets have only recently begun to develop in China. In health care, most services are offered in public facilities and the market is heavily influenced by government controls. Prices are fixed by government decree, and entry and exit of providers are still very restricted. These are two mechanisms by which demand is rationalized after insurance changes for a wide segment of the population (Pauly,1986). Simply stated, consumers have few options, other than self-care, when faced with insurance-based price changes.

A second issue that may limit the applicability of Western-based economic theory relates to the concept of moral hazard. Implicit in the concept of moral hazard is the assumption that insurance-induced increases in consumption of health care constitute overconsumption. In populations where standards of care are better defined and where most people receive this minimum standard of care, this judgement may be valid. In China, such standards are not well-defined, and

utilization patterns are not sufficiently well understood to assess whether a minimum standard is largely met. If they are not, and if insurance sufficiently improves financial access, then the gains in welfare from risk pooling (Manning & Marquis, 1989) may, in fact, outweigh deadweight loss (Shepard et al., 1990) with better insurance coverage. A third issue in China is the assumption that consumers are well-informed about which services are most beneficial. The poorly trained rural doctors are not a source of good information (Cretin, personal communication).

Manning and Marquis (1989) listed several assumptions underlying health insurance theory to which estimates of insurance effects are sensitive:

1. Consumers have well-behaved utility functions
2. Ex post demand functions for health care can be estimated consistently as a function of price, income, and other factors
3. Consumers maximize expected utility with objectively correct assessments of risk.

The extent to which the first and third assumptions are true is debated, even with regard to market-based systems. The second assumption is less questioned. In China, central economic planning is giving way to market forces and incomes are rising rapidly (although less so in rural than in urban China). In such a state, demand functions may not be stable and may continue to change as people learn more about market forces.

Despite these questions, no well-developed alternative exits to the economic model on which to base a study of demand for health care in rural China. Therefore, the economic framework outlined above will provide the theoretical base for this analysis, noting those areas where assumptions may not be valid and where results may thus require cautious interpretation. It is worth repeating Newhouse's (1978a) comment that even in Western market contexts many of the assumptions underlying insurance theory are not met; yet the fact remains that theory often does predict what in fact is observed. This may also be true in China.

Empirical Evidence on Insurance Effects

Before the early 1970s, few empirical studies had been published about insurance effects on the demand for health care. Increased policy interest in the United States at that time was probably related to the introduction of two massive new public insurance programs (Medicare and Medicaid) and very high inflation that had begun to characterize the health care market. As methodologically flawed as most of the studies were then, they at least established a clear link between health insurance and demand. Until the RHIE, no good data had been obtained from a controlled experiment to confidently estimate demand elasticities.

Studies from the 1970s used three basic data sources: aggregated utilization data (usually insurance claims), surveys, or natural experiments. Each of these types of data has a number of weaknesses when used to estimate demand response to insurance. In the 1970s, these weaknesses were the basis of much of the debate about insurance effects on demand for health care (Newhouse, 1981, 1978b; Newhouse, Phelps, and Marquis, 1979; Phelps and Newhouse, 1974). Strengths and weaknesses of these data sources, as discussed in the literature, are summarized in Table 3.1. Specific findings of some of the most widely cited studies are summarized in Table 3.2.

Aggregated Utilization Data

Two early studies of insurance effects on health care demand used aggregated data. Heaney and Riedel (1970) used monthly summary claims data from Blue Cross of Connecticut to study differences in utilization of hospital inpatient services between groups with indemnity coverage and groups with full coverage. Davis and Russell (1972) used published hospital data aggregated to the state level. Both of these studies reported negative own-price effects for inpatient demand; Davis and Russell also reported negative own-price effects for outpatient care and positive cross-price elasticities which indicated that outpatient and inpatient care were substitutes.

Their results were compromised by methodological problems that are typical of studies using aggregate data. The most important problem is price

Table 3.1
Assessment of Data Sources for Health Care Demand Studies

TYPE OF DATA	WEAKNESSES	STRENGTHS	STUDIES
Aggregated (Insurance Claims) Data	• Use of "average" price or coinsurance rates (with aggregated data): - assumes consistency across groups - ignores nonlinearities in price schedules (e.g., deductibles) - ignores variations in coverage (e.g., OP and IP differences) • Usually little information about characteristics of the insured • Fails to capture information about services for which no claim was made • Representativeness - insured people may include more of those who expect to use more services than the general population (self-selection)	• If individual claim is unit of observation, price specification may be straightforward • Self-selection may be minimal, if insurance is employment-based	• Phelps and Newhouse (1974) • Davis and Russell (1972) • Heaney and Riedel (1970)
Survey Data	• Utilization, price, and insurance levels subject to recall error • Use of "average" price or coinsurance rates: - Ignores nonlinearities in price schedules (e.g., deductibles) - Ignores variations in coverage (e.g., OP and IP differences)	• Random sampling can ensure better generalizability • Information can be collected on other individual characteristics to test for interaction effects • More complete information can be collected on utilization, including use of services for which insurance claims were not made	• Newhouse and Phelps (1976) • Rosett and Huang (1973) • Acton (1973,1976)
Natural Experiments	• Effects of price often confounded by unobserved factors (e.g., epidemics, other policy changes) • Results often not generalizable because non-random samples often not representative of other populations • Control groups often lacking or poorly matched with experimental group • Range of coinsurance rates typically narrow	• Price specification is generally more straightforward and accurate • Same group generally is observed before and after price change (a built-in type of "control") • Usually a small segment of the market for health care is involved, so supply effects are not likely to confound results	• Scitovsky and Synder (1972) • Phelps and Newhouse (1972) • Roemer (1975) • Helms, Newhouse and Phelps (1978) • Beck (1974)

Table 3.2
Summary of Reported Insurance and Price Effects in Health Care Demand Studies

	Heaney and Riedel (1970)	Davis and Russell (1972)	Rosett and Huang (1973)	Acton (1973)	Acton (1976)
Data Type	Insurance Claims	Insurance Claims	Survey Data	Survey Data	Survey Data
Data Source	1967 Ct.[1] Blue Cross Ins Claims	1970 State-level Ins Data	1960 BLS[2] Survey of Consumer Exps	1965 Survey of OPD Users in NYC	1968 NORC & OEO HH Surveys, NYC
Dependent Variable	IP Use • Adm Rate • LOS • Patient Days	• OP Visits • IP Admissions	Expenditures (OP + IP)	• OPD Visits • IP Admissions	OPD Visits
Price Variable		Average revenue per OP visit, IP admission		Time-price	Time-price
Insurance Variable	Indemnity versus full coverage	• Percent of pop with Blue Cross insurance • Percent of pop with other IP insurance	Percent of total annual charges (OP + IP) paid out-of-pocket	Dummy variable: 1 if anyone in family had any insurance	• OP: dummy var, 1 if none • IP: 2 dummy vars, for Medicaid and Medicare coverage
Analytic Method	Z-tests, t-test	Log-linear regression	Probit regression	OLS and TSLS regression	Regression
Own-Price	• Adm Rate o weak pos (elas=.14) • LOS o weak pos (elas=.02) • Patient Days o signif pos (elas=.07) (from P&N,1974)	• OP Visits o elas = -1.0 • IP Admissions o elas = -.32 to -.46	Significant neg coefficient • At CI = 20% elas = -.35 • At CI = 80% elas = -1.50	• OPD Visits o elas = +.22 • IP Admissions o elas = +.02	Ambiguous coefficients (poor measure)
Cross-Price IP ---> OP	NA	SUBSTITUTES o elas = +.85 to +1.46	NA	COMPLEMENTS o elas = -1.72	COMPLEMENTS o significant pos coeff.
Cross-Price OP ---> IP	NA	SUBSTITUTES o elas = +.25	NA	COMPLEMENTS o elas = +.17 to +.09	NA

[1] Ct. = Connecticut
[2] BLS = Bureau of Labor Statistics

Table 3.2 (cont.)

	Phelps and Newhouse (1972)	Phelps and Newhouse (1974)	Newhouse and Phelps (1976)	Helms, Newhouse and Phelps (1978)	Keeler et al. (1982 & 1988)
Data Type	Natural Experiment	Insurance Claims	Survey Data	Natural Experiment	Controlled Experiment
Data Source	Stanford Univ. Group Health Plan	Claims data from four Insurance Co's	1963 CHAS Household Survey	CA Medi-Cal Copayment Exp	RAND Health Insurance Exp
Dependent Variable	• MD Visits • Change in number of visits	Total expenditure for MD, hospital, and drugs.	• IP Admissions • MD Use/Nonuse	• MD Visits • Hospital Days	No. of episodes o hospital o acute OP o chronic OP
Price Variable				Dummy variable, 1 = experimental group participant	
Insurance Variable	Coinsurance rate (dummy variable: 0% in 1966, 25% in 1968)	Coinsurance rate (ranging from 10% to 25%)	CI Rate - defined as total annual OOPcosts/charges		Series of dummy variables: o 0% CI o 25% CI o 50% CI o 95% CI
Analytic Method	Multiple regression	"Implied elasticities", based on a formula	OLS and TSLS regression	Multiple regression	OLS and NBR regression
Own-Price	Highly significant, neg coefficient (arc elas = +.14, from P&N, 1974)	Elasticity = +.07 (falling from .12 to .04 through CI range)	• IP Admissions o elas = -.17 • MD Use/Nonuse o elas = -.11	• MD Visits o significant negative coefficient • Hospital Days o positive coefficient	• Hospital o negative coefficients (not significant) • Acute OP o negative, highly significant coefficients • Chronic OP o negative, significant coefficients
Cross-Price IP ---> OP			COMPLEMENTS o elas = -.07	SUBSTITUTES	
Cross-Price OP ---> IP			COMPLEMENTS o elas = -.57	SUBSTITUTES	

specification. In the Heaney and Riedel study, price was not explicitly defined. Instead, two groups were compared: one group with indemnity coverage and one group with full coverage. In the Davis and Russell study, price was defined as average revenue per outpatient visit or per inpatient admission and day. In both cases, these price variables assume constant prices across insurance plans and across services, an assumption that clearly is not valid. Nonlinearities in price (such as would occur with the presence of deductibles), spending caps, or indemnity provisions also create price variation that are missed when average prices are used. These problems would bias estimated insurance effects away from zero, suggesting that perhaps demand for the services studied is perhaps less elastic than reported.

Self-selection raises another problem. Those who anticipate heavier use of services, such as those in poorer health, are more likely to opt for better insurance coverage. Lack of information about sociodemographic characteristics prevents the analyses from controlling for these potential confounders.

Survey Data

Data from surveys are often better than both aggregated and insurance claims data. Randomness in survey sampling improves generalizability of results, and the unit of observation (usually the individual) captures more of the variability in prices. Information on both users and nonusers of care is typically included, and sociodemographic information permits researchers to measure and control for effects of these potential insurance confounders. Measures of total utilization may be more complete because respondents can be asked about the use of noncovered services as well as covered services.

Household survey data also have several important drawbacks. Recall error is likely to result in inaccurate measurement of actual utilization and spending. Price specification may be as problematic as in the case of aggregated data from insurance claims. Researchers using survey data have most commonly specified price as the proportion of total recalled annual charges for health care paid out-of-pocket by the consumer. Since nonlinearities in price over the year and across service types are not accounted for in such a measure, problems arise in

estimating insurance/price effects. Because better covered services tend to have higher expenditures (e.g., hospital inpatient services), people with inpatient utilization will tend to have an assigned higher "average" coverage rate. In the estimated model then, the estimated insurance effect will be biased away from zero. Additionally, individuals who expect higher medical costs (e.g., those in poorer health) probably tend to self-select insurance plans with better coverage, again biasing estimated insurance effects away from zero.

Several studies illustrate these problems. Rosett and Huang (1973) used the 1960 Bureau of Labor Statistics Survey of Consumer Expenditures to estimate insurance effects on hospital outpatient visits and inpatient admissions. They reported very high elasticities of demand, ranging from -0.35 at a coinsurance rate of 20 percent and -1.50 at a coinsurance rate of 80 percent. Their coinsurance variable was subject to the biases described above, and indeed these elasticities are at the high end of published estimates.

Newhouse and Phelps (1976), using 1963 CHAS survey data, estimated a coinsurance variable in much the same way as Rosett and Huang. However, they found much lower own-price elasticities: -0.11 for the probability of having any physician visits and -0.17 for hospital admissions. Estimated cross-price elasticities for outpatient and inpatient care were negative, evidence that the two types of services were acting as complements.

Acton (1973) published results from a 1965 survey of outpatient department users in New York City. His insurance measure was a dummy variable indicating whether or not the person's family had any insurance. Those from families with some insurance were found to use more of both outpatient and inpatient services. He also determined that outpatient and inpatient services were complements. Acton (1976) later reported results from two household surveys conducted in New York City in 1968. With respect to outpatient visits, the reported estimates of insurance effects were ambiguous. This results may have been due to the poor quality of price and insurance measures and measurement differences between the two surveys.

Natural Experiments

Data from natural experiments have several advantages over survey data. Data are at the individual level and price and insurance variables are known quantities; they are not derived as averages from potentially faulty recall of consumers. Control of potential confounders is often possible, either because before and after observations are made on the same individuals or because a separate group of individuals exists for whom the intervention did not occur.

One important natural experiment occurred in the late 1960s at Stanford University. The coinsurance rate for outpatient services in the University's Group Health Plan was raised in 1967 from 0 to 25 percent. Using descriptive analysis, Scitovsky and Synder (1972) compared utilization rates in 1966 and 1968. They found that physician visits declined 25 percent. The change was nearly the same for all but one of the subgroups examined; the decline among female dependents of University employees was greater. Phelps and Newhouse (1972) confirmed these results with multivariate analysis. They estimated that demand for physician services declined 33 percent. Reexamination of utilization rates among the same group four years later determined that these effects were not transitory (Scitovsky and McCall, 1977).

Another well-known natural experiment occurred in the early 1970s among California's Medi-Cal population. In 1972, a $1 copayment for physician visits was imposed on a group of Medi-Cal enrollees. The remainder of the Medi-Cal population who did not have to pay this charge constituted a control group. The number of physician visits among experimental group enrollees declined, but hospital admissions increased by 17 percent, suggesting that outpatient and inpatient care were substitutes (Roemer, 1975; Helms, Newhouse,& Phelps, 1978).

This study demonstrates some common problems that compromise the validity of results from natural experiments. First, the experimental and control groups were not comparable. Because of political constraints, poorer Medi-Cal clients could not be assigned to the experimental group. It has also been reported that copayment collection was not uniform (Meyers, 1974), demonstrating the difficulty of ensuring strict adherence to protocols in natural experiments. Finally, other

policy changes (such as the "prior authorization" rule imposed for certain services in the midst of the experiment) might have confounded the results (Helms, Newhouse, and Phelps, 1978).

Beck's (1974) Saskatchewan study of the effect of introducing a $1.50 copayment for physician office visits demonstrates two additional points. First, unlike most other studies, the change studied in Saskatchewan applied to the entire population in a large market area (the province). When only a small segment of a health care market is affected by a change in insurance conditions, it may be reasonable to assume that supply remains relatively constant (Pauly, 1986). When the change applies to a large segment of the market (in the Saskatchewan case, to the entire provincial population), some dynamic interaction probably occurs between demand and supply side responses. Second, Beck identified an income-insurance interaction in demand response. He found that while demand for physician visits declined 6 to 7 percent in the whole population, it declined 18 percent among the poor.

The RAND Health Insurance Experiment

The RHIE was the first controlled experiment designed to study insurance effects on demand for health care. The experimental design allowed researchers to avoid many of the problems that limited the reliability of results from previous studies. Results from the RHIE are, therefore, generally considered definitive with respect to health care demand in the United States. Whether or not these results also apply to non-U.S. populations is the central focus of this research.

The RHIE was carried out between 1974 and 1979; 2,760 families from 6 sites around the U.S. were enrolled in 1 of 4 basic types of health insurance plans for either 3 or 5 years. The range of coinsurance rates in these plans (0 to 95%) was wider than in most previous studies (mostly between 0 and 25%). The design solved two problems: the endogeneity of insurance and lack of adequate data on potential confounders. The presence of deductibles and spending caps resulted in nonlinearities in price and complicated specification of the price variable for analyses of annual utilization rates, just as had been the case in many of

the earlier studies. However, analysis of "plan" (rather than "price") partially overcame this limitation.

Data were collected from each participant for all in-plan and out-of-plan health care utilization. Unlike most of the earlier studies, Keeler et al. (1988) used the demand for *episodes* of health care, rather than the usual physician visits or hospital admissions. These were defined as hospital episodes or one of four types of outpatient episodes: acute, chronic, well care, and dental. (Well care and dental episodes are be discussed here because these services were not covered in the CHIE plans.) This approach was chosen because the policy interest was how insurance affected peoples' behavior and initiation of care for an illness was thought to be a better measure of that behavior. Subsequent care within an episode of illness was thought to be less purely a decision of the patient. (See Chapter 5 for a more complete discussion of episodes of care as a dependent variable.)

In most non-RHIE research which used multivariate analytic techniques, either OLS or two-stage-least-squared regression was used. This was not strictly appropriate when the data were count data (e.g., visit or episode data) or when the distribution of visits (or episodes) is not normal. Keeler and colleagues used negative binomial regression (a form of poisson regression; see Chapter 6) instead. Additionally, excellent data on sociodemographic characteristics were available for their models.

Own-Price Effects The elasticities reported were in line with the low estimates published earlier by other researchers. Of particular interest was the RHIE finding that cost-sharing primarily affected demand through decisions about when to initiate care (the number of episodes of care received). Those with more generous coverage had significantly more episodes of care, but the cost per episode of care did not differ significantly across the plans. Pauly (1986) suggested that higher cost-sharing provisions may "screen out less severe illnesses," thereby increasing the severity of illnesses for which care is sought. If this explanation were true, then use of resources would be expected to be greater for the more severe illnesses seen in the high cost-share plans,

but such a cost difference was not observed in RHIE data. Pauly explains these results by suggesting that providers responded by reducing the intensity of services delivered to those in higher cost-sharing plans. Such a supply-side response supports earlier research findings that suggested that demand effects are a result of an interaction between the choices of both consumers and suppliers. It also provides further justification for the use of episodes of care over visits or admissions, where decisions are less in the control of the consumer, as the measure of demand.

Cross-Price Effects Cross-price elasticities for outpatient and inpatient care were negative (Pauly,1986), supporting the results of researchers who found outpatient and inpatient care to be complements.

Empirical Evidence on Sociodemographic Effects

Sociodemographic characteristics are potential confounders of insurance effects on demand for health care. To avoid bias in estimating insurance effects, demand models must include these variables. Effects of these characteristics on demand are also interesting in their own right. Furthermore, possible interactions between insurance and sociodemographic characteristics are also important to assess. In this section, published reports of the influence of socio-demographic variables are reviewed. Their findings are summarized in Table 3.3.

Health Status

Health status has consistently been found to strongly affect demand, regardless of whether the measure is clinically based or self-reported. In two studies by Acton (1973; 1976), different measures of health status were used. In both cases, poorer health significantly increased demand for health care, for both OPD visits and inpatient admissions. Using a self-reported health status measure, Newhouse and Phelps (1976) also observed a negative relationship for both outpatient and inpatient care. Greater age is expected to be associated with poorer health status; however, Newhouse and Phelps reported that age was not a significant predictor of demand when a health status variable was included in

Table 3.3
Summary of Reported Socio-Demographic Effects on Demand for Care

COVARIATE	Rosett and Huang (1973)	Acton (1973)	Acton (1976)	Beck (1974)
AGE	Expenditures decreased as age of household head increased	•OP visit elas = +.03 •IP elas = -.18	Age and age^2 not related to number of OPD visits	More visits as age of family head increased
GENDER	No significant relationship (gender of household head)	•OP elas = -.02 (male) •IP elas = +.11	Males had fewer visits	
EDUCATION	No significant relationship (education of household head)	•OP elas = +.39 •IP elas = +.10	People with lower education had more OPD visits	
HEALTH		•OP elas = neg •IP elas = neg	# OPD visits increased as number of chronic conditions increased	
HOUSEHOLD SIZE	No significant relationship	•OP elas = -.70 •IP elas = +.01	# visits decreased as household size increased	Number of visits increased as number of children in household increased.
INCOME	No significant relationship (after tax income)	•OP elas = -.15 (gross wage) •IP elas = -.08	Inconsistent; significance varied by site and whether income was earned or nonearned	Number of visits increased as income increased
DISTANCE		•OP elas= -2.07		
TIME-PRICE			Number visits decreased as time-price and as travel time increased	
INTER-ACTIONS				Poor more responsive

Table 3.3 (cont.)

COVARIATE	Phelps and Newhouse (1972)	Newhouse and Phelps (1976)	Keeler et al. (1982 & 1988)	Wedig (1987)
AGE	U-shaped demand	No significant relationships	Higher age --> more acute and chronic episodes	Higher age --> higher probability of use (adults)
GENDER	Females had more visits, especially for dependents	•No significant IP relationship •Females had more MD visits	Females had more of all type of episode	Females more likely to have visits and have more visits
EDUCATION		No significant relationships	More education -> more chronic episodes	Negative effect on both measures
HEALTH		People in poorer health had more IP and MD use	People in poorer health had more of all types of episodes	Positive effect on both measures
HOUSEHOLD SIZE	No significant relationship	•No significant IP relationship •Larger HHs had fewer MD visits	No significant relationships	Negative effect on both measures
INCOME		•Higher nonwage income -> more IP admissions. •Higher wage and nonwage income ->more MD visits	Higher income -> more acute and chronic episodes	Inconsistent results
DISTANCE	Significant negative effect only at 20+ miles			
†IME-PRICE		•No significant IP relationship •Higher time price -> higher MD use		Negative effect on both measures
INTER-ACTIONS	Female dependents more responsive			Health/price: not significant

their model. They also reported a significant interaction between health status and insurance; those in poor health had higher price elasticities of demand. Although the effect of health status has consistently been reported to be strong, Newhouse (1981) cautioned that there may be "reverse causality" between health status and demand (that is, heavier use of health services may influence a person's subjective assessment of their health status).

In the RHIE, Keeler et al. (1988) constructed a health "worry" index from self-reported answers to several baseline questions about health. They also reported that poorer health was a significant predictor of greater demand for acute and chronic outpatient episodes but not a significant predictor in the demand for hospital episodes.

Age and Gender

Nearly all researchers have reported that age significantly affects demand. In most cases, this effect is reported to be nonlinear. Age is generally modeled either as a series of dummy variables representing age categories (Phelps and Newhouse, 1976) or as age in years, usually with an age-squared term to capture nonlinearities (Keeler et al., 1988; Acton, 1976; Beck, 1974). Demand is most commonly reported to be u-shaped with respect to age, with higher demand among children and the elderly.

In the RHIE, demand for acute outpatient episodes of care followed this u-shaped pattern. For chronic outpatient episodes, the relationship between age and demand was significant but linear (the age-squared term was not significant). For hospital episodes, age was not a significant predictor of demand.

Females are widely reported to have higher demand than males (Acton, 1976; Newhouse and Phelps, 1976). However, gender is typically entered independently of age. Newhouse and Phelps (1976) point out that the implicit assumption that gender differences in demand are constant across age may not be reasonable, but apparently they did not test for this in their analysis. In an analysis of the RHIE data that included a dummy variable for adult women, Keeler et al. (1988) found that they had significantly higher demand for acute and chronic outpatient episodes of care, as well as for hospital episodes.

Some researchers have reported on age and gender interactions with insurance. Demand among female dependents of enrollees in Stanford University's Group Health Plan decreased more than the average after a change in coinsurance rates (Scitovsky and Synder, 1972; Newhouse and Phelps, 1972). Meyers (1974) commented that demand among mothers and children in the experimental copayment group of the CMCE decreased more than among other age/gender groups. Keeler and colleagues (1988) found no interaction between insurance and either age or gender. Leibowitz (1985) and Valdez (1985), both using RHIE data, looked explicitly for an interaction between insurance and childhood. They reported that children in 95-percent coinsurance plans had 67 percent fewer episodes compared to those in free plans but concluded that children's demand for health care is no more or less responsive to insurance than that of adults.

Education

Findings on the importance of education in determining demand have been mixed, perhaps because of the use of widely varying measures. Using education of the household head, Rosett and Huang (1973) reported that education was not significant. However, their data were from 1960 when most household heads were probably men. A more relevant measure would have been education of the female household head, since it is commonly believed that she exerts more control over household health care decisions.

Acton's 1973 study used own education and reported significant and positive elasticities in both outpatient visit and inpatient admission models. His 1976 study concluded that the opposite was true for outpatient visits; more highly educated individuals used fewer services. Since Acton did not indicate in either study how children's education was modeled, it may account for his contradictory results. Differences in the two samples may also account for these results. The 1973 study used data on users only; the 1976 study included both users and nonusers.

Modeling education as "highest grade completed," Newhouse and Phelps (1976) reported negative but nonsignificant coefficients for both outpatient and inpatient care. The episode analysis of RHIE data (Keeler et al., 1988) modeled

education as the maximum level of education of anyone in the household. They reported insignificant coefficients for hospital and acute care episodes. For chronic episodes, higher education had a significant and positive effect on demand.

Family Size

About half of the studies that looked at family size reported that it was not an important covariate (Rosett and Huang, 1973; Phelps and Newhouse, 1972; Keeler et al., 1988). Acton (1973) reported a high, negative elasticity for family size with respect to outpatient care but a very low elasticity with respect to inpatient admissions. Similarly, when Newhouse and Phelps (1976) disaggregated outpatient and inpatient care, they found that a larger family size significantly decreased people's probability of using any physician services but that it had no significant effect on the number of inpatient admissions.

Beck (1974) reported that a greater number of children in the family predicted significantly more physician visits. In the RHIE (Keeler et al., 1988), the log of family size was significant only in the estimate for acute outpatient episodes; larger family size depressed demand. The coefficient for the chronic care equation was also negative but not significant at the conventional $p<.05$ level (it was significant at the $p<.10$ level). The coefficient for the hospital episode equation was essentially zero.

Income

Income effects on demand are of high policy interest; it is thus not surprising that most researchers include some income variable in their models. However, income is a difficult variable to measure. The considerable variation in the source and specification of this variable probably accounts for much of the disagreement in reported effects (Newhouse, 1981). Self-reported income often underestimates true income, but it is the easiest measure to collect. Earned income is often an incomplete measure, but nonearned income is difficult to measure accurately. "Permanent" income may be more important in demand decisions, but it is more difficult to measure than transitory income (Newhouse, 1981).

Considerable research attention has also been given to insurance-income interactions. In Saskatchewan, Beck reported that demand for physician services decreased considerably more among the poor than in the general population (18 percent compared to only 6 to 7 percent). Newhouse (1981) reviewed research reports of insurance-income interaction and concluded that the results were "inconclusive." Results from the RHIE did not find any significant income-insurance interactions.

Distance/Travel Time

Distance and travel time are measures of access to care; generally they measure the time-price of care. Few studies have included these measures in their demand models. Acton (1976) estimated his models using both travel time and time-price and reported significant negative associations with demand for hospital outpatient visits. Newhouse and Phelps (1976) also estimated time-price effects and reported that they were not significantly related to demand for inpatient admissions. For outpatient department visits, a higher time-price was significantly related to greater demand.

An International Perspective

Insurance is not a new financing mechanism for health care in developing nations. Most insurance schemes in these countries cover employed, urban populations, but some do cover rural groups. For example, in preindustrial Japan, insurance cooperatives were established in rural communities (Higuchi, 1973). These local rural cooperatives were incorporated into a national insurance scheme by 1938. In Korea, the government began to phase in insurance coverage for its rural population in 1981, completing the process in 1988. In China, rural health insurance schemes have existed since the 1950s (see Chapter 2).

In his 1979 monograph, *Health Care Financing in Developing Countries,* Zschock discusses the role of price and other determinants of demand for health care in much the same terms as the literature based on U.S. populations. His discussion implies that adverse selection, moral hazard, and sociodemographic

factors operate in developing countries in much the same way as has been observed in the United States. However, his document contains little empirical information to support these assertions. Analyses in the published literature on the subject of price and insurance effects on demand for health care in developing populations provide only weak evidence that people in developing countries behave similarly to the U.S. populations. Several of these studies are summarized below for illustrative purposes.

The Philippines

Prepaid HMO plans were pilot tested in the late 1980s in The Philippines. Two communities were chosen that had well established health services delivery systems, a mix of income groups, and a sizeable proportion of the population experiencing "difficulties in availing themselves to these services because of financial constraints" (LIKAS, 1990). Consultation (provider visit) rates for HMO members were compared with those reported by respondents during a community survey carried out before establishing the HMOs.

"Much higher" consultation rates (outpatient consultations were not distinguished from inpatient consultations) were observed for HMO members. The authors concluded that "the HMO has increased the availability of medical care to its members" and "that HMO members are more likely to seek prompt medical care when they are not constrained by cost." Hospital lengths of stay were lower for members in both HMO plans than for the general community in the pre-HMO period (2.1 versus 7.0 days, and 3.4 versus 5.8 days). The authors attribute these results to "prompt and effective primary medical care," suggesting that outpatient and inpatient care were substitutes.

These results are consistent with the conclusion that there was a negative price effect; the marginal cost of a consultation for HMO members should have been lower (zero) compared with those for services received in the prior, full charge fee-for-service system. Unfortunately, the project report did not present sufficient information to determine whether the HMO and survey groups were comparable, and no statistical tests of significance were reported for the HMO-survey differences.

Zaire

In 1990, Shepard, Vian, and Kleinau published an evaluation of two rural health insurance programs in Zaire that were implemented in the mid- and late-1980s. One program covered hospitalizations only; the other covered ambulatory care only. Coinsurance was a feature of both plans. The report provides descriptive evidence that coinsurance rates were negatively associated with demand.

The Bwamanda plan covered only hospitalizations. A 20-percent coinsurance rate was imposed on all plan-covered services. Employers paid the premium and the coinsurance portion of charges for members enrolled through the workplace. Hospital utilization rates were compared for these three groups: the uninsured (100-percent coinsurance), nonemployed members (20-percent), and employed members (0-percent).

The employed insured constituted only 5 percent of the population in the area where the insurance plan was offered, but they represented 17 percent of all hospitalizations. The nonemployed insured represented 60 percent of the population and 77 percent of hospitalizations. Thirty-five percent of the local population was uninsured and they were under represented in hospitalization (6 percent). The admission rate for the employed insured group was 20 times higher than the uninsured group; the rate for nonemployed insured was 7 times higher.

Although the differences are large, the authors provide no indication that they subjected these comparisons to tests for statistical significance and they admit that factors other than insurance may account for these observed differences. Moreover, the control group (the uninsured) appears to have differed in some important ways from the insured groups. For instance, employed insured probably had higher incomes than either the nonemployed insured or the uninsured. The uninsured might have been either the poorest who could not afford the premiums or healthier people who did not anticipate need for hospitalizations (adverse selection). It is not possible to assess the extent to which the differences may have been caused by income or health status rather than insurance coverage.

In short, while the data presented do clearly show a negative association between demand for hospitalizations and coinsurance, these differences may easily also be accounted for by other factors. Evidence from the United States suggests that demand for inpatient care is less responsive to coinsurance rates than demand for outpatient care, but the evidence from the Bwamanda region of Zaire contradicts this body of research, suggesting a very large response.

In the Bokoro region, a plan to provide comprehensive coverage was introduced in 1985. In 1989, coverage was limited to curative (nonchronic) ambulatory care. A 25-percent coinsurance rate was imposed, and as in Bwamanda, the copay amount for employed enrollees was paid by employers (i.e., an effective coinsurance rate of 0-percent). The premiums were reported to be too high for most nonemployed individuals, so the insured groups was comprised mostly of employed persons.

The insured were observed to have "11 to 12 times higher utilization than the uninsured." When episodes ("consultation rates for 'new disease'") were used as the unit of comparison, the difference dropped to a factor of five. These comparisons, however, suffer from the same problems described for the Bwamanda comparisons. There was no indication that the differences were subjected to statistical tests of significance. Comparability of the two groups was assessed using survey data from only 47 individuals (21 insured and 26 uninsured).

Korea

Korea completed its process of extending health insurance coverage to its entire population in 1988. Regional health insurance societies are managed locally under guidelines established by the central government. Coinsurance was instituted "from the beginning [as] the primary way to discourage unnecessary utilization." In the early 1980s the rate was set at 20-percent for inpatient care and 30-percent for outpatient care. A higher rate (50-percent) was later imposed for outpatient care sought at hospitals to provide incentives for people to use outpatient facilities as the entry point for care.

Yu and Anderson (1992) reported only a "slight decrease" in utilization following imposition of these coinsurance provisions, although utilization rates

at hospitals "remained high." In 1986, a graduated system of copayments (in addition to the coinsurance rates) was imposed in an attempt to discourage use of hospital services. Visits "declined slightly for a short period, but soon returned to original levels."

The authors conclude that Korean consumers are insensitive to coinsurance rates. They explain this surprising finding as follows: Koreans were accustomed to paying full charges and did not find the coinsurance rates significant. Though no data are shown, they do claim that coinsurance had a differential effect on utilization by income class, "with the low income groups using considerably fewer services than higher income groups."

In what appears to have been a well-designed survey, Kim et al. (1986) compared visits in Korean communities before and after introduction of the health insurance program with somewhat different results. They found that after introduction of insurance, use of formal outpatient health services (government health centers, clinics, and hospitals) increased significantly. Use of other sources of outpatient care (such as drugstores) decreased significantly. Inpatient admission rates and inpatient days per 100 persons also increased significantly. Overall, they concluded that the observed increase in demand in the formal sector represented a shift in utilization patterns, not an increase in "new effective demand."

In summary, what little evidence exists from developing countries suggests that insurance effects are similar to those described in studies of populations in Western, developed nations; that is, demand for health care increases with better insurance. Much controversy arose about the magnitude of insurance effects in the United States until the controlled RAND Health Insurance Experiment settled the debate. The poor quality of data from developing countries does not allow for precise estimates of the magnitude of the insurance effects. The China Health Insurance Experiment produced data on utilization that allows insurance effects to be estimated. Data on the important covariates of health care demand provide an opportunity to compare the demand functions for health care in a developing country context.

CHAPTER 4

THE CHINA HEALTH INSURANCE EXPERIMENT: Experimental Design and Data

The CHIE was sponsored by the Ministry of Public Health in Beijing in response to the vacuum in rural financing created by the decline of CMS organizations. The objective was to study the feasibility of locally administered health insurance schemes financed primarily by premiums paid by enrollees. The Chinese government was primarily interested in the actuarial and managerial feasibility of insurance as an option to the nearly defunct Rural Cooperative Insurance mechanism. RAND researchers worked in cooperation with researchers from the West China Medical University in Chengdu, Sichuan Province. This chapter describes the experimental design, data collection and analytic file construction methods. This study is based on data from a 20-percent sample of households that enrolled in the experiment. This sample is also described in this chapter.

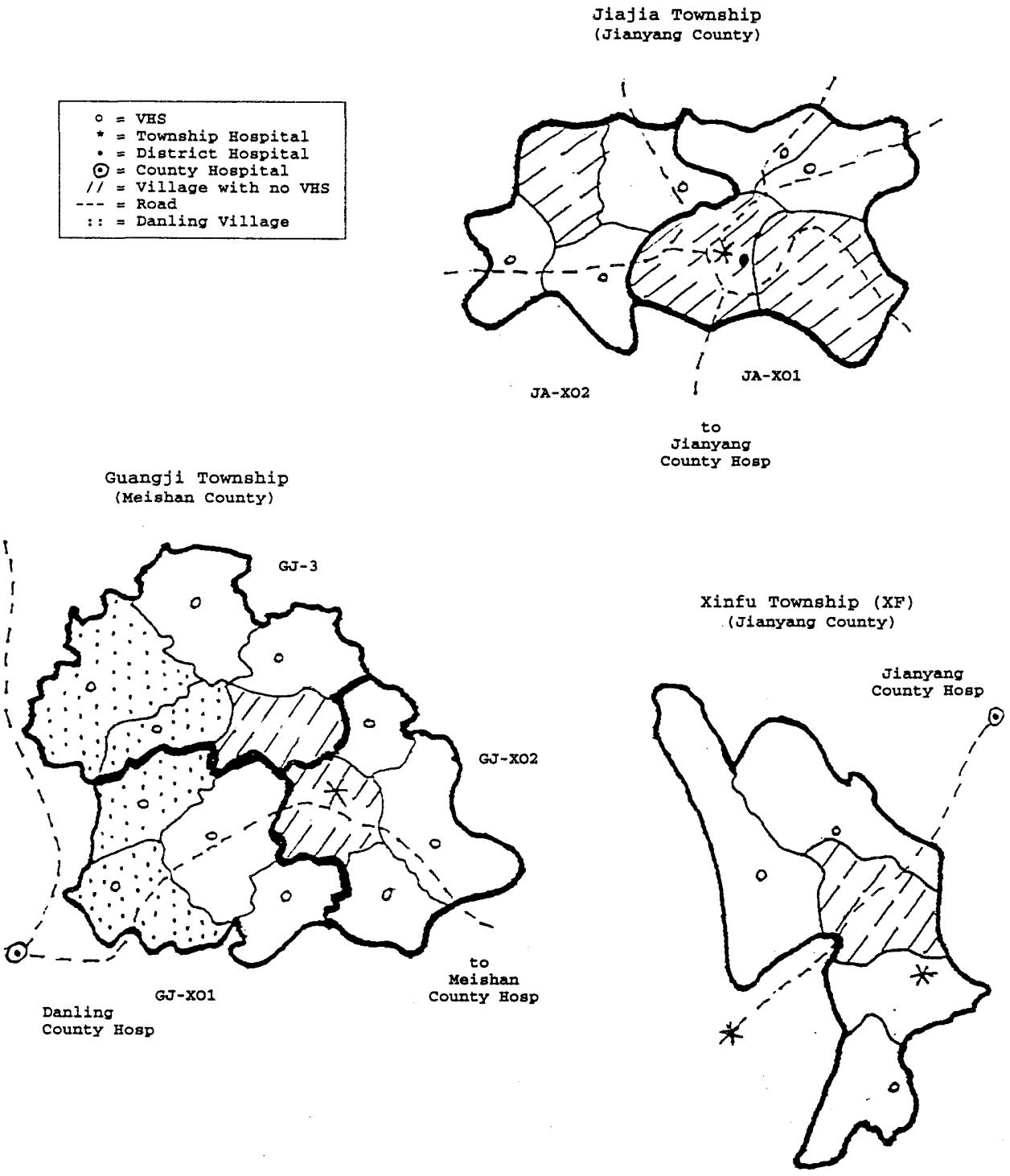
Experimental Design

Figure 4.1 shows the location of the experimental areas. Two rural counties, each about 75 kilometers from the Sichuan provincial capital of Chengdu, were purposively selected to participate in the experiment. One township (Guangji) from Meishan County and two townships (Jiajia and Xinfu) from Jianyang County were selected in the second sampling stage. All villages in each township participated, for a total of 26 villages. Enrollment within each village was voluntary. However, households enrolled as a unit, and enrollment rates generally exceeded 90 percent.

The CHIE was carried out in several phases beginning in 1985 with a self-reported utilization survey. Results from this survey were used to design a pilot study. The pilot study was conducted in 1988 in 4 of the 26 villages. All 26 villages participated in the quasi-experimental phase. The three components of this phase were

1. Baseline Survey (December 1988) - sociodemographic information was collected for each person enrolled at the beginning of this phase

Figure 4.1
CHIE Experimental Areas



(baseline information other than age and sex was not available for late enrollees)

2. Quasi-experimental Period (January 1989 to December 1 1990) - utilization of plan-covered health services was monitored

3. Satisfaction Survey (December 1990) - information on knowledge and attitudes toward local health services and insurance, and use of out-of-plan health services was collected from a sample of households in each village.

The following description focuses on the quasi-experimental period.

Insurance Plan Description and Assignment

These twenty-six villages were grouped into six geographical units of four or five villages each. (These groups will be referred to as "experimental" groups.) One experimental group (five villages in Guangji Township) was located in a mountainous area. One of eight different insurance plans was assigned to each experimental group in the first experimental year. In 1990, each group switched to a different plan.

Notations for the six experimental groups (see Appendix 1 for list of villages in each group) are

1. GJ-XO1 - Guangji Crossover Group 1 - Residents of four villages in Guangji Township. GJ-XO1 "crossed over" with GJ-XO2.
2. GJ-XO2 - Guangji Crossover Group 2 - Residents of four villages in Guangji Township. GJ-XO2 "crossed over" with GJ-XO1.
3. GJ-3 - Guangji Group 3 - Residents of five villages in a mountainous area of Guangji Township. This group did not participate in the crossover design.
4. JA-XO1 - Jiajia Crossover Group 1 - Residents of four village in Jiajia Township. JA-XO1 "crossed over with JA-XO2.
5. JA-XO2 - Jiajia Crossover Group 2 - Residents of four villages in Jiajia Township. JA-XO2 "crossed over" with JA-XO1.
6. XF - Xinfu Group - Residents of five villages in Xinfu Township. This group did not participate in the crossover design.

Four of these groups (16 villages in all) were selected to participate in a crossover design. The two "flat" groups in Guangji Township constituted one pair; the two Jiajia Township groups constituted the other pair. In the first year, two insurance plans were assigned to each crossover group, one paired plan was assigned to each group in the crossover pair. In 1990, villages within each cross-over pair "crossed over" to the 1989 plan from its matched pair.

The insurance plans covered curative and some preventive health services received at specific facilities (see Figure 2.1 for details of facilities and services). Some preventive services were delivered through separate mechanisms

and were not covered by the CHIE plans. Each of the eight plans had a unique set of coinsurance rates; one set for outpatient care and one set for inpatient care. (Coinsurance is defined as the proportion of charges that enrollees were required to pay; the insurance plan paid the remainder.) Some plans were "balanced;" that is, inpatient and outpatient rates were similar or the same. The rate structure in other plans favored either outpatient or inpatient services. Coinsurance rates were more favorable (10 percent lower) for services received at the two lower level facilities (VHS and township hospital). The rate difference by level of care was intended to promote entry into the system at the lower levels and use of the referral system for higher level care. Table 4.1 summarizes the coinsurance rate structures for the plans.

For VHS and township hospital services, enrollees were required to pay out-of-pocket only the coinsurance portion of charges. Facility staff billed the township insurance management entity for the balance. Patients were required to pay, up front, full charges incurred for services received at district and county hospitals. They were later reimbursed by the insurance entity for the amount covered by their plan. Although enrollees could initiate care at any of these levels, there were limitations. For example, enrollees would be reimbursed for services provided at the township (or district or county) hospital in their own township (or district or county). They could choose to seek services at another township (or district or county) hospital, but they would not be reimbursed for any charges incurred. This rule had two explicit exceptions. First, four Guangji Township (Meishan County) villages were permitted to receive services in the neighboring Danling County hospital in 1990. These villages (see Figure 4.1) were on the far western side of the township, and their remoteness from the township and county hospitals severely compromised access to care above the VHS level. Second, in both 1989 and 1990, villagers in Xinfu Township were permitted to seek care at the nearby Caoshi Township hospital.

Enrollees were issued identification cards that were to be presented each time they sought services at one of the health facilities in their area. (The village doctors and township hospitals also retained up-to-date enrollment lists

Table 4.1
Coinsurance Rates for CHIE Plans

EXPERIMENTAL GROUP	1989 CI Rates[1]		1990 CI Rates[1]	
	OP	IP	OP	IP
GJ-XO1	70%	40%	40%	70%
GJ-XO2	40%	70%	70%	40%
GJ-3	70%	40%	50%	50%
JA-XO1	70%	30%	50%	60%
JA-XO2	50%	60%	70%	30%
XF	50%	75%	60%	50%

[1] CI rates listed are for VHS and township hospital care; rates at district and county hospitals were 10 percent higher (except at for the Xinfu group where district and county hospital rates were 5 percent higher).

to accommodate patients who forgot their insurance ID cards.) Medical personnel completed an encounter form for each outpatient visit or inpatient stay, listing the patient's name, age, and identification number. Completed encounter forms also contained information on charges for the visit or hospital stay, categorized according to the type of service (e.g., Western or Chinese drugs, exam, operation, or "other"). Patients were reimbursed on the basis of their coinsurance rates and the charge information contained on these forms. These forms were also the source of information for data file construction.

Data File Construction

Initial input into computer data files was carried out at the West China Medical University (WCMU). Data cleaning was performed jointly at WCMU and RAND. Three data files were constructed, one each for the baseline and satisfaction surveys and one for the health services utilization records. The full sample for the quasi-experimental phase consisted of about 11,000 households and 40,000 individuals in 1990 (including all original enrollees and all who enrolled after the January 1, 1989 start date). A "20-percent sample" was randomly drawn from

among the households in the full sample:

1. Each participating household was assigned a unique five-digit household identification number (the first two digits represented a village identifier; the last three digits were assigned sequentially in each village starting from 001).

2. Households with IDs ending in digits 2 and 7 were assigned to the "20-percent sample."

3. All individual enrollees living in these households were included in the 20-percent sample.

4. For this sample of participants, data on all encounters at the village, township, district, and county levels were extracted and entered into the computer.

Table 4.2 compares the full and 20-percent sample sizes. RAND staff worked only with files for this 20-percent sample, and the remainder of this document pertains only to this sample. This section describes the utilization file for the 20-percent sample.

Each observation in the raw data set represented one outpatient visit or one hospital stay. In some cases, prescriptions for Chinese and Western drugs written for the same visit or stay were recorded as separate encounters. During data cleaning, these cases were combined into a single observation.

A total of 55,039 case records covering outpatient and inpatient utilization in 1989 and 1990 were included in the original WCMU 20-percent sample file. Nine percent of these cases were combined with other cases or dropped from the final visit-level data set:

1. 7 percent (4017) = records combined (same day outpatient visits at the same facility; i.e., multiple prescriptions; cost information combined into one record)

2. 2 percent (1164) = records dropped (duplicate records, missing or invalid identification or visit date information).

The final visit-level, 20-percent sample contained 49,858 records. Three-quarters of the reduction resulted from combining records; only 2 percent of the original records were unusable. Nearly all of these changes were made to outpatient records. The number of inpatient records dropped from 661 to 651 (1.5 percent). In each of these ten inpatient cases, inpatient admission/discharge dates overlapped with another inpatient case; charge and date information from the two cases were combined. Table 4.3 compares the number of records in the

Table 4.2
Number and Proportion of Households and Individuals:
Full and 20-Percent Sample

SAMPLE	HOUSEHOLDS		INDIVIDUALS	
	1989 No. (%)	1990 No. (%)	1989 No. (%)	1990 No. (%)
Total Population[1]	10,908 (100%)	11,461 (100%)	41,226 (100%)	42,637 (100%)
Enrolled Population[1]	10,144 (93%)	11,003 (96%)	37,928 (92%)	40,079 (94%)
20-percent Sample	2,237 (22%)	2,249 (20%)	8,660 (23%)	8,705 (22%)

[1] From Table 2, "Results of Analysis"; Project Report (Cretin and Williams, 1991, pg 15)

original and final visit-level, 20-percent sample data files by township residence of the enrollee.

Two annual files, one each for 1989 and 1990, were constructed from the cleaned 20-percent sample. These files contained all outpatient visits and inpatient stay records. One blank record was added to files for each person who had no outpatient visits or inpatient stays in the respective year.

Creation of Episode Files

The unit of analysis for this research is episodes of care (see Chapter 5 for discussion of dependent variables). Each outpatient visit and inpatient stay was, therefore, assigned to either an episode of outpatient or inpatient care. Ideally, both encounter dates and diagnostic information are needed to assign individual visits and hospital stays to an episode of care. Encounter date information was nearly always complete; however, usable diagnostic information was not collected during the CHIE.

To define a rule for grouping outpatient visits and hospital stays into episodes, visit sequences were examined for about 100 individuals who had large numbers of visits. Visit clusters were identified, and the number of days

Table 4.3
Comparison of Original and Final 20-Percent Sample
(Visit-level Files)

NUMBER OF RECORDS	TOWNSHIP			TOTAL
	Guangji	Jiajia	Xinfu	
Original 20-percent Sample	23,387	21,825	9,827	55,039
Records Combined	2,540	972	505	4,017
Records Dropped	382	593	189	1,164
Final 20-percent Sample	20,465	20,260	9,133	49,858

between these clusters was calculated. Gaps between clusters were almost always 15 days or greater. A space of 15 days or more between visits or inpatient stays, therefore, was used to assign encounters (outpatient visits or inpatient stays) to an "episode of care:"

1. The first encounter in each year was defined as the beginning of the first episode for that year.
2. If the next encounter occurred 14 days or less after the first outpatient visit date or inpatient discharge date, it was considered to be part of that episode. If it occurred 15 or more days later, a new episode was defined as having begun.
3. Applying the same rule, each subsequent encounter in that year was compared to the previous one.

A total of 28,078 episodes of care was derived by this method. Episodes that would have spanned 1989 and 1990 according to this algorithm were defined as two episodes; 1989 encounters were grouped into one episode and 1990 encounters were grouped into another episode. These episodes were split because different coinsurance rates applied to visits that occurred in different years during the episode. Only 76 episodes spanned the 2 years; splitting these into 2 episodes, 1 for each year, should not significantly affect the analyses. An additional 437 episodes (1.6 percent of the total) may not have been complete because the first visit occurred within the first 14 days of the start of the experiment. According to the 15-day episode definition rule, it is conceivable that the episode began before the start of the experiment. Since the insurance

Table 4.4
Total Number of Visits and Episodes
by Township and Year

TOWNSHIP	1989		1990	
	Visits	Episodes	Visits	Episodes
Guangji	8,967	5,435	11,498	7,143
Jiajia	7,867	4,241	12,393	6,195
Xinfu	4,218	2,408	4,915	2,656
TOTAL	21,052	12,084	28,806	15,994

plans were not in effect when the episode started (before January 1, 1989), the prospective coinsurance rate was probably not a factor in the decision to initiate care. Similarly, 727 episodes of care (2.6 percent) may not have been completed during the experimental period; that is, the last recorded visit occurred within the last 14 days of 1990. The effect of coinsurance on the decision to initiate care in these cases was most likely similar to other decisions made during that year because even though care may have continued past the end of the year, care began within that year.

Episodes were further defined as either outpatient (if all encounters within the episode were outpatient visits) or inpatient (if one or more encounters in the episode were inpatient stays) episodes. Table 4.4 shows the number of episodes generated from the cleaned visit-level files, by year of the visit and township.

To test the sensitivity of the episode composition to the 15-day definition rule, data sets were also constructed using a 22-day rule as a cut off point. Using this rule, 10 percent fewer episodes were created from the encounter-level files. This difference is not substantial, and all episode analyses reported in this study pertain to files constructed using the 15-day rule. (See Appendix 2 for a comparison of number of episodes created using the two different rules.)

CHAPTER 5

DESCRIPTION OF EPISODE DATA FILES

In this chapter, the variables in the episode data files are defined and the sub-samples used in the analyses are defined and compared. Those sub-samples are

1. Panel Sample - This sample includes only those individuals in the 20-percent sample who were enrolled in the CHIE for the full two-year duration of the CHIE quasi-experimental period. Those who either enrolled late (after January 1, 1989) or those who disenrolled early (before December 31, 1990) are defined as "nonpanel" enrollees. Multivariate analyses in this report use only panel sample data.

2. Household Samples (2) - As noted in Chapter 4, the 20-percent sample is comprised of individuals in households with a household identification number ending with either a 2 or a 7. The 7-sample is slightly smaller than the 2-sample. To prevent overfitting the data, the 7-sample was used for model building and the 2-sample was reserved for final model estimation.

3. Experimental Group Samples (6) - Insurance plans were assigned to six experimental groups. (See Chapter 4 for a definition of these groups.)

The panel and nonpanel samples are compared descriptively to assess the degree to which an estimated model of demand for health care might be expected to differ between the two. Data are censored for individuals in the nonpanel samples (late enrollees and early dropouts); that is in one or both years, utilization data are for partial years. Thus, in an analysis of annual demand, they cannot be compared to those with full year utilization data. In the case of late enrollees, there may also have been adverse selection (healthy people may have delayed enrolling to save paying the premium, or people may have enrolled after falling sick). In the case of early dropouts, they may have been older and less healthy (as in the case of those who died), or they may have been younger and healthier (as in the case of newborns or those who moved for marriage or employment).

The two household samples are compared to determine whether they are sufficiently similar to justify splitting the data into model building and model estimation subsamples. Finally, the experimental group samples are compared because a key independent variable for this research, coinsurance rate, was assigned by experimental group. The intention is to rule out the chance that any

coinsurance effect found in the analysis may be attributable to confounding from gross differences between the experimental groups. Each of these comparisons is made on the basis of seven sociodemographic characteristics.

Comparison of Panel and Nonpanel Samples

The full 20-percent sample (1989 and 1990 data combined) contained information on 8,607 individuals. Of that number, 7,333 (85 percent) were panel sample enrollees; that is, they were enrolled for the full two years between January 1, 1989 and December 31, 1990. The remaining 1,274 nonpanel individuals fall into one of two groups: those who enrolled late or those who dropped out before December 31 1990. Table 5.1 summarizes the number of individuals in each sample by township.

Guangji Township had the most stable enrollment of the three townships; only 6 percent of the full (panel plus nonpanel) sample enrolled late and only 2 percent dropped out early. In Jiajia Township, 22 percent of the full sample enrolled late and four percent dropped out early. In Xinfu Township, the smallest township, 20 percent enrolled late and 8 percent dropped out early. Over half of the late enrollment (703 out of 1,276) occurred in 1989, of which two-thirds occurred in Jiajia township. The year of enrollment is not known for about one-quarter of late enrollees. Reason for dropping out early was recorded for only 46 percent (163 out of 357) of those cases. Relocation outside of the experimental areas for employment was the most common reason for disenrolling (45 percent), followed by death (23 percent) and relocation for marriage (18 percent).

Differences in recruiting and "propaganda" techniques in the three townships probably account for differences in late enrollment rates. Important differences in enrollment procedures also affected these rates. In Jiajia and Xinfu Townships, for instance, individuals were not listed as enrolled until their premium was paid. Those individuals may have been prevented from receiving plan-covered services until the premium was paid. In Guangji Township, people with a stated intention to participate were listed as enrolled even if they had

Table 5.1
Summary of Enrollment, by Township

	TOWNSHIP			TOTAL
	Guangji	Jiajia	Xinfu	
Panel Enrollees: No. (%)[1]	3,774 (92%)	2.353 (74%)	1,206 (73%)	7,333 (82%)
Late Enrollees: 1989	114	450	139	703
1990	0	112	153	265
Year Unknown	123	141	44	308
Early Drop Outs[2]: 1989	79	62	79	220
1990	19	56	62	137
Total Enrollees[2]	4,107	3,163	1,655	8,925

[1] Percent of total enrollees who were panel enrollees.
[2] 41 out of the 357 early dropout enrollees were also late enrollees (2 in Guangji, 11 in Jiajia, and 28 in Xinfu); therefore, columns do not add to figures in the total enrollees row.

not yet paid their premium and it was reported that these people were able to receive plan-covered services. The higher dropout rate in Xinfu (the poorest of the three townships) appears to be attributed to a higher proportion of individuals leaving the township for employment. Table 5.2 compares the panel sample with the samples of late enrollees and early dropouts.

Age and Sex Panel sample enrollees are on average about the same age (29) as those who dropped out early (28). However, the age distributions for these two groups are different. Only 17 percent of the panel sample was between ages 18 and 24, 45 percent of the early dropout sample was in this age group. This is consistent with the fact (noted above) that two-thirds of those who dropped out early cited marriage and employment as the reason for dropping out. After marriage, women in China traditionally move to live with their husbands' family, which may account for the disproportionate percentage of females in this sample.

Late enrollees were more than 9 years younger than the panel sample (20 versus 29 years). Thirty-four percent of late enrollees were aged four or less. Most of these were newborns to other CHIE enrollees. (Because of differences in

Table 5.2
Comparison of Panel and Nonpanel Samples

CHARACTERISTIC	SAMPLE		
	Panel	Late Enrollees[1]	Early Dropouts
Mean Age	29 yrs (*)	20 yrs	28 yrs
Percent Female	48% (+)	55%	62%
Percent Age 4 or Less	7% (*)	34%	6%
Percent Poor Health	2.9%	NA	2.8%
Mean Education[2]	2.1	NA	2.2
Mean Income Per Capita	413 Yuan (+)	413 Yuan	397 Yuan
Mean Household Size	4.3 (*)	1.8	4.3
Sample Size	7333	1276	357

[1] Individual characteristic baseline data, other than age and sex, not collected for late enrollees. Household characteristics data assigned according to information for panel enrollees in household.
[2] Education codes: 1=none; 2=primary school; 3=jr. high school or higher.

* Difference between panel and late enrollee samples significant at p≤.05 or greater.
+ Difference between panel and early drop out samples significant at p≤.05 or greater.

methods of calculating age in China, some newborns may be reported as up to 2 years of age soon after birth. Other newborns may not have been enrolled until an illness triggered a visit to one of the covered health care facilities. Consequently, the baseline age for that child is listed as its age at the first visit.)

Health Status Health status is similar to the education variable; it is an individual characteristic and was measured during the baseline survey. It is, therefore, missing for late enrollees. Comparing the panel and early dropout samples, we find that both groups had about the same percentage in poor health (i.e., self-reported presence of one or more chronic health problems; 2.9 and 2.8 percent respectively).

Education Education status is measured individually, and this information is missing for people not interviewed for the baseline survey. The late enrollee group cannot be compared to the panel sample for this characteristic. Early dropouts, on the other hand are nearly identical to the panel sample; the average person in both samples has just above a primary school education.

Income Per capita income for late enrollees (those not interviewed during the baseline survey) was assigned according to the income of other members in the household for whom baseline information was collected if someone in the household was enrolled at the beginning of the experiment (52 percent of late enrollees). Income information is not available for households in which all individuals were late enrollees. Income was nearly identical for the panel and late enrollee samples and somewhat lower for the early dropout group.

Household Size The average household size among late enrollees was less than half that of the panel and early dropout samples. This is consistent with the observation that late enrollees are on average much younger, possibly because much of the late enrollment occurred among younger families that had either formed after the experiment started or were reluctant to join initially, perhaps because they were healthy and expected fewer benefits. Younger families would be expected to have smaller households.

In summary, on the measures compared, the only major differences between the panel and nonpanel samples were in age, the percent female, and the percent aged four or less. The analyses in subsequent chapters use only the panel sample data and the remainder of this document pertains only to this group of 7,333 panel individuals.

Comparison of Model Building and Model Estimation Samples

Given the large sample available, it was desirable to create "model building" and "model estimation" subsamples. In this section, it is shown that these two samples are sufficiently similar to justify using them for such a split. Panel enrollees whose household ID number ended in 7 (3,502 individuals) comprised the model building sample. Those whose household ID number ended in

2 (3,831 individuals) comprised the model estimation sample. Since the household ID number was randomly assigned, it provides a useful way to randomly select sub-samples. Comparison of these samples is shown in Table 5.3.

These samples are similar enough to justify splitting the data by household identification number. The mean age of the model estimation sample is 1 year higher and the percent female is 2 points lower compared to the model building sample. The percent in poor health is half a point higher in the model estimation sample. There are no statistically significant differences between the samples on the measures compared.

Comparison of Experimental Groups

Coinsurance rates are a key covariate for the multivariate analysis in this study, and these were assigned by experimental group. In this section, the panel samples from each of the six CHIE experimental groups are compared to determine whether major differences exist that might confound insurance effects (Table 5.4).

Age and Gender The mean age of enrollees is the same in four of the six groups and only slightly lower in the other two groups. The age distributions (not shown) are also similar across groups, constricted at the lower end (young children, probably reflecting strict population policies), with peaks occurring in early adulthood, and then gradually tapering off. The proportion of female enrollees is slightly higher in the Xinfu group compared to the other five groups.

Health Status A factor of more than two separates the experimental groups with the highest and the lowest proportion in poor health (4.0 versus 1.6 percent). This difference is statistically significant (standard t-test for difference between two proportions); however, given that the number of people who self-reported poor health in the panel sample is quite small (212); these differences may not be important.

Education There is little differences between experimental groups in education levels.

Table 5.3
Comparison of Model Building and Model Estimation Samples

CHARACTERISTIC	SAMPLE		z-statistic for difference between samples
	Model Building (7-sample)	Model Estimation (2-sample)	
Mean Age	29 yrs	30 yrs	-1.00
Percent Female	50%	48%	1.71
Percent Age 4 or Less	7%	6%	0.74
Percent Poor Health	2.6%	3.1	-1.25
Mean Education[1]	2.1	2.1	0.44
Mean Income Per Capita	411 Yuan	415 Yuan	-0.42
Mean Household Size	4.3	4.3	0.85
Sample Size	3502	3831	

[1] Education codes: 1=None; 2=Primary School; 3=Jr. High School or higher

Income Xinfu and the mountainous Guangji experimental groups (XF and GJ-3) have lower average per capita incomes compared to those of the four crossover experimental groups. For the GJ-3 (mountainous region) group, location and poor transportation access, in addition to mountainous farming conditions, may well account for the relative difference. Reasons for lower average income in the Xinfu group are unknown.

Average Cost per Visit There was almost a twofold difference between the highest and lowest cost VHS visit in 1989. This most likely reflects differences in drug supplies. Availability of drugs, particularly Chinese herbal medicines, vary widely from village to village; usually they comprise over two-thirds of the cost of a VHS visit. Differences in costs for township hospital outpatient visits are less pronounced.

Variable Descriptions

The variables used in the statistical analyses are described in this

Table 5.4
Comparison of Experimental Groups

CHARACTERISTIC	EXPERIMENTAL GROUP					
	GJ-XO1	GJ-XO2	GJ-3	JA-XO1	JA-XO2	XF
Mean Age (years)	28	29	30	30	30	30
Percent Female	48%	48%	47%	48%	48%	51%
Percent Age 4 or Less	8%	6%	8%	6%	6%	6%
Percent Poor Health	4.0%	1.7%	2.8%	3.3%	1.6%	3.6%
Mean Education[1]	2.2	2.2	2.0	2.2	2.1	2.0
Mean Income Per Capita (Yuan)	425	408	348	451	444	384
Mean Household Size	4.6	4.3	4.6	4.2	4.3	4.1
Mean Visit Cost (Yuan) in 1989:						
VHS	1.23	1.53	1.18	1.82	1.50	2.07
Township Hosp	2.46	2.50	2.54	2.20	2.23	2.62
Sample Size	1466	1413	895	1326	1027	1206

[1] Education codes: 1=None, 2=Primary School, 3=Jr. High School or higher

section. Definitions are shown in Table 5.5. Means and standard deviations for the panel sample are shown in Table 5.6.

Dependent Variables

Annual number of outpatient and inpatient episodes of care (epis_op and epis_ip) are used in negative binomial regression models of demand for health care. Hornbrook and colleagues (1985) defined an episode of care as "a series of temporally contiguous health care services related to treatment of a given spell of illness or provided in response to a specific request made by the patient or other relevant entity." They also noted that illness or disease may or may not be present during an episode of care. In these data, outpatient episodes include only outpatient visits (no inpatient stays). Inpatient episodes

Table 5.5
Variable Definitions

VARIABLE NAME	DEFINITION
Dependent Variables	
epis_op	Number of outpatient episodes.
epis_ip	Number of inpatient episodes.
ep_d_op	Change in number of outpatient episodes of care, 1989 to 1990.
ep_d_ip	Change in number of inpatient episodes of care, 1989 to 1990.
Independent Variables	
year	Year of observation (0=1989; 1=1990).
ci_op	Outpatient coinsurance rate (VHS and township hospital).
ci_ip	Inpatient coinsurance rate (township hospital).
ci_d_op	Change in outpatient coinsurance rate, 1989 to 1990.
ci_d_ip	Change in inpatient coinsurance rate, 1989 to 1990.
vhs	Whether or not village had an operating village health station.
dis_cls	Distance (KM) to nearest (VHS or township hospital) health facility.
ba_chr	Whether or not person reported one or more chronic health problems.
educ_no	Whether or not person had not had any formal education.
educ_prm	Whether or not highest level of education was primary school (omitted group).
educ_hi	Whether or not highest level of education was greater than primary school.
inc_lo	Whether or not a low income household (less than 550 yuan per capita in 1988).
inc_med	Whether or not a middle income household (between 550 and 650 yuan per capita in 1988; omitted group).
inc_hi	Whether or not a high income household (greater than 650 yuan per capita in 1988).
fam_sz	Number of people in household enrolled in CHIE plan at beginning of year.
age0_4	Child age 4 or less.
age5_12	Child age 5 to 12.
age13_19	Adolescent age 13 to 19.
age20m24	Male age 20 to 24 (omitted group).
age20f24	Female age 20 to 24.
age25m39	Male age 25 to 39.
age25f39	Female age 25 to 39.
age40m49	Male age 40 to 49.
age40f49	Female age 40 to 49.
age50m59	Male age 50 to 59.
age50f59	Female age 50 to 59.
age60m	Male age 60 or greater.
age60f	Female age 60 or greater.
danling	Whether or not person lived in a Danling village. (Poor access to health facilities above VHS level in 1989; access to Danling County hospital in 1990.)
guangji	Whether or not person lived in Guangji Township.
jiajia	Whether or not person lived in Jiajia Township.
xinfu	Whether or not person lived in Xinfu Township.
nplan_op	Per capita number of out-of-plan outpatient visits in household during December 1990.
nplan_ip	Per capita number of out-of-plan inpatient stays in household during July to December 1990.
qual_cls	Perceived quality of services at closest health care facility (VHS or township hospital).

Table 5.6
Descriptive Statistics of Variables

VARIABLE NAME	MEAN	S.D.	MINIMUM	MAXIMUM
Dependent Variables				
epis_op	1.70	2.00	0	12
epis_ip	0.03	0.29	0	5
ep_d_op	0.37	1.86	-8	10
ep_d_ip	0.008	0.27	-2	3
Independent Variables				
year	0.50	0.50	0	1
ci_op	57	12	40	70
ci_ip	52	15	30	75
ci_d_op	-2.67	23.22	-30	30
ci_d_ip	-0.65	27.49	-30	30
vhs	0.77	0.42	0	1
dis_cls	1.18	0.80	0	4.50
ba_chr	0.03	0.17	0	1
educ_no	0.20	0.40	0	1
educ_prm	0.52	0.50	0	1
educ_hi	0.28	0.45	0	1
inc_lo	0.80	0.40	0	1
inc_med	0.19	0.39	0	1
inc_hi	0.01	0.12	0	1
fam_sz	4.4	1.5	1	11
age0_4	0.07	0.25	0	1
age5_12	0.11	0.31	0	1
age13_19	0.20	0.40	0	1
age20m24	0.07	0.25	0	1
age20f24	0.05	0.22	0	1
age25m39	0.11	0.32	0	1
age25f39	0.12	0.32	0	1
age40m49	0.06	0.23	0	1
age40f49	0.05	0.21	0	1
age50m59	0.04	0.20	0	1
age50f59	0.04	0.20	0	1
age60m	0.04	0.19	0	1
age60f	0.04	0.21	0	1
danling	0.13	0.33	0	1
guangji	0.51	0.50	0	1
jiajia	0.32	0.47	0	1
xinfu	0.16	0.37	0	1
nplan_op[1]	0.05	0.19	0	1.67
nplan_ip[1]	0.004	0.059	0	1.250
qual_cls[1,2]	5.3	1.2	2	8

[1] Data available only for households participating in Satisfaction Survey (863 households, 3298 individuals in panel sample).
[2] 1=Low quality; 8=High quality.

include one or more inpatient stay. Inpatient episodes may or may not include outpatient visits as well.

Two "change" episode variables (ep_d_op and ep_d_ip) were derived by subtracting the number of episodes of care received in 1990 from the number received in 1989. The two change variables are used in fixed effects models to investigate the effect of *change* in coinsurance rates (as opposed to year-specific rates used in negative binomial regression models) on *change* in demand for care.

Since we are interested in people's decisions about how much health care to use, aggregating the original units in the CHIE data (outpatient visits and inpatient admissions) into episodes of care provides a better unit of analysis than visits. Individuals make the decision to initiate care for an episode of illness, but subsequent decisions about the amount of care to receive within an episode of care shifts at least in part to the provider (Keeler et.al., 1988). The number of visits, therefore, does not provide as clean an indicator of a person's decisions and behavior.

In these data, an episode of care includes any CHIE-covered care received at any of the four possible health care facilities (see Figure 2.1) during the period that defines the episode. Out-of-plan care received was not measured. It is possible that there were shifts between plan-covered and other sources of care and that the total number of episodes of care may be underestimated. The number of episodes may also have been overestimated if out-of-plan care would "bridge" two apparently separate episodes. However, there are relatively few alternatives to the public system of health care in rural Sichuan Province.

An additional source of measurement error in these dependent variables is the lack of diagnostic information. Diagnostic information is generally used to link contiguous and noncontiguous visits into episodes of care. Episodes of care were created from the CHIE data using only temporal data (see Chapter 4 for method used), which may have resulted in some visits being misassigned to episodes. However, this should have occurred randomly and thus the measures used probably represent a good approximation of annual numbers of episodes per person,

even if some visits were not correctly assigned. (Recall also that assignment to episodes was not very sensitive to the episode definition rule used, suggesting the breaks between episodes as defined were accurate.)

Explanatory Variables

Year Each panel enrollee is represented twice in the data set, once each for 1989 and 1990.

Coinsurance Rate There are four coinsurance rate values for each individual: one outpatient (ci_op) and one inpatient (ci_ip) rate for each year. These variables are used in negative binomial regression models. Two "change" variables (ci_d_op and ci_d_ip) were constructed for use in the fixed effects models.

Village Health Station This dichotomous variable (vhs) indicates whether or not a VHS was present and staffed. Values were the same for both years for all villages except for Wanchangou in Xinfu Township where there was an operating VHS in 1989 but not in 1990.

Distance to the Nearest Health Facility This variable (dis_cls) indicates the distance in kilometers from the enrollee's house to either the VHS or the township hospital, whichever was closer. Where there was no operating VHS, distance to the township hospital is used.

Health Status Three percent of panel enrollees reported that they had one or more chronic health problems at the time of the baseline survey. This was coded as a dichotomous variable (ba_chr) indicating the presence or absence of any chronic illness.

Education Three dummy variables indicate whether the enrollee had no formal education (educ_no), a primary school education (educ_prm), or attended school above the primary school level (educ_hi). Own education is used except for children under the age of 16, for whom educational attainment for the most highly educated adult female in the household is used (referred hereafter to as "mother's education").

Income Per capita household income was coded using a set of dummy variables, defined as low income (inc_lo, less than 550 yuan), middle income

(inc_med, from 550 to 650 yuan), or high income (inc_hi, greater than 650 yuan).

Household Size For 1989, household size (fam_sz) is measured as the number of CHIE enrollees in the household at the beginning of the experimental period. For 1990, it is measured as the 1989 household size, minus the number of early dropouts in 1989, plus the number of late enrollees from the household in 1989 (i.e., the number of enrollees at the beginning of the second year).

Age/Sex Age and gender data were integrated to produce 13 age/sex dummy variables (see Chapter 6 for method used to create these categories). There were three childhood categories, eight adult age categories (one male and one female category for each of four age groups), and two older adult categories (one for each gender). The "mean" values in Table 5.6 indicate the percentage of individuals in the data set in each category.

Danling A value of one for this variable indicates that the enrollee lived in one of the four Danling villages. Access to the Guangji Township hospital and the Meishan County hospital was limited by their remote location at the far western end of the township. To improve access to care for these enrollees, terms of the CHIE insurance plans were eased in 1990, and services sought at the county hospital in neighboring Danling County were covered.

Township Township of each enrollee's residence was coded in three dummy variables (guangji, jiajia, and xinfu). The insurance plans were managed at the township level, and these variables are meant to capture unmeasured differences between townships.

CHAPTER 6

ANALYTIC METHODS

The principal questions to be addressed in this study are

1. How is utilization affected by coinsurance rates?
   Here we are interested primarily with separating sociodemographic effects from coinsurance effects.

   HYPOTHESIS: Utilization of health services declines as coinsurance rates increase; and, conversely, utilization increases as coinsurance rates decrease.

2. Does coinsurance interact with other factors?
   Analysis of HIE data suggests that the following interaction effects may be important (Manning, et al, 1987).

   HYPOTHESIS 1: Income - coinsurance has a greater effect on utilization among the poor.
   HYPOTHESIS 2: Age - utilization by children is less responsive to coinsurance than by adults.

   All other independent variables will be tested as well to determine whether additional interaction effects with coinsurance exist.

3. Are the effects different for different types of care?
   Research has shown that utilization for acute care episodes is more responsive to differences in insurance plans than are chronic and inpatient episodes (Keeler, et al., 1988).

   HYPOTHESIS 1: Inpatient care is less affected by coinsurance rate compared to outpatient care.
   HYPOTHESIS 2: Acute care is more affected by coinsurance rate than care for chronic conditions.

Statistical Methods

This analysis has three components. The first component uses ordinary least squares (OLS) regression as an exploratory technique. OLS regression was also used to compute standard error correction factors for negative binomial regression (NBR) estimates (discussed below). The second component uses negative binomial regression to define and estimate models for demand for outpatient and inpatient episodes of care. The last component uses a fixed effects, first difference model to investigate change in the number of episodes of care from 1989 to 1990. Each of these components is described in more detail next.

Ordinary Least Squares Regression Models

The model building sample was fitted to an OLS model for two purposes: to

explore basic relationships between demand for episodes of care an the independent variables and to obtain standard error correction factors for intra-household correlation in the number of episodes of care received.

Given the exploratory nature of this OLS analysis, the total number of episodes of care (outpatient plus inpatient) was used as the dependent variable, and the 1989 and 1990 data were pooled. (In subsequent analyses, outpatient and inpatient episodes were disaggregated.) This variable was log transformed because it does not follow a normal distribution. A value of 1 was added to each observation so that the log-transformation could be performed on all observations, including those with no utilization (zero episodes).

Demand for health care among persons within a household are probably correlated. A priori, no prediction was made about the direction of the correlation. It may be negative if a household budget constraint was exceeded by one or more members, or it may be positive if the care of one person brought another into the health care system. This correlation effectively reduces the amount of useful information in the data, usually causing standard errors to be underestimated and t-statistics to be overestimated. Huber regression estimates the degree of such correlation, computes an "effective sample size," and corrects both the standard errors and the t-statistics accordingly. Typically (though not always), Huber standard error estimates are lower than those estimated by standard OLS methods.

The statistical software package used to estimate negative binomial regression models does not include a Huber standard error adjustment. A good approximation of this adjustment, however, can be obtained by estimating the OLS model twice: once using standard OLS regression and once using the Huber regression technique for OLS. The formula for computing the correction factors is SE_{Huber}/SE_{ols} (that is, the ratio of standard errors derived from Huber regression to standard errors derived from OLS regression). (The computed correction factors are shown in Appendix 4). Standard errors estimated by negative binomial regression can then be corrected by multiplying by these correction factors; in turn, these corrected standard errors can be used to

derive corrected t-statistics.

Negative Binomial Regression Models

OLS regression is not an appropriate statistical model for demand analysis because episodes of care are count, not continuous data. It is also not an appropriate method because the data are not normally distributed. The distribution is truncated at zero (i.e., it is not possible to have a negative number of episodes of care) and has a high density at this point. Poisson regression overcomes some of the distributional properties of episode data. Specifically, it avoids the problem where the dependent variable may have a zero value. However, it was also rejected. Although episodes do generally arise through a Poisson process, that process almost certainly varies across individuals because of unmeasured heterogeneity in most demand studies. This violates the Poisson assumption of equal variance (i.e., episodes are generated by the same Poisson process). Negative binomial regression relaxes this restriction, allowing Poisson variances to differ for different individuals.

The basic negative binomial regression model is

$$E_{it} = \alpha + \beta_1 x_{1i} + \beta_2 x_{2it} + e_{it}$$

where: E_{it} = Number of episodes for person i in year t
α = Intercept
β = parameter estimates
x_{1i} = Vector of individual and household characteristics (assumed to be constant over time t)
x_{2it} = Outpatient (or inpatient) coinsurance rates for person i in year t
e_{it} = Individual error term in year t

There were four steps in the NBR modeling process:

1. Categorical variable construction Age and gender were initially combined to produce 26 age-sex categories. A main effects (no interaction terms) model was estimated using the 7-sample and f-tests performed to determine whether the number of categories could be reduced without obscuring important differences. A similar approach was used to reduce the number of categories for the education and income variables. Tables 5.5 and 5.6 show the final categories for these variables.

2. Interaction terms determination Final main effects models were estimated using the variables defined from step one. Each variable with a coefficient significant at the $p<.05$ level or better was interacted with the coinsurance variable, and the model was re-estimated with this interaction term. Each interaction term was tested separately; that is,

multiple models were estimated, each to test one interaction term.

3. Fully interacted model A final model was estimated with all main effects and significant interaction terms (from step 2).

4. Standard error and t-statistic corrections The correction factors derived from the OLS regression analysis were applied to standard errors from the fully interacted model estimates, and t-statistic were adjusted accordingly.

This process was followed to estimate outpatient and inpatient demand models. The full model building sample was used for steps 1, 2 and 3. Step 3 was repeated using the full model estimation sample; these results are reported in Chapter 7. The process was repeated to estimate a model for adults (age 20 to 49) and for children (age 12 or less). For the chronic and survey samples, final models were estimated using the combined 2- and 7-samples.

Fixed Effects Models

Fixed effects models were fitted to the data to control for unobserved heterogeneity in the data, thereby producing a less biased estimate of coinsurance effects than the NBR models. When compared to the NBR results, this approach also serves as a test of the robustness of results from NBR model estimates. The model works as follows

$$
\begin{array}{rcccccccccc}
Y^{90} & = & \alpha & + & \beta_1 x_1^{90} & + & \beta_2 x_2 & + & \beta_3 x_3^{90} & + & e^{90} \\
-[Y^{89} & = & \alpha & + & \beta_1 x_1^{89} & + & \beta_2 x_2 & + & \beta_3 x_3^{89} & + & e^{89}] \\
\hline
(Y^{90}-Y^{89}) & = & (0) & + & \beta_1 (x_1^{90}-x_1^{89}) & + & 0 & + & \beta_3 (x_3^{90}-x_3^{89}) & + & (e^{90}-e^{89})
\end{array}
$$

where: Y = annual number of episodes of care
α = constant term
x_1 = year (capturing unmeasured secular trends)
x_2 = vector of baseline sociodemographic variables (i.e., age, sex, health status, income, education, etc.)
x_3 = outpatient (or inpatient) coinsurance rate

The value for each variable in 1989 is subtracted from the value for the same variable in 1990 to yield "first difference" variables. All personal, household, and community characteristics that are fixed (i.e., do not vary from year to year) drop out of the model. The constant term is also assumed to remains invariant and drops out. Four terms remain in the resulting first

difference equation: change in the number of episodes of care (the dependent variable), change in the coinsurance rate, a secular trend term (represented by a constant term in the first difference model estimate), and an error term.

Separate models are estimated for outpatient and inpatient demand, using the model estimation 2-sample for outpatient models and the combined model building and model estimation samples for inpatient models. The model was also estimated with interaction terms for comparison with interaction test results from the negative binomial regression models.

CHAPTER 7

RESULTS

Results from multivariate analyses are presented in this chapter; explanations and discussion of these results follow in Chapter 8. All models were estimated using data from the panel sample (i.e., excluding those who enrolled after January 1, 1989 or who dropped out before December 31, 1990). The first section of this chapter presents negative binomial regression results. Fixed effects models were estimated using first difference OLS regression; these results are reported in the second section. Results from the OLS model building analysis and standard error correction factors (from Huber OLS regression) are shown in Appendices 3 and 4. In all analyses, the unit of observation is the individual.

Negative Binomial Regression Results

Pooled versus Unpooled Data: The Likelihood Ratio Test:

Initially, outpatient models were estimated separately for 1989 and 1990 data and then for pooled 1989 and 1990 data. The coefficient for outpatient coinsurance rate ("ci_op") was significant in the 1989 model estimate and not significant in the 1990 estimate. To determine whether the coefficients in the year-specific estimates were statistically different from the coefficients in the pooled estimate, a likelihood ratio test was performed using negative binomial regression results from the model building sample. The null hypothesis for this test is that the coefficients from the year-specific (unrestricted) models are the same as the coefficients from the pooled (restricted) model. For models estimated using maximum likelihood techniques, the formula for calculating the likelihood ratio statistic is

$$LR = 2[(Loglikelihood_{1989} + Loglikelihood_{1990}) - Loglikelihood_{pooled}]$$

This statistic is chi-squared distributed with its degrees of freedom equal to the difference in the degrees of freedom in the restricted (pooled) and the unrestricted (unpooled, 1989 plus 1990) models.

The likelihood ratio statistic was calculated to be 17.7. At the 0.05

level of significance and 26 degrees of freedom, this value is less than the critical chi-square value of 38.9. Therefore, the null hypothesis cannot be rejected. As a result, all subsequent negative binomial regression model estimates are based on the pooled data.

Models Estimated and Samples Used

Negative binomial regression model estimates are described in Table 7.1. The panel model was estimated using all individuals in the panel sample. The child model was restricted to children age 12 or less, and the adult model was restricted to adults aged 20 to 49. The survey model was estimated to determine the effect of attitudinal and other variables from the Satisfaction Survey. (See Appendix 7 for the Satisfaction Survey questionnaire and variable construction.) Individuals in households that participated in the survey comprised this sample.

To determine whether the demand function for people in poor health differed from the panel model, a model was estimated using only adults who reported the presence of a chronic health problem during the baseline interview ("ba_chr"=1). Only 26 children age 19 or less (10 children age 12 or less) had a reported chronic health problem; they were not included in this analysis. Results from this chronic model must be interpreted cautiously. The health status measure used is based on one question only. No probes to this question were used and no follow-up was done to determine whether these reported chronic health problems persisted.

The model building sample was used to estimate final models for all outpatient models except the chronic model. The number of adults in the combined panel sample who reported the presence of a chronic health problem during baseline interview was small (401); therefore, the chronic model was estimated using combined model building and estimation sample data. All final inpatient models were also estimated using the combined samples because the number of inpatient episodes was small (252 in the model estimation sample, 229 in the model building sample).

Tests for Interactions with Coinsurance Variables

Using the model building sample, two main effects models (no interaction

Table 7.1
Description of Negative Binomial Regression Models Estimated

Model Name	Estimated Models	Sample Description	Sample Size (7/2-sample)
Panel	OP and IP	All panel individuals	3502/3831
Adult	OP and IP	Adults age 20 to 49	1622/1761
Child	OP and IP	Children age 12 or less	609/659
Chronic	OP and IP	Adults age 20 or greater with a chronic health problem	114/87
Survey	OP only	Individuals in households that participated in Satisfaction Survey	1592/1706

terms) were fitted using negative binomial regression: one for outpatient episodes and one for inpatient episodes. (The estimated main effects negative binomial regression model for outpatient episodes is shown in Appendix 5.) Coinsurance interaction terms were tested separately for each independent variable with a statistically significant coefficient in main effects model estimations.

In the inpatient model, no interaction terms were significant. In the outpatient model, coefficients for interactions with "year," presence of a village health station ("vhs"), having no formal education ("educ_no"), being a child aged 4 or less ("age0_4"), and whether the person lived in a Danling village ("danling") were significant. When these four interaction terms were included jointly in one model, the "educ_no" interaction term was not significant, and it was not included in subsequent models. Next, the remaining three interaction terms were included in a model estimated using the model estimation sample. Year and age interactions were not significant in this estimate. The final outpatient model included only "vhs" and "danling" coinsurance interaction terms. These interactions were significant in the panel and the adult models only; therefore, they were not included in the child, chronic, and survey models.

Results

Final outpatient model estimates are shown in Table 7.2. Estimates from both model building and model estimation sample data are reported for the outpatient panel model; however, discussion pertains only to the model estimation sample estimation. Table 7.3 reports final inpatient model estimations. All standard errors were adjusted using the adjustment factors derived from Huber-OLS regression (see Appendix 4); significance levels reported in Tables 7.2 and 7.3 reflect these adjustments.

Parameters are presented as odds ratios (see Appendix 6 for table of coefficients for the panel sample model estimations). Odds ratios greater than 1.00 indicate that the variable has a positive effect on demand. Odds ratios less than 1.00 indicate that the variable has a negative effect on demand. Odds ratios for 0/1 dummy variables are derived by taking the antilog of coefficients (i.e., $e^{(B*1)}$). Odds ratios represent the ratio of the number of episodes of care demanded by the average person with the characteristic compared to the average person without the characteristic. For continuous variables such as distance to the nearest health care facility ("dis_cls"), the odds ratio represents the effect of each one unit increase in the variable (e.g., each additional kilometer from the nearest health care facility).

For the panel and adult outpatient models, odds ratios for interaction variables cannot be interpreted directly from Table 7.2. To determine the coinsurance effect in these models for instance, separate odds ratios must be calculated, taking into account whether a VHS is present and whether the village is a Danling village. For other samples, the coinsurance odds ratios represent the effect of a 1-percent change in the coinsurance rate on the number of episodes of care. Comparing utilization given a 1-percent change in the coinsurance rate is less informative than comparing utilization over the full range of rates in the CHIE (i.e., 40- to 70-percent for outpatient care). The odds ratios shown in Table 7.4 reflect this range and account for interaction effects, where present. The ratios compare the number of episodes of care demanded by individuals in the 70-percent coinsurance condition compared to the

Table 7.2
Negative Binomial Regression Results
for Outpatient Models
(Odds Ratios)

Variable	Sample					
	Panel-2	Panel-7	Adult	Child	Chronic	Survey
year	1.16***	1.21***	1.15***	1.14**	1.16**	1.24***
ci_op	0.98***	0.98***	0.98***	0.99***	0.99**	0.99***
ci_vhs	1.01***	1.01***	1.01***			
ci_dan	0.98***	0.99***	0.98***			
vhs	1.33***	1.48***	1.44***	1.25**	1.33*	1.07
danling	0.61***	0.55***	0.64***	0.68***	0.33***	0.64***
dis_cls	0.87***	0.90***	0.91***	0.79***	0.76***	0.86***
ba_chr[1]	1.93***	1.68***	1.94***			1.72***
educ_no	0.91 *	0.85***	0.93	0.80**	0.89	0.90
educ_prm[2]	-	-	-	-	-	-
educ_hi	1.06	1.06	1.07	1.08	1.05	1.08
inc_lo	0.85 **	0.77***	0.79***	1.03		0.87*
inc_med[2]	-	-	-	-		-
inc_hi	1.18	1.08	1.27	1.06		1.23
fam_sz	1.00	1.00	1.02	0.99	0.96	1.01
age0_4	2.24***	2.85***		1.92***		2.06***
age5_12[3]	1.13	1.43***		-		1.00
age13_19	0.71***	0.76***				0.63***
age20f24	0.92	1.25***	0.94		0.92	0.84
age25f39	1.34***	1.54***	1.35***		"	1.25**
age40f49	1.34***	1.34***	1.19*		"	1.11
age50f59	1.31**	1.50***			1.20	1.27
age60f	1.21*	1.52***			1.08	1.00
age20m24[3]	-	-	-		-	-
age25m39	1.08	1.22***	1.10		-	1.02
age40m49	1.08	1.23***	1.08		-	1.02
age50m59	1.10	1.38***			0.93	1.06
age60m	0.98	1.18			1.19	0.90
jiajia	1.25***	1.19***	1.24***	1.06	0.86	1.32***
guangji[2]	-	-	-	-	-	-
xinfu	1.15**	0.99	1.08	0.94	1.14	1.25**
qual_cls						1.10***
nplan_ip						0.39**
R^2	.041	.047	.029	.044	.047	.046
N	7,638	6,992	3,506	1,318	400	3,404

[1] Coefficient for "ba_chr" not estimated for children; 10/1268 reported presence of a chronic condition at baseline.
[2] Omitted category for education, income, and township variables.
[3] Omitted age category is 5-12 for children, males 20-24 for adults, and males 20-49 (age categories collapsed) for chronic model.

*** $p \leq 0.01$
** $p \leq 0.05$
* $p \leq 0.10$

Table 7.3
Negative Binomial Regression Results
for Inpatient Models
(Odds Ratios)

Variable	Sample			
	Panel	Adult	Child	Chronic
year	1.39***	1.59***	1.11	1.47
ci_ip	0.99 *	0.99	0.99	1.00
vhs	0.76**	0.76	1.18	0.56
danling	0.68*	0.79**	1.10	0.50***
dis_cls	0.84**	0.65*	0.92	0.43*
ba_chr[1]	2.40***	2.54*		
educ_no	0.87	0.61**	1.05	1.07
educ_prm[2]	-	-	-	-
educ_hi	1.10	1.24	0.89	0.33
inc_lo	1.06	1.09	1.12	
inc_med[2]	-	-	-	
inc_hi	0.59	0.53	1.00	
fam_sz	0.97	1.01	0.87	0.97
age0_4	1.72*		2.15**	
age5_12[3]	O.84		-	
age13_19	0.96			
age20f24	1.48	1.51		2.24
age25f39	1.75*	1.95***		"
age40f49	2.56***	3.00***		"
age50f59	3.31***			3.23
age60f	2.97***			1.98
age20m24[3]	-	-		-
age25m39	1.15	1.22		-
age40m49	1.52*	1.67*		-
age50m59	1.77*			1.66
age60m	2.31***			1.54
jiajia	1.18	1.08	1.90*	1.03
guangji[2]	-	-	-	-
xinfu	1.08	0.76	1.51	1.72
R^2	.034	.028	.033	.140
N	14,630	6,746	2,534	400

[1] Coefficient for "ba_chr" not estimated for children; 10/1268 children age 12 or less reported presence of a chronic condition at baseline interview.
[2] Omitted category for education, income, and township variables.
[3] Omitted age category is 5-12 for children; males 20-24 for adults.

*** $p \leq 0.01$
** $p \leq 0.05$
* $p \leq 0.10$

number demanded in the 40-percent condition.

Coinsurance Effects

Higher coinsurance clearly reduces the demand for episodes of outpatient care (Table 7.4). Odds ratios for the difference in demand between 40- and 70-percent coinsurance rate conditions were significant under all conditions for all outpatient models. In the inpatient models, the estimated coinsurance effect was significant only in the model estimated using the full panel sample. The small number of inpatient episodes in the other inpatient models may have made it difficult to detect a coinsurance effect.

Demand for outpatient episodes was more responsive to coinsurance among people who lived in villages where there was no VHS and in Danling villages. In the panel sample in non-Danling villages with a VHS, those who faced a 70-percent outpatient coinsurance rate had only 10 percent fewer episodes compared to those who faced a 40- percent rate. In non-Danling villages without an operating VHS, the difference in demand was 37 percent. People who lived in a Danling village and faced a 70-percent coinsurance rate had only half as many episodes of care compared to those who faced a 40-percent coinsurance rate.

Magnitudes of coinsurance effects for the adult sample were similar to the panel sample. To estimate an "average" coinsurance effect for these samples, the proportion of the each sample living in the three conditions listed in Table 7.4 was multiplied by the odds ratio for the respective condition; these three products were then summed. For the panel sample, the average odds ratio was computed to be 0.78; for the adult sample, the average odds ratio was 0.76.

Among children, there were no detectable interactions between coinsurance and either VHS or Danling variables. The estimated coinsurance effect is, therefore, the same over all VHS and Danling village conditions. Compared to the average coinsurance effect for the panel and adult samples, demand for outpatient episodes was less responsive among children. Children who faced a 70-percent outpatient coinsurance rate had 18 percent fewer episodes compared to those who faced a 40-percent coinsurance rate. The odds ratio for outpatient coinsurance for the chronic and survey samples were similar to the odds ratios for children.

Table 7.4
Coinsurance Effects on Demand for Episodes of Care
(Odds Ratios: 70% | 40%)

Condition[1]	Odds Ratios				
	Panel	Adults	Child	Chronic	Survey
Outpatient Episodes					
VHS Present, Not Danling Village	0.90*	0.88*	0.82*	0.82*	0.80*
No VHS, Not Danling Village	0.63*	0.57*	"	"	"
VHS Present, Danling Village	0.48*	0.48*	"	"	"
Inpatient Episodes	0.82*	0.86	0.69	0.89	NA

[1] Coinsurance effect for no VHS present, Danling village condition not estimated because no such condition existed in experimental area.

* Significant at $p \leq 0.05$

Among the inpatient models, a significant coinsurance effect was found only for the panel sample. The estimated coinsurance effect on demand for inpatient episodes was similar to that estimated in the outpatient models. Those facing a 70-percent inpatient coinsurance rate had 18 percent fewer inpatient episodes compared to those facing a 40-percent coinsurance rate.

Effect of Access Variables

Three variables measured access to services in these models: presence of an operating VHS ("vhs"), living in a Danling village ("danling"), and distance to the nearest health care facility ("dis_cls"). The first two interacted with the coinsurance variable in the panel and adult outpatient models. Table 7.5 shows the odds ratios for these variables.

People who lived in villages with an operating VHS ("vhs"=1) had more episodes of outpatient care. In the panel and adult models, the VHS effect was stronger when the coinsurance rate was higher. The VHS effect was constant across different coinsurance rates for the child, chronic, and survey models. Among children, the VHS effect was considerably lower compared to adults; those who lived in a village with an operating VHS had only 25 percent more episodes

Table 7.5
Effects of Access Variables on Demand for Episodes of Care

Variable/Condition	Sample				
	Panel	Adult	Child	Chronic	Survey
Outpatient Episodes					
VHS: 70% CI Rate	2.93*	4.06*	1.25*	1.30	1.07
40% CI Rate	2.09*	2.60*	"	"	"
DANLING: 70% CI Rate	0.14*	0.15	0.68*	0.39	0.64
40% CI Rate	0.28*	0.28	"	"	"
DIS_CLS	0.87*	0.91*	0.79*	0.78*	0.86*
Inpatient Episodes					
VHS	0.76*	0.76	1.18	0.56	0.56
DANLING	0.68*	0.65	0.92	0.43	0.43
DIS_CLS	0.84*	0.79*	1.10	0.50*	0.50*

* Significant at $p \leq 0.05$

than those who lived in a village without a VHS. Among adults, the difference in demand ranged from 109 to 193 percent greater between the VHS and no VHS conditions. The direction of the VHS was also positive for the chronic and survey models, but the effect was not statistically significant.

The effect of presence of a VHS on demand for inpatient episodes was generally in the opposite direction; those who lived in a village with an operating VHS had fewer inpatient episodes of care. This suggests that outpatient care and inpatient care were substitutes. The effect was statistically significant only in the panel model. Having VHS services available in one's village was associated with 24 percent fewer inpatient episodes compared to not having VHS services available.

The effect of living in a Danling village (four villages on the western fringe of Guangji Township, which were remote from their township and county health facilities) was stronger for outpatient episodes and among adults. For outpatient episodes, adults living in Danling villages had between 72 percent (where the outpatient coinsurance rate was 40-percent) and 85 percent (where the outpatient coinsurance rate was 70-percent) fewer episodes compared to their counterparts in non-Danling villages. Children living in a Danling village had

a constant 32 percent fewer outpatient episodes, regardless of the coinsurance rate. In the chronic model, the Danling effect was intermediary, with Danling villagers using 67 percent fewer episodes of care.

The impact of living in a Danling village on demand for inpatient care was weaker. In the panel model, those who lived in Danling villages had 32 percent fewer inpatient episodes. The Danling effect was in the same direction but not statistically significant in each of the other three inpatient models.

As distance to the nearest health care facility ("dis_cls") increased, demand for both outpatient and inpatient episodes of care decreased. Across the full panel sample, each additional kilometer from the facility was associated with 13 percent fewer outpatient episodes of care. The effect on demand for outpatient episodes was stronger in the child and chronic models (21 and 24 percent fewer episodes, respectively, for each kilometer from the facility) than in the adult model (9 percent fewer episodes).

The overall effect (panel model) on inpatient demand was similar; each kilometer was associated with 16 fewer inpatient episodes of care. For adults, the effect of distance on inpatient demand was stronger compared to the effect on outpatient demand; each kilometer was associated with 21 percent fewer inpatient episodes. Among children, distance was not significantly associated with inpatient demand. In the chronic model, distance had a strong effect; each additional kilometer was associated with a 50 percent drop in demand for inpatient episodes.

Effect of Sociodemographic Variables

In the negative binomial regression models, no significant interactions were found between coinsurance and the sociodemographic variables. Odds ratios from Tables 7.2 and 7.3 can, therefore, be interpreted directly to assess their effects on demand.

Health Status In both outpatient and inpatient models, health status had a strong effect on demand. In the panel model, those in poor health had nearly twice the number of outpatient and nearly two and a half times more inpatient episodes compared to those in better health. Nearly all panel sample individuals

with a reported chronic health problem were adults, so the odds ratios for this variable are nearly the same in the panel and the adult models. There were too few children had a reported chronic health problem to estimate the effect of health status in the child model.

Education Education is measured as own education for individuals aged 16 and above and as education of the most highly educated woman in the household (usually the child's mother) for children less than 16 years old. Demand increased monotonically with educational status in all outpatient models. However, the difference between the primary school and higher education categories was not statistically significant in any of these models.

The education effect on outpatient demand appears to be concentrated among children. The odds ratio for the no education category was less than one but not significant in the adult model. The odds ratio for this category in the child model, on the other hand, was significantly different from one; children whose mother had no formal education had 20 percent fewer outpatient episodes compared to children whose mother had a primary school education. The direction of the educational influence on outpatient demand was the same for people in poor health (the chronic model), but the odds ratios were not significant.

In the inpatient models, no education had a significant negative effect on demand among adults (39 percent fewer episodes compared to adults with a primary school education). In the child and chronic models, the education effect was in the opposite direction, although the odds ratios were not statistically significant. Demand decreased as education level increased.

Income Income was measured as per capita household income in 1988, the year preceding the start of the experiment. In the outpatient models, increasing income was associated with increasing demand for care. As with education, demand among those in high income households (greater than 650 yuan per capita) was statistically different from demand among those in middle income households (panel-2 model). Those in low income households (less than 550 yuan per capita) had 15 percent fewer episodes of outpatient care compared to those in middle income households. The income affect appears to be concentrated among adults.

Adults in low income households had 21 percent fewer episodes, while demand among children in low income households was not statistically different from demand among children in middle income households. There was insufficient variation in household income in the chronic model to estimate income effects.

Income had the opposite effect (although not statistically significant at the 0.05 level) on demand for inpatient episodes of care. As income rose, demand for inpatient episodes declined. This was true in the panel, adult, and child models.

Family Size Family size was measured as the number of persons enrolled in the experiment at the beginning of each experimental year (generally, enrollment within a household was all or none). Odds ratios in all outpatient and inpatient models were close to one, and none were statistically significant. This suggests that after controlling for other factors included in these models, family size did not have an affect on demand.

Age and Gender In the model building analysis phase, no gender differences were detected in demand among enrollees less than 20 years of age. Age categories were, therefore, not separated by gender for the three childhood age groups. In the panel and adult models, the 20 to 24 year old male group is the reference (omitted) group. In the child model, only two age groups were included, and the older (5 to 12) group was the reference group. As noted earlier, children were not included in the chronic models. In addition, for each gender the first three age-gender categories (20 to 24, 25 to 39, and 40 to 49) were collapsed because of the small number of individuals with chronic health problems in each separate category.

In the outpatient models, demand was highest among young children ("age0_4", age 4 or less). They had more than twice as many episodes of care compared to males aged 20 to 24 ("age20m24"). Demand declined through the next two childhood age categories. Among females aged 20 to 24 ("age20f24"), demand was not statistically different from males aged 20 to 24. Demand among females rose in the 25 to 39 age group ("age25f39") and remained at roughly the same higher level (compared to the male 20 to 24 reference group) through old age.

Outpatient demand was roughly flat throughout the life cycle for adult males. Among adults with a chronic health problem (chronic model), no statistically significant differences were noted between males and females or across age groups in demand for outpatient episodes.

Demand for inpatient episodes was also high among young children, declining through childhood, and rising again among adult women. The increase in demand among women was not only greater compared to the increases noted for outpatient episodes, it continued to rise with age. The oldest women had the highest demand for inpatient episodes with about three times the number of episodes compared to the reference group. Demand for inpatient episodes among adult men also rose with age, though not as sharply as among women. Males aged 60 and over (the oldest group) had more than two times the number of episodes of care compared to males aged 20 to 24. In the inpatient chronic model, odds ratios for women were higher than for men, suggesting that women in poor health have higher demand for inpatient care compared to men. However, these odds ratios were not statistically different from one.

Township Residence To measure some potential geographic differences that might be associated with differences in demand, variables were included in each model to indicate the township of residence of the enrollee. After controlling for other factors in the model, residence was a significant predictor of demand for outpatient episodes. Those living in one of the two Jianyang County townships (Jiajia and Xinfu) had significantly greater demand (25 and 15 percent, respectively) than those living in Guangji Township (Meishan County). Comparing estimates from the adult and child models, it appears that most of this township effect occurred among adults; the odds ratios in the child model were both closer to one and not statistically significant. No significant township effect was detected in the outpatient chronic model.

In the inpatient models, a statistically significant township effect was found only in the child model. Demand for those living in Jiajia Township was almost twice as high compared to demand among children in Guangji Township.

Influence of Attitudes and Out-of-Plan Use on Demand

The head of households from a random selection of households in each of the 26 experimental villages answered questions during the Satisfaction Survey conducted at the conclusion of the two-year experiment. Data from all members of these households were included in the survey model analysis. Only two variables tested from the Satisfaction Survey data proved to be significant as explanatory variables for demand. These were perceived quality of service at the nearest health care facility ("qual_cls") and out-of-plan inpatient use ("nplan_ip"). These variables were significant only in the outpatient demand model. Results from this model estimation are shown in the last column in Table 7.2.

The attitude variable was measured on a scale from two to eight; increasing values are associated with higher perceived quality at the facility. For each one point increase on this scale, there was a 10 percent greater demand for outpatient episodes of care. Out-of-plan use of inpatient care was measured over a six-month period previous to survey administration. Each additional out-of-plan inpatient episode in a household was associated with a 61 percent reduction in the number of in-plan outpatient episodes of care for each member of that household.

Fixed Effects Model Results

Unobserved heterogeneity because of unmeasured individual and community characteristics is typical in health care utilization data. To the extent that these unmeasured characteristics are correlated with the coinsurance variables, estimated insurance effects may be biased. Fixed effects models, specifically, first difference models, may be used to control for these unobserved characteristics and to evaluate the robustness of results obtained from negative binomial regression models. (See Chapter 6 for a more complete description of fixed effects models.)

Table 7.6 summarizes the effect of change in coinsurance rates on change in demand for outpatient and inpatient episodes of care. Main effects outpatient

Table 7.6
Effects of Coinsurance Rate Change on Demand
for Episodes of Care
(First Difference Model Estimates)

Variable	Model		
	Outpatient		Inpatient
	Main Effects	VHS Interaction	Main Effects
CI Rate Change	-0.01057**	-0.01947**	-0.00046**
CI-Interaction	-	0.01102**	-
Constant Term	0.3447**	0.3334**	0.0074

** $p \leq 0.01$

and inpatient models were estimated. Interaction effects models were also estimated for each variable included in the negative binomial regression models (above) and compared with the interaction terms found to be significant from the negative binomial regression analysis.

Coinsurance Effects: Main Effects Models

In the main effects model estimations, the coefficient for coinsurance rate change represents the change in the number of episodes of care demanded given a 1 percent change in the coinsurance rate. The coefficient for this variable was significant and negative in both the outpatient and inpatient main effects models. To compare these results with those from the negative binomial regression panel models, these coefficients need to be multiplied by 30 percent (the largest outpatient rate change). For outpatient episodes, a 30-percent coinsurance rate change was associated with an average change of 0.317 episode (-0.01057 x 30-percent). Evaluated at the mean number of outpatient episodes of care in the full panel sample (1.705), the elasticity of demand over this range was -0.19 (95-percent confidence interval = -0.14 to -0.24). This compares with an elasticity of -0.22 (1-0.78, the "average" coinsurance odds ratio from the outpatient panel model).

For inpatient episodes, the same change in inpatient rates (30 percent) was associated with a 0.014 change in the number of inpatient episodes. Evaluated

at the mean (0.33 inpatient episodes), the elasticity for inpatient episodes was -0.42 (95-percent confidence interval = -0.11 to -0.73). This compares to an elasticity of -0.18 in the negative binomial regression panel model.

Coinsurance Effects: Interaction Effects Models[1]

Only the "vhs" variable interacted significantly with the change in coinsurance rate in the fixed effects outpatient model. The elasticity of demand for outpatient episodes was -0.14 for people who lived in a village with an operating VHS. Where there was no operating VHS, the elasticity of outpatient demand was -0.42. These elasticities cannot be strictly compared to those from the negative binomial regression model because "danling" did not interact with coinsurance rate change variable in the fixed effects model. However, compared to elasticities from the non-Danling conditions in the negative binomial regression panel model (-0.10 and -0.37,respectively, see Table 7.4), these are similar.

[1] In the NBR inpatient model, there were no significant interactions with the coinsurance rate variable. In the fixed effects model, the Danling-coinsurance rate change interaction was significant. However, this result is most likely a statistical artifact. In all four Danling villages, inpatient coinsurance rates decreased from 1989 to 1990, while access to care improved. It is difficult to separate coinsurance from secular effects. The coefficients for the fixed effects, inpatient "danling" interaction were

CI Rate Change	=	-0.00058 ($p<0.01$)
Interaction Term	=	0.00107 ($p<0.05$)
Constant Term	=	0.0040

CHAPTER 8

DISCUSSION

Four principal findings from this study are discussed in this chapter:

1. In rural China coinsurance exerts a significant and negative effect on the demand for episodes of health care.
2. Coinsurance effects are similar for different population subgroups and for different types of episodes.
3. Elasticities of demand varied significantly according to whether or not there was a functioning VHS in the person's village.
4. Patterns of sociodemographic effects on demand were similar to those reported by other researchers.

Coinsurance Effects

The main hypothesis of this study was that health insurance effects in rural China are similar to those reported in studies of United States and other Western populations. Specifically, coinsurance has a significant and negative effect on demand for episodes of health care. Results from this study support this hypothesis. The evidence with respect to outpatient demand is stronger than evidence for inpatient demand.

For outpatient episodes, the magnitude of this effect over the coinsurance rate range of 40- to 70-percent (an elasticity of -0.22 in the negative binomial regression panel model and -0.19 in the fixed effects model) was similar to U.S.-based studies with low range estimates. Differences in responsiveness to coinsurance were investigated to assess the concern that certain groups might be more vulnerable to cost-sharing requirements. Two such groups examined were children and those in poor health. Little evidence was found to support these concerns; estimated elasticities were similar in all outpatient models. Income and education interactions with coinsurance were also tested for, and no significant interactions were found.

Ideally, demand among those in higher need for health care would be less influenced by the price of care (coinsurance in this study) compared to less needy groups, such as healthy adults. Indeed, point estimates were lower in the child and chronic outpatient models than in the adult model (-0.18 for the child

and chronic model, compared to -0.24 for the adult model). But the 95-percent confidence intervals overlapped for these three estimates, indicating that these two groups were not more responsive.

One caveat that should be attached to this finding is that CHIE service coverage to women and children may not have been uniform. In the experimental areas, some pregnancy-related services were also available from other, non-CHIE covered sources. Consequently, utilization for women of childbearing age as recorded in the CHIE may not represent all pregnancy-related services received. In addition, though preventive services for children were provided at VHS facilities, some costs were subsidized by the Ministry of Public Health. Should these services be covered under the same terms as other services, then coinsurance effects on these groups should be reevaluated.

Furthermore, change in demand is just one of a number of possible insurance effects. Groups with higher health care needs may still be adversely affected, even though elasticities may be the same. For example, an increase in coinsurance rates may lead low income people to forego more demonstrably valuable health care than higher income people. The current study does not permit an assessment of the health impact of lower utilization on different groups. In rural China, the lower utilization rates induced by coinsurance may possibly lead to poorer health outcomes, even among less vulnerable groups.

Findings for inpatient episodes are not as conclusive. The small number of inpatient episodes in the CHIE data reduced the precision of estimated elasticities. In the negative binomial regression panel model, the estimated inpatient elasticity was -0.18. As theory would predict, this estimate is lower than the -0.22 elasticity estimated for outpatient episodes from the same sample. However, the 95-percent confidence intervals for these two estimates do overlap, which suggests that demand responsiveness for the two types of episodes may not be different. The estimated inpatient elasticity from the fixed effects model is even less precise.

There are at least two policy perspectives from which to consider these coinsurance effects. First, before 1989 the CHIE experimental areas had no

insurance; people faced an effective coinsurance rate of 100-percent. From this perspective, the CHIE represented a decrease in coinsurance rates, and the question would be: does lower coinsurance (lower price) induce greater demand, and if so, by how much? Second, from the perspective of policymakers interested coinsurance as a policy lever, the question would be: how effective is coinsurance in restraining moral hazard induced by insurance?

The answer to the first question is clear: demand *does* increase as a function of coinsurance. Strictly speaking, however, the most that can be said with certainty is that demand did increase (by about 20 percent) over the range of coinsurance rates tested. Data on preexperimental utilization were not available and thus it cannot be said for certain that the introduction of insurance caused demand to increase. Demand for inpatient episodes increased by about the same amount as for outpatient episodes, but the confidence interval for this estimate is greater.

This finding provides strong evidence that insurance effects on health care seeking behavior are similar in very different social and economic systems. Despite the fact that markets were poorly developed in China in 1989 and 1990 (the two experimental years) and that the Chinese economy is characterized by central planning, people responded in much the same way to health insurance as has been described in more developed, market-based economies.

The second policy issue involves questions of budgets and relative values of competing opportunities for social expenditures. The technical answer is that coinsurance *is* an effective tool to restrain demand. Increased utilization may be socially desired from the standpoint of health effects, but the increased spending almost certainly entails a trade-off with other goods and services. This is particularly true in developing countries. Assessing the relative benefits of these choices is beyond the scope of this study. Suffice to say, in the resource-scarce environments of developing countries, such assessments have important implications for overall development strategies and outcomes.

Interactions with Coinsurance

While coinsurance interactions were not found to be significant with

respect to population characteristics or type of episode, elasticities did vary significantly according to whether or not there was a functioning VHS. There was also a statistically significant interaction between coinsurance and whether or not the village was a Danling village. Coinsurance effects were stronger where access to health care services was poorer.

VHS: People who lived in villages without a functioning VHS were more responsive to coinsurance than those who lived in villages with a VHS (-0.42 and -0.14, respectively). This interaction was found in both negative binomial regression and fixed effects analyses. This appears to contradict the time-price theory of demand which states that as the indirect cost of seeking care (measured by travel costs and opportunity costs of the person's time) rises, the direct (money) price of care becomes less important in determining demand.

Indirect costs would be expected to be greater for people who must travel further for services that otherwise would be available at a VHS. In such cases, relative to places with a VHS, indirect costs should be a greater proportion of total costs of care. Therefore, coinsurance (which affects direct costs only) should be less important where there is no VHS. However, the next cheapest alternative to the VHS is the township hospital where costs are on average 50 percent greater. This price differential would raise the relative importance of direct costs. In addition, two of the six villages with no VHS were township centers that had township hospitals. In these two villages, travel distances to the nearest health facility were not on average greater.

Close proximity to a township hospital and greater costs at alternative facilities would move the direction of the coinsurance effect for these villages in the opposite direction from that suggested by time-price theory. This combination of factors might have produced the unexpected negative interaction between coinsurance and VHS. It is worth mentioning here that the effect of having a VHS is as expected; demand was greater among people who lived in villages with a VHS, regardless of the coinsurance rate. The VHS effect on demand is discussed below.

Danling: In the first experimental year, access to plan-covered care above

the VHS level for the four Danling villages was considerably compromised by their remoteness. In the second year, services received at the closer county hospital in neighboring Danling County were covered. However, county hospital services are considerably more expensive and a higher coinsurance rate applied. Enrollees in these villages still faced considerable financial barriers to care, even in the second year.

Results from the negative binomial regression panel and adult outpatient models show that enrollees from these villages were the most responsive to coinsurance. Their coinsurance elasticity was -0.52, which is considerably higher compared to the other access conditions in these models. Health effects of this high elasticity could not be evaluated with the CHIE data. However, concern over these differences is justified and policymakers should consider whether the goals of coinsurance and health promotion conflict in situations such as these.

Given that coinsurance rate changes were in the same direction for all four villages, these findings may be statistical artifacts. Still, the potential that people from areas with seriously compromised access are more responsive to coinsurance warrants attention from policymakers. Planners should consider the distribution of facilities and prevailing utilization patterns in establishing coverage provisions for new insurance plans. Establishing coverage according to administrative boundaries may be less desirable. It may also be true that insurance effects differ by provider type. The highly organized, tiered nature of the rural health care delivery system in China provides an opportunity to study these differences.

Secular Trends

A secular trend toward increased utilization was identified by the "year" variable in the negative binomial regression model and by the constant term in the fixed effects models. The magnitude of this trend was significant and nearly identical in all outpatient models; there was about a 16 percent increase in demand from 1989 to 1990. A secular trend was not consistently identified across

inpatient models, suggesting that, as expected, inpatient care is less prone to secular influences.

Increasing incomes in rural China probably contributed to this upward trend in outpatient utilization. Learning and familiarization may also have played important roles. The CHIE may have provided enrollees with an opportunity to learn about insurance and the service delivery system. Increased trust and confidence in management of the insurance plans may also have contributed to the secular trend. If this is true and if access remains at least constant, then the secular trend observed may attenuate over time.

Sociodemographic Effects

Health Status Constraints on data collection in the CHIE prohibited collecting more than a simple measure of health status. Despite its weakness, the measure used was found to be a significant predictor of outpatient demand, a finding that is consistent with Western-based research results. Compared to adults with no reported chronic health problem, those who reported one or more chronic health problems had nearly twice the number of outpatient episodes of care and two and a half times the number of inpatient episodes. These are very large differences compared to other effects in this study.

Two important conclusions can be drawn. First, health status data collection methods in developing countries need not be complicated or expensive to yield useful information. The simple, self-reported measure used in the CHIE was sufficient to capture strong health effects on demand. Second, given higher utilization rates and similar elasticities of demand, *absolute* changes in utilization rates due to coinsurance were larger for people in poorer health compared to the general population. As stated earlier, the importance of these larger magnitude changes in utilization could not be assessed with these data, although there is reason to be concerned. On the one hand, the elasticity finding (people with chronic health problems were no more or less responsive to coinsurance rates) would support policies that treated chronic and acute conditions the same in terms of insurance coverage. On the other hand,

policymakers might consider offering more generous insurance coverage for the care of chronic conditions to avoid potentially harmful health effects in this population.

Education and Income In well-developed market economies, education and income are often highly correlated, and the effects of one are often assumed to be a good proxy for the other. In China, there is less correlation between these two variables. Moreover, there is less variation in educational attainment and income status in China, particularly in rural areas. Thus there was some reason to believe that education and income effects might not be strong. However, estimated effects, as might be expected, were largely based on published results from populations in developed nations.

In the outpatient model for the full panel sample, the effects of education and income were monotonic and increasing. That is, higher education and higher income were associated with higher rates of episodes. The education effect was concentrated in the distinction between no education and primary or higher education; there was no significant difference between the latter two categories. The same was true for the low, middle, and high income categories. Comparing the adult and child model estimates shows that income was more important in determining demand among adults (low-income adults used less care), while the education was more important among children (children with poorly educated mothers used less care).

Education effects on inpatient demand were also monotonic and increasing. Income effects were monotonic and decreasing (i.e., demand was lower among high-income people). These odds ratios, however, were not significant at the 5-percent level.

As incomes and educational levels rise in China and as disparities increase, the relationships found in the CHIE data may not persist. It may be that greater disparities in utilization already existed in China at the time of the CHIE. However, the population in rural Sichuan Province was (and still is) poorer and less educated than many other rural areas. Low variation in the data set may have hidden such disparities.

Age and Gender Age effects were expected to interact with gender. To capture this interaction, these variables were modeled as a series of age/sex dummy variables. The demand curve across age groups for outpatient episodes followed a backward j-shape for both males and females. Demand was highest in the youngest age group (0 to 4) and declined through childhood. Gender differences in demand were not significant in the childhood age groups; they were significant in the adult groups. Outpatient demand among women increased after adolescence and peaked in the prime childbearing years (25 to 39). Demand among women declined slightly after age 50. In all adult age groups, demand among women was higher than demand among men. Men had a smaller increase in demand after adolescence, but it remained relatively constant for the remainder of the life cycle.

The effect of age on inpatient demand was even greater, and gender differentials were larger. Among children, demand was high only for the youngest group (age 0 to 4). Demand dropped sharply thereafter. Among adults of both genders, demand consistently increased through old age. Increases were greater among women and, as in the case of outpatient episodes, demand among women was always higher than demand among men. Highest inpatient utilization rates were observed among the oldest people.

These patterns are generally consistent with those reported for Western populations, with the notable exception that demand for outpatient care does not rise nearly as much as might be expected among older Chinese. Utilization patterns among women, particularly for outpatient care, are consistent with known population policies in China. Early marriage is discouraged as is early childbearing, which may explain the fact that demand among women does not rise until after age 25. In other countries at similar economic development stages, demand for health care may rise faster and earlier among women. The continuous increase in hospitalization rates among women after the childbearing years may also reflect the one-child family policy; with a very low birth rate, hospital delivery services are probably lower than they would be compared to other populations.

Among chronic disease patients, age and gender differences in demand were less pronounced for outpatient demand and absent for inpatient demand, probably reflecting less variation in needs for health care.

Family Size Odds ratios for the family size variable were essentially one for all models, which means that family size did not significantly affect demand. This suggests that even in large households in rural China, if the household is insured, resources are sufficient to meet health care costs without having to resort to rationing among family members. Rationing behavior would be a greater concern if children, the chronically ill, or other vulnerable groups were more adversely affected by family size. This does not appear to be the case.

Township Residence Differences in demand based on township residence were observed only among adults for outpatient demand and only among children for inpatient demand. In both cases, Jiajia Township residents had higher utilization rates compared to either Guangji or Xinfu Township residents. Townships were the management unit for insurance plan administration. These differences may reflect unmeasured management differences, health-related events (such as epidemics), or other geographic conditions. Without additional information, it is difficult to interpret these findings, except to say that local conditions matter and planners need to be aware of these as insurance plans are designed and evaluated.

Effects of Access Variables

Presence of a VHS, residence in a Danling village, and distance to the closest health care facility influenced demand as expected. Better access conditions led to increased demand for both outpatient and inpatient care.

Village Health Station As discussed earlier, absence of a VHS in a village had an unexpected effect on the coinsurance elasticity of demand. Contrary to time-price theory, demand was more elastic where there was no VHS. The VHS effect on demand, on the other hand, was strong and as expected. People in villages with an operating VHS had two to three times more outpatient episodes of care than those in villages without a VHS. This finding makes sense; where

there is no VHS, indirect costs of care (travel costs and opportunity costs of time) are on average higher. Higher average costs should inhibit outpatient demand as it apparently did.

VHS presence also influenced inpatient demand, though not as strongly. However, the effect was also in the opposite direction; presence of a VHS *decreased* demand for hospitalizations by 24 percent. This suggests that outpatient and inpatient care in the CHIE were substitutes. Some of the higher inpatient demand for those from villages without a VHS may be travel-related. In general, if there is no VHS, the next closest facility is the township hospital. The distance may be so great or the availability of transportation so limited that the medical staff may have been more apt to admit patients from these villages, even when outpatient care may have been adequate for the encounter. This finding also suggests (assuming that outpatient care is more cost-effective than inpatient care) that establishing a VHS in all villages may be a useful cost-containment strategy in rural China.

Danling Demand among people living in the four Danling villages (in the remote western end of Guangji Township) was consistently lower compared to demand among people in other villages. For outpatient care, this effect was greatest among adults (72 to 85 percent fewer episodes). Outpatient demand among children also suffered in Danling villages, but less so (32 percent fewer episodes). This suggests that parents were more willing to do what was necessary to overcome severe access constraints for their children than they are for themselves. The odds ratio for outpatient demand in Danling villages indicates that people in poorer health were more vulnerable than children but less vulnerable than adults. However, this odds ratio was not significant at the 5-percent level.

Residence in a Danling village did not affect inpatient demand as severely. In the panel model, those in Danling villages had 32 percent fewer episodes of care. Effects on inpatient demand were also negative in other groups, although none of the odds ratios were statistically significant.

Even though access to higher level care was improved in 1990 for these villages and utilization rates did rise, inequities in access probably persisted

because the change in insurance provisions only provided access to a county hospital, the highest and most costly level of service available in CHIE plans. Although geographic access undoubtedly improved in 1990, financial barriers to care persisted. As stated in the discussion of the coinsurance-danling interaction, one lesson to be learned is the importance of the location of health care facilities and utilization patterns. As well organized and as universal as China's three-tiered rural health system is, utilization patterns do not necessarily follow administrative boundaries. Though management may be more complicated, from a health effects perspective, it is worth considering an approach that tailors insurance coverage to fit these patterns.

Distance In all models except the child inpatient model, the greater the distance to the nearest health care facility, the lower the demand for episodes of care. In the panel sample, the influence of distance was only slightly greater for inpatient demand; each 1 kilometer increase in distance was associated with a 16 percent decrease in demand, compared to 13 percent for outpatient episodes. Among chronic disease patients, the impact of distance was greatest. Each kilometer increase in distance was associated with a 50 percent decrease in demand for inpatient episodes and a 21 percent decrease in demand for outpatient episodes. These results are consistent with theory on time-price effects on health care demand. Greater distance is associated with higher time and travel costs, which should depress demand.

Concluding Comments

Results from the CHIE generally show that much of what is known about insurance effects on demand for health care is also true in rural China. The same can be said regarding the influence of most other factors believed to affect demand. It is encouraging to find that coinsurance and access constraints (such as facility siting and travel distances) do not disproportionately affect vulnerable groups (children, the poor, and those in poor health). Although better data are needed to more accurately assess demand for more essential care (such as hospitalization and care for chronic health problems), no evidence was

found to suggest that essential care is more affected by either coinsurance provisions or by access constraints.

The congruence between CHIE results and the results published on western populations should encourage policy makers to proceed with efforts to promote health insurance as a financing mechanism where financial access to care is poor and where central government funds are unable to fill the need for improved access. However, a number of questions remain to be answered and there is reason to proceed cautiously.

First and perhaps foremost, the generalizability of results from the CHIE to other populations, even within China, is unknown. There are great variations throughout China in living standards. Sichuan Province is more fertile and better off compared to many northern and western provinces but is poor compared to coastal provinces. The distribution of income in these data is not great and may account for the fact that no income-insurance interaction was observed. This may not be true either in wealthier parts of China or in wealthier developing countries. It may change in Sichuan Province as incomes continue to rise and disparities increase.

Other questions with regard to differential income effects remain to be answered. For example, although these data do not support the hypothesis that more vulnerable groups (children, the poor, and the sick) are more adversely affected by coinsurance in terms of *elasticities* of demand, some evidence indicates that they may be harmed in other ways. The poor, for instance, have lower utilization rates than the nonpoor. These lower rates may have adverse health consequences, and they may be exacerbated by higher coinsurance rates. Outcomes data were not available in the CHIE data, and minimal accepted standards of care for rural Chinese have not been defined. Consequently, it is difficult to judge whether or not these differences are meaningful in terms of health status.

At least part of the negative coinsurance effect observed operates through annual demand for episodes of care. Preliminary analysis of the CHIE data (not presented here) shows that coinsurance also significantly influences annual

health care expenditures. These two results agree with those reported by Keeler, et al., (1988) using RHIE data. Keeler also reported that coinsurance did *not*, however, influence cost per episode of care, which isolated the impact of coinsurance on utilization to decisions about how many episodes of care to initiate. This last hypothesis remains to be tested on the CHIE data.

APPENDIX 1

List of Villages and Experimental Groups

Township	Village Group	Village ID Number	Village Name
Guangji	Crossover Group I	1	Jiguang
		6	Rengeng
		7	Tongxin
		8	Conglin
Guangji	Crossover Group II	2	Jinwang
		3	Weixing
		4	Siying
		5	Yachi
Guangji	Mountain Group	9	Wuyi
		10	Songzui
		11	Huangfen
		12	Shuiku
		13	Lianao
Xinfu	Group	51	Panshan
		52	Lengwan
		53	Yongyi
		54	Xinfu
		55	Wanchangou
Jiajia	Crossover Group I	61	Jiankang
		62	Duanjinmiao
		63	Tuanhe
		64	Dishui
Jiajia	Crossover Group II	65	Erdaoqiao
		66	Huoshui
		67	Zhulin
		68	Wuli

APPENDIX 2

Comparison of Episode Files

This table shows the number of episodes produced from encounter-level files using the 15-day and 22-day rules as maximal intervals between encounters. (Intervals greater than or equal to 15 or 22 days between encounters defined the beginning of a new episode of care.)

	1989		1990	
Township	15-Day Rule	22-Day Rule	15-Day Rule	22-Day Rule
Guangji	5,435	4,999	7,143	6,521
Jiajia	4,241	3,820	6,195	5,489
Xinfu	2,408	2,169	2,656	2,408
TOTAL	12,084	10,988	15,994	14,418

APPENDIX 3

OLS Regression Results

NOTE: Inpatient and outpatient data pooled for ordinary least squares regression.

Dependent variable: epis_l = log (epis_op + epis_ip + 1)

epis_l	Coef.	Std. Err.	t	P>|t|
year	.127336	.0123013	10.351	0.000
ci_op	-.0036581	.000533	-6.864	0.000
vhs	.222596	.031935	6.970	0.000
dis_cls	-.0658536	.016358	-4.026	0.000
ba_chr	.3055146	.0661585	4.618	0.000
educ_no	-.0933444	.0337997	-2.762	0.006
educ_hi	.03983	.0250107	1.593	0.111
inc_lo	-.1592786	.032974	-4.830	0.000
inc_hi	.1024223	.0864248	1.185	0.236
l_famsz	-.0092509	.0338641	-0.273	0.785
age0_4	.6959621	.0458045	15.194	0.000
age5_12	.1949947	.0432453	4.509	0.000
age13_19	-.1248782	.0362897	-3.441	0.001
age20f24	.1424189	.0475883	2.993	0.003
age25m39	.1039367	.0410104	2.534	0.011
age25f39	.2368805	.0405647	5.840	0.000
age40m49	.1016455	.0497181	2.044	0.041
age40f49	.137087	.0545098	2.515	0.012
age50m59	.146988	.0528737	2.780	0.005
age50f59	.2374621	.0558403	4.253	0.000
age60m	.0755566	.0594224	1.272	0.204
age60f	.2279758	.0615627	3.703	0.000
danling	-.3019179	.0377814	-7.991	0.000
jiajia	.0807662	.0326021	2.477	0.013
xinfu	-.0424241	.0403109	-1.052	0.293
_cons	.8460223	.0807133	10.482	0.000

APPENDIX 4

Huber Standard Error Correction Factors

Note: Standard error correction factors were derived as follows

1. Regress log of outpatient episodes (+1) on all dependent variables (main and interaction variables) using standard OLS regression.
2. Repeat step 1 using Huber regression.
3. For each predictor variable, the standard error correction factor = SE_{huber}/SE_{ols}.
4. Repeat once each for outpatient and inpatient models.

Standard errors from negative binomial regressions were multiplied by their respective correction factor as calculated above. These corrected standard errors were then used to calculate corrected t-statistics for significance of coefficients.

OUTPATIENT MODELS:

	SAMPLE				
VARIABLE	PANEL-2	ADULT	CHILD	CHRONIC	SURVEY
year	.849	.774	.719	.658	.870
ci_op	.971	.820	.703	.632	.903
ci_vhs	.952	.823			
ci_dan	.904	.802			
vhs	1.597	1.311	1.272	1.115	1.516
dis_cls	1.621	1.430	1.439	1.064	1.514
ba_chr	1.427	1.466			1.368
educ_no	1.410	1.213	1.163	1.318	1.239
educ_hi	1.408	1.284	1.316	1.073	1.374
inc_lo	1.734	1.464	1.367		1.619
inc_hi	1.685	1.623	1.147		1.203
fam_sz	1.773	1.509	1.211	1.188	1.739
age0_4	1.346		1.272		1.344
age5_12	1.274				1.269
age13_19	1.200				1.190
age20f24	1.101	1.089		1.264	1.136
age25m39	1.226	1.207			1.218
age25f39	1.249	1.229			1.225
age40m49	1.180	1.164			1.192
age40f49	1.240	1.229			1.226
age50m59	1.229			1.324	1.280
age50f59	1.228			1.175	1.263
age60m	1.181			1.296	1.185
age60f	1.290			1.297	1.206
danling	1.708	1.459	1.300	1.010	1.596
jiajia	1.692	1.392	1.333	1.151	1.690
xinfu	1.688	1.423	1.286	1.334	1.604
qual_cls					1.612
nplan_ip					.407
_cons	1.098	.972	1.016	1.009	1.260

INPATIENT MODELS:

	SAMPLE			
VARIABLE	PANEL	ADULT	CHILD	CHRONIC
year	.981	.980	.980	.908
ci_ip	.993	.990	.966	.920
vhs	1.158	1.172	1.026	.949
dis_cls	1.014	.922	1.068	.576
ba_chr	1.866	1.609		
educ_no	1.087	.978	.936	1.089
educ_hi	1.001	1.020	1.111	.675
inc_lo	1.121	1.049	1.064	
inc_hi	.761	.742	.966	
fam_sz	1.148	1.142	1.316	1.110
age0_4	.966		1.158	
age5_12	.811			
age13_19	.827			
age20f24	.937	.939		.852
age25m39	.846	.851		
age25f39	.931	.932		
age40m49	.943	.949		
age40f49	1.145	1.163		
age50m59	1.036			.743
age50f59	1.368			1.464
age60m	1.106			.789
age60f	1.201			.872
danling	.902	.916	.944	.696
jiajia	1.140	1.158	1.051	.820
xinfu	1.062	.938	.976	1.272
_cons	.990	1.034	1.095	.930

APPENDIX 5

Coefficients for Main Effects (No Interaction Terms)
Negative Binomial Regression Results
(Outpatient Panel Model, Model Building [7] Sample)

(NOTE: printout from STATA 3.1)

Negative Binomial Regression — Number of obs = 6992
Model chi2(25) = 1142.16
Prob > chi2 = 0.0000
Log Likelihood = -12004.7181312 — Pseudo R2 = 0.0454

epis	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.2387059	.0264468	9.026	.1868712	.2905406
ci_op	-.0074029	.0011233	-6.590	-.0096046	-.0052012
vhs	.384621	.0351142	10.953	.3157985	.4534435
dis_cls	-.1147967	.0182946	-6.275	-.1506536	-.0789399
ba_chr	.5144143	.0759197	6.776	.3656143	.6632142
educ_no	-.1641469	.0423599	-3.875	-.2471707	-.0811231
educ_hi	.0642641	.032085	2.003	.0013786	.1271495
inc_lo	-.2506215	.0343063	-7.305	-.3178605	-.1833824
inc_hi	.0710826	.1023061	0.695	-.1294337	.2715989
fam_sz	-.000643	.0087196	-0.074	-.0177331	.016447
age0_4	1.03608	.068359	15.156	.9020988	1.170061
age5_12	.3488599	.0672898	5.184	.2169743	.4807455
age13_19	-.2736475	.0640667	-4.271	-.3992159	-.1480792
age20f24	.2298373	.0765416	3.003	.0798186	.379856
age25m39	.1976539	.0666497	2.966	.0670229	.3282849
age25f39	.431463	.0648723	6.651	.3043157	.5586103
age40m49	.2138345	.0786511	2.719	.0596811	.3679879
age40f49	.3007319	.0825633	3.642	.1389108	.462553
age50m59	.3186119	.0825152	3.861	.1568851	.4803388
age50f59	.4262904	.0882475	4.831	.2533285	.5992522
age60m	.1867116	.0913163	2.045	.0077349	.3656884
age60f	.4311047	.091378	4.718	.2520072	.6102022
danling	-.5528523	.0474934	-11.641	-.6459375	-.459767
jiajia	.1802929	.0332457	5.423	.1151324	.2454533
xinfu	-.0178689	.0391377	-0.457	-.0945773	.0588396
_cons	.5827429	.1068177	5.455	.373384	.7921018
_lnalpha					
_cons	-.5573714	.0405727	-13.738	-.6368925	-.4778503

alpha .5727125 [_lnalpha]_cons = ln(alpha)
R test against Poisson, chi2(1) = 1690.138 P = 0.0000)

APPENDIX 6

Coefficients for Negative Binomial Regression Models
(Corresponding to Odds Ratios in Table 7.2 and 7.3)

Coefficients for PANEL-2 Outpatient Model:

Negative Binomial Regression — Number of obs = 7638
Model chi2(27) = 1124.75
Prob > chi2 = 0.0000
Log Likelihood = -13018.4666285 — Pseudo R2 = 0.0414

epis_op	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.1497103	.0275835	5.428	.0956477	.2037728
ci_op	-.0152999	.0026239	-5.831	-.0204425	-.0101572
ci_vhs	.0113488	.0029684	3.823	.0055309	.0171667
ci_dan	-.0206698	.0033328	-6.202	-.0272019	-.0141376
vhs	.2852805	.0341826	8.346	.2182839	.3522771
dis_cls	-.1355495	.0171337	-7.911	-.1691309	-.1019681
ba_chr	.6584572	.0674846	9.757	.5261898	.7907245
educ_no	-.0936476	.0399327	-2.345	-.1719144	-.0153809
educ_hi	.0631445	.0317253	1.990	.0009641	.1253249
inc_lo	-.1637287	.0328092	-4.990	-.2280336	-.0994239
inc_hi	.1693961	.1014601	1.670	-.0294621	.3682542
fam_sz	.0038384	.009218	0.416	-.0142286	.0219054
age0_4	.8051214	.065532	12.286	.6766811	.9335618
age5_12	.1260391	.0637223	1.978	.0011457	.2509325
age13_19	-.3389429	.0596155	-5.685	-.4557871	-.2220987
age20f24	-.0794077	.0774166	-1.026	-.2311415	.072326
age25m39	.0807235	.0620615	1.301	-.0409148	.2023618
age25f39	.293496	.0617393	4.754	.1724893	.4145028
age40m49	.0783817	.0736608	1.064	-.0659908	.2227543
age40f49	.1900697	.0778645	2.441	.0374581	.3426813
age50m59	.0904462	.0802284	1.127	-.0667986	.247691
age50f59	.2693698	.0850279	3.168	.1027181	.4360214
age60m	-.0249436	.0851656	-0.293	-.191865	.1419779
age60f	.1897164	.0845041	2.245	.0240915	.3553413
danling	-.4880929	.0471089	-10.361	-.5804247	-.3957612
jiajia	.2226459	.0322785	6.898	.1593811	.2859106
xinfu	.1428549	.0379029	3.769	.0685665	.2171433
_cons	1.161474	.1733446	6.700	.8217244	1.501223
_lnalpha					
_cons	-.5135263	.0380861	-13.483	-.5881737	-.438879

alpha .5983818 [_lnalpha]_cons = ln(alpha)
(LR test against Poisson, chi2(1) = 1957.345 P = 0.0000)

Coefficients for PANEL-7 Outpatient Model:

Negative Binomial Regression

Number of obs = 6992
Model chi2(27) = 1172.82
Prob > chi2 = 0.0000
Log Likelihood = -11887.0823577 Pseudo R2 = 0.0470

epis_op	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.1910022	.0283653	6.734	.1354072	.2465972
ci_op	-.0159659	.0026871	-5.942	-.0212326	-.0106992
ci_vhs	.0121765	.0030309	4.017	.0062361	.0181169
ci_dan	-.0144139	.0035327	-4.080	-.0213379	-.0074899
vhs	.3939827	.0355029	11.097	.3243984	.4635671
dis_cls	-.1090651	.018438	-5.915	-.1452029	-.0729274
ba_chr	.5216157	.0765467	6.814	.3715869	.6716445
educ_no	-.1631362	.042641	-3.826	-.246711	-.0795615
educ_hi	.0618287	.0322807	1.915	-.0014402	.1250976
inc_lo	-.2605609	.0345099	-7.550	-.3281991	-.1929228
inc_hi	.0800963	.1023871	0.782	-.1205787	.2807713
fam_sz	-.0005087	.0087835	-0.058	-.0177241	.0167068
age0_4	1.048687	.0687419	15.255	.9139555	1.183419
age5_12	.3580311	.0676432	5.293	.2254528	.4906094
age13_19	-.2700292	.0644327	-4.191	-.3963149	-.1437434
age20f24	.2224651	.0770877	2.886	.071376	.3735542
age25m39	.1984925	.0670449	2.961	.067087	.3298979
age25f39	.4283408	.0652838	6.561	.3003869	.5562946
age40m49	.2075305	.0791975	2.620	.0523062	.3627548
age40f49	.2923436	.0831753	3.515	.129323	.4553641
age50m59	.3217557	.0830164	3.876	.1590465	.4844648
age50f59	.4023611	.0889975	4.521	.2279292	.576793
age60m	.1650494	.0922216	1.790	-.0157017	.3458005
age60f	.4184252	.0919973	4.548	.2381138	.5987366
danling	-.593817	.0494913	-11.998	-.6908182	-.4968157
jiajia	.1733271	.0335167	5.171	.1076356	.2390186
xinfu	-.0081123	.0393802	-0.206	-.0852961	.0690716
_cons	1.075692	.1773804	6.064	.7280331	1.423351
_lnalpha					
_cons	-.5540383	.0409522	-13.529	-.6343032	-.4737734

alpha .5746246 [_lnalpha]_cons = ln(alpha)
(LR test against Poisson, chi2(1) = 1652.094 P = 0.0000)

Coefficients for ADULT Outpatient Model:

Negative Binomial Regression — Number of obs = 3506; Model chi2(20) = 360.87; Prob > chi2 = 0.0000; Log Likelihood = -6060.8582765; Pseudo R2 = 0.0289

epis_op	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.1370816	.0398621	3.439	.0589533	.2152098
ci_op	-.018907	.0037789	-5.003	-.0263134	-.0115006
ci_vhs	.0147715	.004269	3.460	.0064044	.0231385
ci_dan	-.0206519	.0047658	-4.333	-.0299926	-.0113111
vhs	.3643775	.0496489	7.339	.2670674	.4616876
dis_cls	-.098918	.0247182	-4.002	-.1473648	-.0504712
ba_chr	.6605631	.1184553	5.576	.4283949	.8927314
educ_no	-.0754031	.0625468	-1.206	-.1979927	.0471864
educ_hi	.0658387	.0431136	1.527	-.0186625	.1503398
inc_lo	-.2361037	.047246	-4.997	-.3287041	-.1435032
inc_hi	.2393906	.1386032	1.727	-.0322667	.5110479
fam_sz	.0228414	.0134087	1.703	-.0034392	.049122
age20f24	-.0667324	.0770224	-0.866	-.2176935	.0842286
age25m39	.0930344	.062154	1.497	-.0287851	.2148539
age25f39	.3033957	.0625552	4.850	.1807897	.4260017
age40m49	.0773085	.0745558	1.037	-.0688183	.2234352
age40f49	.1770606	.0804433	2.201	.0193945	.3347266
danling	-.4442555	.0674226	-6.589	-.5764014	-.3121095
jiajia	.2206228	.046867	4.707	.1287653	.3124804
xinfu	.0794876	.0550449	1.444	-.0283985	.1873736
_cons	1.241572	.2428859	5.112	.7655245	1.71762
_lnalpha					
_cons	-.5500317	.0560814	-9.808	-.6599492	-.4401142

alpha .5769315 [_lnalpha]_cons = ln(alpha)

(LR test against Poisson, chi2(1) = 869.5203 P = 0.0000)

Coefficients for CHILD Outpatient Model:

Negative Binomial Regression — Number of obs = 1318; Model chi2(13) = 231.54; Prob > chi2 = 0.0000; Log Likelihood = -2548.1445112; Pseudo R2 = 0.0435

epis_op	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.1284819	.0556699	2.308	.0193709	.2375929
ci_op	-.0066662	.0023669	-2.816	-.0113053	-.002027
vhs	.2234859	.075902	2.944	.0747207	.3722511
dis_cls	-.2300467	.036942	-6.227	-.3024517	-.1576417
educ_no	-.2243564	.0925867	-2.423	-.4058229	-.0428898
educ_hi	.0753913	.0640068	1.178	-.0500598	.2008423
inc_lo	.028766	.0722231	0.398	-.1127886	.1703206
inc_hi	.0636592	.2218999	0.287	-.3712566	.4985751
fam_sz	-.0105577	.0231739	-0.456	-.0559777	.0348622
age0_4	.6548548	.0597536	10.959	.5377398	.7719697
danling	-.3810679	.0944241	-4.036	-.5661357	-.1960002
jiajia	.0592205	.0725471	0.816	-.0829692	.2014103
xinfu	-.0629603	.0813644	-0.774	-.2224316	.096511
_cons	.9774356	.2013822	4.854	.5827337	1.372137
_lnalpha					
_cons	-.6480103	.084063	-7.709	-.8127707	-.4832499

alpha .5230855 [_lnalpha]_cons = ln(alpha)

(LR test against Poisson, chi2(1) = 423.8295 P = 0.0000)

Coefficients for CHRONIC Outpatient Model:

Negative Binomial Regression — Number of obs = 400; Model chi2(15) = 94.65; Prob > chi2 = 0.0000; Log Likelihood = -844.4207471; Pseudo R2 = 0.0531

epis_op	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.1519993	.0971863	1.564	-.0384823	.3424809
ci_op	-.0067298	.0042319	-1.590	-.0150241	.0015645
vhs	.2888049	.1376464	2.098	.019023	.5585868
dis_cls	-.2687184	.073528	-3.655	-.4128305	-.1246062
educ_no	-.1152471	.1236321	-0.932	-.3575616	.1270673
educ_hi	.0469059	.173353	0.271	-.2928598	.3866715
fam_sz	-.0448987	.0318792	-1.408	-.1073807	.0175833
age20f49	-.0832157	.162548	-0.512	-.401804	.2353726
age50m59	-.069405	.1825873	-0.380	-.4272696	.2884596
age50f59	.1795461	.1976387	0.908	-.2078187	.5669109
age60m	.1716313	.1680668	1.021	-.1577737	.5010363
age60f	.0734968	.1907797	0.385	-.3004245	.4474182
danling	-1.116471	.1604723	-6.957	-1.430991	-.8019512
jiajia	-.1440086	.1367932	-1.053	-.4121183	.1241011
xinfu	.1338723	.1330534	1.006	-.1269076	.3946521
_cons	1.770831	.3631331	4.877	1.059103	2.482558
_lnalpha					
_cons	-.7593806	.1451609	-5.231	-1.043891	-.4748705

alpha .4679562 [_lnalpha]_cons = ln(alpha)

(LR test against Poisson, chi2(1) = 148.0598 P = 0.0000)

Coefficients for SURVEY Outpatient Model:

Negative Binomial Regression — Number of obs = 3404; Model chi2(27) = 562.08; Prob > chi2 = 0.0000; Log Likelihood = -5867.9777077; Pseudo R2 = 0.0457

epis_op	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
qual_cls	.0953226	.015655	6.089	.0646393	.1260059
nplan_ip	-.9412365	1.010887	-0.931	-2.922539	1.040066
year	.2133044	.0374141	5.701	.1399741	.2866346
ci_op	-.0074949	.0016432	-4.561	-.0107155	-.0042744
vhs	.0694937	.0545944	1.273	-.0375093	.1764967
dis_cls	-.1536156	.0232094	-6.619	-.1991052	-.108126
ba_chr	.5427081	.0907994	5.977	.3647447	.7206716
educ_no	-.109187	.0577431	-1.891	-.2223614	.0039874
educ_hi	.0813141	.047188	1.723	-.0111726	.1738009
inc_lo	-.1371063	.046277	-2.963	-.2278075	-.0464051
inc_hi	.2088783	.1392531	1.500	-.0640529	.4818094
fam_sz	.0102082	.01272	0.803	-.0147225	.035139
age0_4	.7202917	.0963889	7.473	.5313729	.9092105
age5_12	-.003129	.0925802	-0.034	-.1845829	.1783249
age13_19	-.4678627	.0842504	-5.553	-.6329904	-.3027351
age20f24	-.1707851	.1141603	-1.496	-.3945351	.052965
age25m39	.0184776	.0893375	0.207	-.1566206	.1935758
age25f39	.2219956	.0890314	2.493	.0474972	.396494
age40m49	.0174233	.1024856	0.170	-.1834447	.2182914
age40f49	.1016162	.1069946	0.950	-.1080894	.3113217
age50m59	.0567196	.1145062	0.495	-.1677084	.2811475
age50f59	.2366951	.1211535	1.954	-.0007614	.4741517
age60m	-.102475	.1236384	-0.829	-.3448017	.1398517
age60f	-.0049398	.121338	-0.041	-.242758	.2328784
danling	-.4402875	.0634615	-6.938	-.5646698	-.3159053
jiajia	.2797401	.0479598	5.833	.1857406	.3737396
xinfu	.2239394	.0543284	4.122	.1174576	.3304212
_cons	.4304536	.1674281	2.571	.1023007	.7586066
_lnalpha					
_cons	-.6054342	.0579144	-10.454	-.7189443	-.4919242

alpha .5458374 [_lnalpha]_cons = ln(alpha)

(LR test against Poisson, chi2(1) = 819.7013 P = 0.0000)

Coefficients for PANEL Inpatient Model:

Negative Binomial Regression

Number of obs = 14630
Model chi2(25) = 144.05
Prob > chi2 = 0.0000
Log Likelihood = -2042.6145967 Pseudo R2 = 0.0341

epis_ip	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.3320075	.0986939	3.364	.1385711	.525444
ci_ip	-.0067829	.0035017	-1.937	-.0136462	.0000804
vhs	-.2706025	.1162805	-2.327	-.4985081	-.0426969
dis_cls	-.1701403	.0685732	-2.481	-.3045413	-.0357393
ba_chr	.8741771	.1932153	4.524	.4954821	1.252872
educ_no	-.1370213	.1462584	-0.937	-.4236826	.14964
educ_hi	.0904369	.1261134	0.717	-.1567408	.3376147
inc_lo	.0576226	.1290356	0.447	-.1952825	.3105277
inc_hi	-.5214056	.5322879	-0.980	-1.564671	.5218594
fam_sz	-.0265687	.0328329	-0.809	-.0909199	.0377826
age0_4	.5441981	.2836485	1.919	-.0117427	1.100139
age5_12	-.1752807	.3010438	-0.582	-.7653156	.4147543
age13_19	-.0441869	.2634175	-0.168	-.5604757	.4721019
age20f24	.3919885	.3055282	1.283	-.2068358	.9908128
age25m39	.1374217	.2746998	0.500	-.4009801	.6758234
age25f39	.558853	.2601142	2.148	.0490386	1.068667
age40m49	.4222112	.306303	1.378	-.1781317	1.022554
age40f49	.9378974	.2953687	3.175	.3589854	1.516809
age50m59	.5699	.315201	1.808	-.0478826	1.187683
age50f59	1.1961	.3041206	3.933	.6000345	1.792165
age60m	.83584	.3099993	2.696	.2282526	1.443427
age60f	1.089908	.3139879	3.471	.4745036	1.705313
danling	-.3922125	.1925629	-2.037	-.7696289	-.0147961
jiajia	.1610013	.1206863	1.334	-.0755395	.397542
xinfu	.0794062	.1503356	0.528	-.2152463	.3740586
_cons	-3.278904	.3767987	-8.702	-4.017415	-2.540392
_lnalpha					
_cons	1.116988	.2214171	5.045	.6830183	1.550957

alpha 3.055636 [_lnalpha]_cons = ln(alpha)
(LR test against Poisson, chi2(1) = 55.37804 P = 0.0000)

Coefficients for ADULT Inpatient Model:

Negative Binomial Regression — Number of obs = 6746; Model chi2(18) = 54.89; Prob > chi2 = 0.0000; Log Likelihood = -943.6232976; Pseudo R2 = 0.0283

epis_ip	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.4619434	.1464911	3.153	.1748262	.7490606
ci_ip	-.0049008	.0051259	-0.956	-.0149473	.0051458
vhs	-.2813914	.1692517	-1.663	-.6131187	.0503359
dis_cls	-.2359811	.104116	-2.267	-.4400447	-.0319175
ba_chr	.9334375	.343581	2.717	.2600311	1.606844
educ_no	-.4921453	.2603385	-1.890	-1.002399	.0181087
educ_hi	.2165614	.1661003	1.304	-.1089892	.542112
inc_lo	.0833504	.1853016	0.450	-.2798341	.4465349
inc_hi	-.6402964	.7520046	-0.851	-2.114198	.8336055
fam_sz	.0137557	.0493984	0.278	-.0830634	.1105747
age20f24	.4102552	.3059966	1.341	-.1894871	1.009998
age25m39	.1965229	.2768328	0.710	-.3460593	.7391052
age25f39	.6671808	.2643762	2.524	.1490129	1.185349
age40m49	.5119191	.3118698	1.641	-.0993346	1.123173
age40f49	1.097996	.3068293	3.579	.4966213	1.69937
danling	-.4353101	.2742494	-1.587	-.972829	.1022088
jiajia	.0812821	.1741772	0.467	-.2600991	.4226632
xinfu	-.2702964	.2359401	-1.146	-.7327306	.1921377
_cons	-3.567686	.4991033	-7.148	-4.545911	-2.589462
_lnalpha					
_cons	1.074848	.345956	3.107	.3967865	1.752909

alpha 2.929547 [_lnalpha]_cons = ln(alpha)
(LR test against Poisson, chi2(1) = 20.68994 P = 0.0000)

Coefficients for CHILD Inpatient Model:

Negative Binomial Regression — Number of obs = 2534; Model chi2(13) = 19.46; Prob > chi2 = 0.1095; Log Likelihood = -286.7297978; Pseudo R2 = 0.0328

epis_ip	IRR	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	1.10606	.2837444	0.393	.6689824	1.828701
ci_ip	.9876424	.0091439	-1.343	.9698823	1.005728
vhs	1.1785	.3899726	0.496	.6161157	2.254225
dis_cls	1.096725	.1683571	0.601	.8117661	1.481716
educ_no	1.047221	.4332436	0.112	.4654679	2.356064
educ_hi	.8905832	.2583022	-0.400	.5044225	1.572369
inc_lo	1.118491	.3774151	0.332	.5773108	2.166983
inc_hi	1.0045	1.065161	0.004	.1257028	8.027028
fam_sz	.8671234	.0955823	-1.293	.6986403	1.076238
age0_4	2.147708	.592436	2.771	1.250763	3.687869
danling	.9175516	.4413129	-0.179	.357462	2.355218
jiajia	1.899651	.6410179	1.902	.9804932	3.680469
xinfu	1.510951	.614292	1.015	.6810608	3.352083
_lnalpha					

alpha .7862604 [_lnalpha]_cons = ln(alpha)

(LR test against Poisson, chi2(1) = .5358948 P = 0.4641)

Coefficients for CHRONIC Inpatient Model:

Negative Binomial Regression — Number of obs = 400; Model chi2(15) = 26.78; Prob > chi2 = 0.0305; Log Likelihood = -128.7967320; Pseudo R2 = 0.0942

epis_ip	Coef.	Std. Err.	z	[95% Conf.	Interval]
_lnmean					
year	.3981659	.3439857	1.158	-.2760338	1.072366
ci_ip	-.0038297	.012369	-0.310	-.0280725	.020413
vhs	-.5322371	.4860394	-1.095	-1.484857	.4203826
dis_cls	-.6061907	.3600845	-1.683	-1.311943	.099562
educ_no	.1513795	.4154902	0.364	-.6629664	.9657254
educ_hi	-1.11482	1.072425	-1.040	-3.216734	.9870942
fam_sz	-.079766	.11772	-0.678	-.3104929	.1509609
age20f49	.7459889	.7080414	1.054	-.6417467	2.133725
age50m59	.382056	.8207	0.466	-1.226486	1.990598
age50f59	1.138822	.7664547	1.486	-.3634014	2.641046
age60m	.3790261	.7603567	0.498	-1.111246	1.869298
age60f	.5290129	.7970477	0.664	-1.033172	2.091198
danling	-.880967	.7001942	-1.258	-2.253322	.4913885
jiajia	-.3251602	.5298394	-0.614	-1.363626	.7133059
xinfu	.5231419	.4760272	1.099	-.4098542	1.456138
_cons	-1.484199	1.245857	-1.191	-3.926033	.9576348
_lnalpha					
_cons	.096351	.7390001	0.130	-1.352063	1.544764

alpha 1.101145 [_lnalpha]_cons = ln(alpha)

(LR test against Poisson, chi2(1) = 4.443337 P = 0.0350)

APPENDIX 7

Satisfaction Survey Questions and Variables

Survey Questions
(Note: Instrument questions appear as translated by researchers at the West China Medical University, Chengdu, China.)

A. HOUSEHEAD'S UNDERSTANDING OF HEALTH INSURANCE

1. (positive of question 3) Somebody said that he (or she) pays a small amount of premium every year to get security in case of illness, especially serious disease, so it is worth to participate (in) health insurance. Do you think the opinion is correct or not?
   (1) Not correct
   (2) Don't Know
   (3) Correct
   (4) No opinion

2. Do you know how much premium every insured of your village paid in 1990?
   (1) Don't Know
   (2) Know (____ Yuan)

3. (negative of question 1) Somebody said that he (or she) has seldom seen doctor since the insurance began, so it isn't worth to participate (in) health insurance. Do you think the opinion is correct or not?
   (1) Not correct
   (2) Don't know
   (3) Correct
   (4) No opinion

4. Where could you go to see doctor and get reimbursed? Score _____
   (Note: Score What interviewed knew:
   1 1 level of medical facility
   2 2 levels of medical facilities
   3 3 levels of medical facilities
   4 4 levels of medical facilities)

5. According to your two years experience, how do you think about the experimental health insurance?
   (1) Not good
   (2) Just so so
   (3) Good
   (5) No opinion
   (4) Very good

B. HOUSEHEAD'S PREFERENCE FOR DIFFERENT KINDS OF INSURANCE PLAN

6.1. Do you think the procedures of referral and reimbursement are convenient or not?
   (1) Very inconvenient
   (2) Not convenient
   (3) Convenient
   (4) Very convenient
   (5) No opinion

6.2. Comparing the insurance plans between 1989 and 1990, which year's plan is better?
   (1) _____ plan is better
   (2) No difference
   (3) No opinion

7. Three different kinds of insurance have been carried out among villages of our township. (Interviewer briefs the characteristics of every insurance plan.) Which kind of insurance is better?
   (1) More outpatient reimbursement
   (2) More inpatient reimbursement
   (3) Balanced reimbursement rate between outpatient and inpatient
   (4) No opinion

B. QUESTIONS ABOUT QUALITY AND UTILIZATION OF CARE AT DIFFERENT LEVELS

B.I. QUALITY OF CARE AT DIFFERENT LEVELS

8. How would you rate the quality of medical care at the village health station?
   (1) The doctor couldn't resolve my problem at all
   (2) So so
   (3) Good
   (4) Very good
   (5) No opinion

9. Did the village doctor serve patients with patience?
   (1) Not patiently
   (2) So so
   (3) Patiently
   (4) Very patiently
   (5) No Opinion

10. How would you rate the quality of medical care at the township level?
   (1) The doctor couldn't resolve my problem at all
   (2) So so
   (3) Good
   (4) Very good
   (5) No opinion

11. Did the township doctor serve patients with patience?
   (1) Not patiently
   (2) So so
   (3) Patiently
   (4) Very patiently
   (5) No Opinion

B.II. UTILIZATION AT DIFFERENT LEVELS

12. Did any member of your family visit a doctor in the past month?
   (1) No
   (2) Yes (If "yes", fill out Table B-1)

TABLE B-1 Use of in-plan and out-of-plan services.

NAME OF SYSTEM	OUTPATIENT (Visits) V	T	D	C	P	OTHER	INPATIENT (Stays) T	D	C	OTHER	IN BED DISABILITY DAYS	PAYMENT OUT OF POCKET

Note: 1) NAME OF SYSTEM: Use "in" or "out" of insurance service system.
2) V: village level C: county level
T: township level P: private doctor
D: district level OTHER: any other level

Total, _____ patients.

Why did you use out of plan services?
(1) Short distance
(2) The doctor's high reputation
(3) More convenient
(4) A great deal of trouble in referral and reimbursement
(5) Too small amount of reimbursed expenditure
(6) Other _____

B.III. ILLNESS, BUT DID NOT SEEK CARE

13. Did any of your family members get illness but not seek care in the past month?
(1) No
(2) Yes
(If "yes", fill out Table B-2.)

TABLE B-2 Reasons for not seeking care during illness.

NAME	SYMPTOM OR DISEASE NAME	REASONS 1	2 (Yuan)	3	4	5	6	IN BED DISABILITY DAYS
TOTAL _____								

Note: REASON: 1 = self-care
2 = self-buy drugs (cost in Yuan)
3 = slight illness
4 = not convenient
5 economic reasons
6 very busy, no time

14. Did any of your family members need to get inpatient care but did not stay at a hospital for care in the past half year?
(1) No
(2) Yes
(If "yes", go to the next questions.)

How many ? _____ family members

Why?
(1) Lower coverage rate and economic reason
(2) No time
(3) No vacant bed at hospital
(4) Other _____

Construction of Variables from Satisfaction Survey

Three variables were constructed from the Satisfaction Survey data for use in the final negative binomial regression outpatient and inpatient models. These were: quality of services at the nearest health facility (VHS or township hospital), per capita number of out-of-plan outpatient visits, and per capita number of out-of-plan inpatient admissions. These variables were constructed as follows:

QUAL_CLS (quality of services at nearest health facility):

= sum of answers to B8 and B9 if VHS closer
= sum of answers to B10 and B11 if township hospital closer

NPLAN_OP (per capita out-of-plan OP visits in 4 week-period):

$$= \frac{\text{total number OP visits to non-CHIE providers by all HH members (from Exit Survey)}}{\text{"hhsize_9"}}$$

where "hhsize_9" = number of people in household on 1/1/90.

NPLAN_IP (per capita out-of-plan IP admissions in 6-month period):

$$= \frac{\text{total number IP admissions to non-CHIE by all HH members (from Exit Survey)}}{\text{"hhsize_9"}}$$

where "hhsize_9" = number of people in household on 1/1/90.

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