The Impact of Increasing Patient Prescription Drug Cost Sharing on Therapeutic Classes of Drugs Received and on the Health Status of Elderly HMO Members

Richard E. Johnson, Michael J. Goodman, Mark C. Hornbrook, and Michael B. Eldredge

Objective. To assess the impact of increased prescription drug copayments on the therapeutic classes of drugs received and health status of the elderly.

Hypotheses Tested. Increased prescription drug copayments will reduce the relative exposure to, annual days use of, and prescription drug costs for drugs used in self-limiting conditions, but will not affect drugs used in progressive chronic conditions and will not reduce health status.

Study Design. Each year over a three-year period, one or the other of two well-insured Medicare risk groups in an HMO setting had their copayments per dispensing increased. Sample sizes ranged from 6,704 to 7,962.

Data Sources/Data Collection. Automated administrative data systems of the HMO were used to determine HMO eligibility, prescription drug utilization, and health status.

Analysis Design. Analysis of variance or covariance was employed to measure change in dependent variables.

Findings. Relative exposure, annual days of use, and prescription drug costs for drugs used in self-limiting conditions and in progressive chronic conditions were not affected in a consistent manner across years by increases in prescription drug copayment. Health status may have been adversely affected. Larger increases in copayments appeared to generate more changes.

Conclusions. Small changes in copayments did not appear to substantially affect outcomes. Large changes in copayments need further examination.

Key Words. drug copayment, drug costs, drug utilization, health status

BACKGROUND AND SIGNIFICANCE

Drug treatment is a necessary component of maintaining the health and functioning of elderly persons. These individuals form the population segment much more likely than the younger adult segment to have multiple potentially disabling medical problems manageable with drug treatment. As a result, persons 65 years of age, while currently constituting about 12 percent of the U.S. population, receive about 25 percent of the total number of prescriptions dispensed per year (National Council on Patient Information and Education 1988; Guralnik, Yanagishita, and Schneider 1988). It is estimated that, by the year 2000, the nearly 35 million elderly will consume one-half of all prescription drugs (National Council on Patient Information and Education 1988). This has important implications for medical care delivery in the future and for future drug policy in particular.

While drugs are a necessary component of healthcare, they are not sufficient to maintain the health and functioning of elderly populations unless they are both accessible and used. While the Medicare and Medicaid programs have dramatically increased the elderly population's access to healthcare services in general, the Medicare program, which serves by far the largest part of the elderly population, does not provide a prescription drug benefit. As a result, nearly 46 percent of the elderly have no prepaid prescription drug coverage, either through private insurance or public assistance programs (Long 1994).

Studies have shown that prescription drug insurance increases prescription drug utilization in a population or community, including the elderly segment (Greenlick and Darsky 1968; Lohr, Brook, Kamberg, et al. 1986; Weeks 1973; Stuart et al. 1991; Sullivan 1992; Stuart and Grana 1993). It

---

The research was supported by Garfield Memorial Fund Grant No. 101–9054. The statements contained in this report are solely those of the authors and do not necessarily reflect the view or policies of Kaiser Permanente, Northwest Division. The authors assume full responsibility for the accuracy and completeness of the information contained in this report.

Address correspondence and requests for reprints to Richard E. Johnson, Ph.D., Senior Investigator, Center for Health Research, Kaiser Permanente, Northwest Division, 3800 N. Kaiser Center Drive, Portland, OR 97227–1098. Michael J. Goodman, Ph.D. is Research Investigator, HealthPartners, Minneapolis, MN; Mark C. Hornbrook, Ph.D. is Senior Investigator, Center for Health Research, Kaiser Permanente, Northwest Division; and Michael B. Eldredge, RPh. is Staff Pharmacist at Kaiser Permanente, Northwest Division. This article, submitted to *Health Services Research* on August 15, 1995, was revised and accepted for publication on June 7, 1996.

is important to note, however, that those with prescription drug coverage, including the elderly, are not random samples of the population. They are by definition a self-selected subgroup more likely to require prescription drugs. Thus, the findings are not indicative of the increased use of medications were the entire population to have prescription drug insurance.

The question of a prescription drug benefit for the elderly population is a continuing one. Congress attempted to address the elderly's prescription drug needs with the enactment of PL 100–360, the Medicare Catastrophic Act of 1988 (Department of Health and Human Services 1989). The act included coverage for outpatient prescription drugs for the highest 16.8 percent of users after a $540 deductible. The act was repealed, however, before implementation.

For future efforts designed to provide prescription drug coverage for the elderly, a major policy question asks to define the kind and level of prescription drug benefit that will provide the drug treatments necessary to maintain the health and functioning of the elderly and, at the same time, contain prescription drug costs. One technique increasingly employed by third-party payors to contain medical care costs and prescription drug costs is patient cost sharing. This approach shifts a share of the cost of the service to the patient. Mechanisms for patient cost sharing include deductibles, coinsurance, and copayments. Underlying the use of cost-sharing techniques is the premise that when a service is free or costs very little, patients may use it beyond what is necessary to realize the benefits from the service. In other words, the cost of the utilization can exceed the benefits from that utilization. Cost sharing, where some of the cost of the service is shifted to the user, can be an attempt to ensure cost-conscious consumption appropriate to a user's actual needs.

The application of this idea to the use of prescription drugs means that inefficient use of prescription drugs is likely among persons with no or little out-of-pocket drug costs, and the introduction of patient cost sharing will reduce or eliminate unnecessary prescription drug use. No adverse health consequences should occur given the assumptions that we have an informed consumer and that the use of the drug is not necessary to maintain health. If this can be shown to be the case, then patient cost sharing of prescription drug use can be an effective way to ensure appropriate use of prescription drugs and to help contain drug costs.

However, patient cost sharing may not affect everyone equally. Those with small, fixed incomes, such as the elderly, may be more likely to reduce drug consumption than those with higher incomes. Stuart and Grana (1993)

found the probability that the elderly would medicate a health problem to increase 2 to 3 percent per additional $3,000 of income up to an annual income of $18,000, after which the effect diminished. Consequently, cost sharing may increase the risk that some *necessary* utilization could be reduced, which, in turn, could increase the risk of adverse health consequences.

Several studies have attempted to show the impact of increased prescription drug cost sharing on the use of various therapeutic classes of drugs, from those that are chronic disease–specific (e.g., antihypertensives, antidiabetics, anti-Parkinsons) to those less disease-specific (e.g., analgesics, sedatives, cough preparations) (Foxman, Valdez, Lohr, et al. [1987]; Greenlick and Darsky [1968]; Harris, Stergachis, and Ried [1990]; Lohr, Brook, Kamberg, et al. [1986]; Nelson, Reeder, and Dickson [1984]). The findings were mixed regarding whether the utilization of more essential types of medications or less essential types of medications or all classes of medications were more likely to be reduced. Ryan and Birch (1991) concluded, upon examining increases in patient prescription drug cost sharing in the British National Health Service over time, that it should not be assumed that unwarranted and frivolous utilization had been reduced given the patients' lack of information on the effectiveness and efficiency of prescribed drugs.

Regarding the potential adverse effects on health of reducing drug utilization, Smith and Kirking (1992) concluded, after reviewing the limited literature on the impact of consumer fees on drug utilization, that health status does not appear to be meaningfully affected by increasing consumer drug cost sharing. On the other hand, a report by Soumerai, Ross-Degnan, Avorn, et al. (1991) concluded that limiting insurance reimbursement for prescription drugs places low-income elderly patients at increased risk of institutionalization. This conclusion, however, was challenged as, at best, tentative (Schultz and Lewis 1992).

In summary, the data addressing this important question–whether or not prescription drug cost sharing results in the more efficient and effective use of medications–are mixed and have not focused on the elderly. The mixed findings are the result of different research designs and populations studied, different levels of cost sharing examined, and different definitions used in referring to appropriate and inappropriate, or necessary and unnecessary, medications. More rigorous examinations are needed into the effects of prescription drug cost sharing on the use of different therapeutic classes of drugs, particularly as such cost sharing may affect the use of prescription drugs and, ultimately, the health status of older Americans.

OBJECTIVES

The objectives of this study were to investigate the effect of increases in prescription drug cost sharing on two patient outcomes: therapeutic classes of medications received and health status. This was accomplished using a pretest-posttest control group design (Campbell and Stanley 1963).

Based on our prior findings–that increasing the copayment per dispensing resulted in significantly smaller increases in the number of annual dispensings and per capita prescription costs (Johnson et al. 1997)–and our assumption that we were dealing with informed consumers in this setting, our hypotheses were (1) that increasing the amount of patient prescription drug copayment will reduce the relative exposure, annual days of use, and prescription drug costs for medications used for self-limiting conditions (discretionary drug use) and will not reduce the relative extent of exposure, annual days of use, and prescription drug costs, for medications used for progressive and life-threatening chronic conditions (essential drug use); and (2) that increasing the amount of patient prescription drug copayment will not reduce the relative health status of the elderly.

METHODS

STUDY POPULATIONS

The study used two well-insured Medicare risk-based programs in a large HMO: the Social HMO (S/HMO) and the basic TEFRA risk (Medicare Plus I) programs in Kaiser Permanente Northwest (KPNW). These two populations included approximately 83 percent of the KPNW membership 65 years of age and older.

On January 1, 1987, there were 4,220 Social HMO enrollees; their mean age was 76, and 62.8 percent were female. On January 1, 1987, the Medicare Plus enrollees numbered 16,960; their mean age was 74, and 57.2 percent were female.

Enrollees in each program had different prescription drug benefits, and their share of prescription drug expenses increased over time. Table 1 shows the changes that occurred in the prescription drug benefit of the two populations over time. Among the Social HMO enrollees, copayment per prescription rose from $1 to $3 to $5 per dispensing. Medicare Plus I enrollees' copay per dispensing rose from 50 to 70 percent, and the maximum payment per dispensing rose from $25 to $30. This resulted in an increase of about $3.50 in average copayment per dispense.

Four two-year analysis periods were defined (Table 1). In each analysis period sampled members had to have 24 months of continuous KPNW eligibility in the same Medicare risk program, either the S/HMO or Medicare Plus. In the first two analysis periods, when the S/HMO drug benefit was changed, age-matched and gender-matched samples of continuously eligible Medicare Plus members were drawn for all continuously eligible Social HMO members. Age-matched and gender-matched samples were possible because the case population (Social HMO), was significantly smaller than the control population (Medicare Plus).

In the last two analysis periods, which included the change in the Medicare Plus drug benefit and the period when neither group had a change, random samples of continuously eligible Medicare Plus members were drawn so that any changes in utilization among Medicare Plus enrollees from changes in the drug benefit would be representative of the whole Medicare Plus population. However, since the numbers of Social HMO enrollees were not sufficient to match the Medicare Plus sample by exact gender and age, an equal number of Social HMO enrollees were randomly drawn as the S/HMO sample. This sampling strategy required us to statistically control for an age and gender effect by including them as covariates in the last two analysis periods.

Table 2 shows the mean ages and the percent female for each study population. The study populations were representative of all Social HMO members in terms of age and sex distributions. The sample Medicare Plus

Table 1: Comparison of Prescription Drug Benefits

	Year				
	1987	*1988*	*1989*	*1990*	*1991*
Social HMO	$1 Copayment	$3 Copayment	$5 Copayment	$5 Copayment	$5 Copayment
Medicare Plus	50% Coinsurance $25 Maximum	50% Coinsurance $25 Maximum	50% Coinsurance $25 Maximum	70% Coinsurance $30 Maximum	70% Coinsurance $30 Maximum
	Analysis Period 1				
		Analysis Period 2			
			Analysis Period 3		
				Analysis Period 4	

study populations were slightly older and had a higher percentage of females than the general Medicare Plus population, which had a mean age of 73 and was 57 percent female in all four baseline years. The decline in the percentage of women in the Medicare Plus population in the last two study periods reflects the sample selection methods in those years, not a shift in the population.

The S/HMO benefit package, which covers expanded home care services, may have attracted a frailer population. In addition, the HMO's membership survey indicated that the Social HMO population had lower family income, but smaller family sizes and a higher probability of being widowed. Of the Social HMO populations, approximately 32 percent reported family incomes of less than $10,000, and 64 percent had family incomes of less than $20,000. Among the Medicare Plus members, 21 percent reported family incomes under $10,000, and 58 percent had family incomes under $20,000. This difference could have been due to family size differences in the two elderly groups. Thirty-six percent of Social HMO enrollees reported a family size of one compared with 26 percent of the Medicare Plus members, and 33 percent of the Social HMO enrollees reported that they were widowed compared with 22 percent of the Medicare Plus members. The two elderly populations reported being of similar socioeconomic groups.

SOURCES OF DATA

All data were gathered from KPNW administrative data systems. Information about eligibility, benefit, age, and gender is contained in the Membership Information Processing System (MIPS). Sources of use and cost data for the study populations were the automated outpatient prescriptions system (TOPS), and outside claims and referrals (OSCAR) for dispensings from other than KPNW pharmacies.

Table 2: Description Data on Study Samples

	Analysis Period			
	1987–1988	*1988–1989*	*1989–1990*	*1990–1991*
Social HMO				
Sample size	3352	3736	3981	3823
Mean age	75	76	77	77
Percent female	65%	65%	66%	66%
Medicare Plus				
Sample size	3352	3736	3981	3823
Mean age	75	76	75	75
Percent female	65%	65%	62%	63%

ANALYSIS DESIGN

We used a pretest-posttest control group design for this study (Campbell and Stanley 1963). This design measures the change in the dependent variable (posttest-pretest) in an experimental group that has experienced an intervention and a control group in which the intervention did not take place. The intervention in our study was an increase in outpatient prescription drug costs. This design controls for events, such as epidemics or weather, that might influence drug use in the study population. For continuous variables the appropriate statistical test of the difference is an Analysis of Covariance (ANCOVA), which is analogous to either a *t*-test or analysis of variance with different control variable assumptions. In this study, we tested for the effect on four dependent variables: days of medication received, HMO prescription drug costs, exposure to a therapeutic class, and overall health status.

In each case, we were interested in assessing whether or not the effect of the intervention was significant on the change in the dependent variable. This was done, in the case of continuous variables, using the regression coefficient. Exposure, which is dichotomous, was measured using an odds ratio calculated in a logistic regression. Significance was measured, therefore, by whether the likelihood of exposure, given exposure in the baseline year, differed between the two populations. The health status analysis used the significance of the *F*-test for the group (e.g., S/HMO or Medicare Plus) variable using the Type III sum of squares in the ANCOVA.

DEPENDENT VARIABLES

At the therapeutic class level, the dependent variable was defined users of the specified therapeutic class in the baseline year. We tested three attributes of drug utilization within each therapeutic class: exposure, days' supply of medication, and KPNW expense for that class of drug. We assumed that a price increase would influence drug utilization only for those individuals receiving a drug in the baseline year; those not receiving a drug within that therapeutic class would not recognize the increased copayment or coinsurance for a specific product as a price increase.

CHANGES IN PRESCRIPTION DRUG UTILIZATION PER THERAPEUTIC CLASS

Exposure was the dichotomous receipt (yes, no) of one or more dispensings for different therapeutic classes in a year. The number of days of drug treatment was the sum of the days' supply for all dispensings received for a therapeutic

class of drug in a year. Drug costs were defined as the sum of the HMO's expense for that therapeutic drug class. Days' supplied were not available for 1987, so a comparison was not calculated for the first time period. Within each therapeutic class, we restricted measurement to those persons using the product in the baseline year (users), because a new user would not face a price increase for that product.

Therapeutic classes of drugs were characterized by whether the drugs in the class were either essential or discretionary to maintaining health. We used the system developed by Harris, Stergachis, and Ried (1990) so that our findings could be compared with theirs. Essential therapeutic classes of drugs were antihypertensives, cardiac agents, antidiabetics, and thyroid preparations. Therapeutic classes defined as discretionary were cough and cold preparations, skeletal muscle relaxants, and non-narcotic analgesics. For additional analyses, we added anti-Parkinson drugs, antiasthmatics, diuretics, immunosuppressives, and antineoplastics to the essential group and topical anti-inflammatories to the discretionary group. The remaining classes of drugs we judged could be classified as either type, depending on the condition being treated.

CHANGES IN HEALTH STATUS

The change in health status was measured on a per capita basis and defined as the mean change in health status per capita between analysis periods for each population.

For this study, we created a health status measure specific to an elderly population's prescription drug use that combined two published health status instruments, the Chronic Disease Score (CDS) and Diagnostic Cost Groups (DCG). In an elderly population, the two measures capture different components of risk. The DCGs, which are based on acute inpatient hospitalizations, capture a small but very sick portion of the population. The CDS, which uses dispensed prescription drugs to identify and weight diseases, is a more general measure identifying individuals treated only in ambulatory settings and those on maintenance medications who may receive no other services in the baseline year but have a higher probability of expense in the following year. The CDS measures an individual's chronic disease status as an indicator of health status. The CDS model was developed by VonKorff, Wagner, and Saunders (1992), and was tested among Group Health Cooperative (GHC) of Puget Sound members as a readily obtainable and low-cost indicator of health status. The model was validated at KPNW (Kaiser Permanente

Northwest) and was found to produce similar results (Johnson, Hornbrook, and Nichols 1994).

DCGs were developed to improve the accuracy of the adjusted average per capita cost (AAPCC). The DCG approach incorporates diagnostic information from nondiscretionary hospitalizations to determine risk classes for the next 12 months. The DCG is a measure of the resource intensity of expected hospital use. The underlying assumption is that the greater the amount of resources consumed, the more morbid the condition (Ash, Porell, Gruenberg, et al. 1989). DCGs were computed for the study populations for each year from 1987 through 1990.

The scores were combined based on our belief that the CDS alone did not sufficiently differentiate among the sickest members of the population. Several models were fit to determine the relative weights to be used in combining the scales. For each year, a regression model was fit using the DCGs and CDS as continuous independent variables to predict prescription drug expense in the following year. An initial model showed that, ignoring the intercept, the coefficient for the CDS was almost exactly three times the coefficient for the DCG (47.8 versus 16.1 = 2.97). This suggested that if the scores were combined, the following formula would be appropriate:

$$(CDS \div 3) + DCG = New\ Score$$

The utility of the new score was evaluated visually by plotting the mean values of prescription drug use for each score level. Although we recognize that year-specific empirical weights would have been slightly more accurate in an individual year, holding the relativity constant allows us to compare our results more accurately across the four analysis periods. We found that the measure had a high correlation with drug expense and total medical care expense in the next year. A full description of our approach is available from the authors.

RESULTS

CHANGES IN THE LIKELIHOOD OF EXPOSURE TO DIFFERENT THERAPEUTIC CLASSES OF DRUGS

Table 3 shows that changing the copayment per dispensing from 1987–1988 through 1989–1990 had no consistent effect across analysis periods on differences in the likelihood of being exposed to most therapeutic classes of drugs, regardless of whether the drugs were classified as essential or discretionary.

Table 3: Likelihood (Odds Ratios) of Change in Exposure to Therapeutic Drug Classes

	Likelihood of Exposure (Odds Ratio)*			
	1987–1988	*1988–1989*	*1989–1990*	*1990–1991*
Essential				
Antiasthmatics	n.s.†	n.s.	0.60	0.43
Antidiabetics	n.s.	n.s.	n.s.	n.s.
Antihypertensives	n.s.	n.s.	n.s.	n.s.
Anti-Parkinson's agents	n.s.	n.s.	n.s.	n.s.
Cardiac agents	n.s.	n.s.	n.s.	n.s.
Diuretics	n.s.	n.s.	0.78	n.s.
Thyroid hormones	n.s.	n.s.	0.39	n.s.
Discretionary				
Cough and cold preps	n.s.	n.s.	n.s.	n.s.
Non-opiate analgesics	n.s.	n.s.	0.60	n.s.
Skeletal muscle relaxants	n.s.	n.s.	n.s.	n.s.
Topical anti-inflammatories	n.s.	n.s.	0.78	n.s.
Other Classes				
Antianxiety agents	1.35	n.s.	n.s.	n.s.
Antidepressants	1.65	1.71	0.32	n.s.
Antiulcer agents	n.s.	n.s.	0.64	n.s.
Cholesterol lowering agents	n.s.	n.s.	n.s.	n.s.
NSAIDs	n.s.	n.s.	0.72	0.77
Opiate analgesics	n.s.	n.s.	0.59	0.67
Systemic antibiotics	n.s.	n.s.	n.s.	n.s.
Systemic corticosteroids	n.s.	n.s.	n.s.	n.s.
Estrogenic agents	n.s.	n.s.	n.s.	n.s.
Laxatives	n.s.	n.s.	n.s.	n.s.
Potassium replacement	n.s.	n.s.	n.s.	n.s.

*Odds ratios calculated by exponentiating logistic regression maximum likelihood parameter estimates.

†n.s. = coefficient not significant, $p < .05$.

From 1987–1988 through 1989–1990, the only consistent finding across years was that an increased copayment per dispensing increased the likelihood of exposure to antidepressants, a drug class whose use we judged could be either essential or discretionary.

During 1989–1990, however, the largest mean change ($ increase) in copayment per dispensing and the largest mean change ($ increase) in total copayment per capita occurred in the Medicare Plus group. Upon comparing the Medicare Plus and Social HMO group, we found the likelihood of change in exposure to be significant for three essential classes (antiasthmatics,

diuretics, and thyroid agents) and two discretionary classes (non-narcotic analgesics and topical anti-inflammatories). The likelihood of the Medicare Plus group being exposed to these drug classes was lower with the increase in copayment.

During 1990–1991, when neither group had a change in their copayment, the likelihood of significant difference in exposure among the Medicare Plus population continued for antiasthmatics. The decreased proportions exposed also continued for two other drug classes, NSAIDs and opiate analgesics, both used primarily for the relief of pain. These latter changes in exposure could have been the continuing effect of the increase in the copayment as well as the increase in prescription drug prices that the Medicare Plus group was subjected to but the Social HMO group was not.

Table 4: Regression Coefficients for Change in Per User Number of Days Dispensed, by Therapeutic Class

	Days Dispensed (Regression Coefficient)		
	1988–1989	*1989–1990*	*1990–1991*
Essential			
Antiasthmatics	−34	n.s.	n.s.
Antidiabetics	n.s.*	51	n.s.
Antihypertensives	n.s.	31	n.s.
Anti-Parkinson's agents	n.s.	n.s.	n.s.
Cardiac agents	−22	31	n.s.
Diuretics	−13	25	n.s.
Thyroid hormones	n.s.	33	n.s.
Discretionary			
Cough and cold preps	−6	n.s.	n.s.
Non-opiate analgesics	n.s.	n.s.	−15
Skeletal muscle relaxants	n.s.	n.s.	n.s.
Topical anti-inflammatories	n.s.	7	n.s.
Other Classes			
Antianxiety agents	n.s.	14	n.s.
Antidepressants	−29	n.s.	n.s.
Antiulcer agents	n.s.	30	23
Cholesterol lowering agents	n.s.	n.s.	n.s.
NSAIDs	−8	13	n.s.
Opiate analgesics	n.s.	11	n.s.
Systemic antibiotics	n.s.	n.s.	n.s.
Systemic corticosteroids	n.s.	n.s.	n.s.
Estrogenic agents	−25	n.s.	n.s.
Laxatives	n.s.	n.s.	n.s.
Potassium replacement	n.s.	22	n.s.

*n.s. = coefficient not significant, $p < .05$.

CHANGES IN THE NUMBER OF DAYS OF MEDICATION RECEIVED PER USER FOR DIFFERENT THERAPEUTIC CLASSES OF DRUGS

Table 4 shows the therapeutic classes with significant differences between users in the two groups in the mean changes in the total number of days of medication received. These data were available for three analysis periods.

During the two analysis periods with increases in copayments, the differences in mean changes in total days of use between groups were significant (fewer days of use) for two essential classes of drugs: cardiac agents and diuretics. Increased copayment resulted in fewer total days of exposure. During the 1989 through 1990 analysis period, where the largest increase in copayment per dispensing occurred, the differences in the mean change in total days of use was significant (fewer days of use) for Medicare Plus users in five of the seven essential classes, and in one discretionary class. The findings were similar for several of the other classes of drugs. With no change in copayments, differences in change in mean days of medication were significant in few therapeutic classes of drugs, none of which were essential drug classes.

CHANGES IN KPNW PRESCRIPTION DRUG COSTS PER USER PER THERAPEUTIC CLASS OF DRUG

Table 5 shows significant differences in the mean changes in prescription drug costs by therapeutic class among users in each analysis period. During 1987–1988 and 1988–1989, the only significant differences in mean change in prescription drug costs among users were observed in the use of diuretics, and that change was small. In 1989–1990, however, the Medicare Plus users had significant differences (decreases) in mean prescription drug costs per user in five of the essential classes of drugs and in four where the change was that they reduced total days of medication.

During 1990–1991, in the absence of any change in copayment, no differences were observed in mean changes in drug costs of users of almost all classes of drugs, including both the essential and the discretionary drug class. The one exception was antidiabetics, where Medicare Plus users had a significant difference change (increase).

CHANGES IN HEALTH STATUS

Figure 1 shows adjusted differences in the mean changes in the health status of the populations in each analysis period. The values reported are population marginal means, which adjust for the covariates and control variables (Searle,

Table 5: Regression Coefficients for Change in Per User, KPNW; Prescription Drug Costs by Therapeutic Class

	Program per User Rx Cost (Regression Coefficient)			
	1987–1988	*1988–1989*	*1989–1990*	*1990–1991*
Essential				
Antiasthmatics	n.s.*	n.s.	$0.78	n.s.
Antidiabetics	n.s.	n.s.	$0.39	n.s.
Antihypertensives	n.s.	n.s.	n.s.	n.s.
Anti-Parkinson's agents	n.s.	n.s.	n.s.	n.s.
Cardiac agents	n.s.	n.s.	$0.60	n.s.
Diuretics	n.s.	n.s.	n.s.	n.s.
Thyroid hormones	n.s.	n.s.	$0.78	n.s.
Discretionary				
Cough and cold preps	$1.35	n.s.	n.s.	n.s.
Non-opiate analgesics	$1.65	$1.71	$0.32	n.s.
Skeletal muscle relaxants	n.s.	n.s.	n.s.	n.s.
Topical anti-inflammatories	n.s.	n.s.	$0.64	n.s.
Other Classes				
Antianxiety agents	n.s.	n.s.	$0.72	$0.77
Antidepressants	n.s.	$1.71	$0.59	$0.67
Antiulcer agents	n.s.	n.s.	n.s.	n.s.
Cholesterol lowering agents	n.s.	$1.56	n.s.	n.s.
NSAIDs	n.s.	n.s.	n.s.	n.s.
Opiate analgesics	n.s.	n.s.	n.s.	n.s
Systemic antibiotics	n.s.	n.s.	n.s.	n.s.
Systemic corticosteroids	n.s.	$1.30	$0.78	$0.81
Estrogenic agents	n.s.	n.s.	n.s.	n.s.
Laxatives	n.s.	n.s.	n.s.	n.s.
Potassium replacement	n.s.	n.s.	n.s.	n.s.

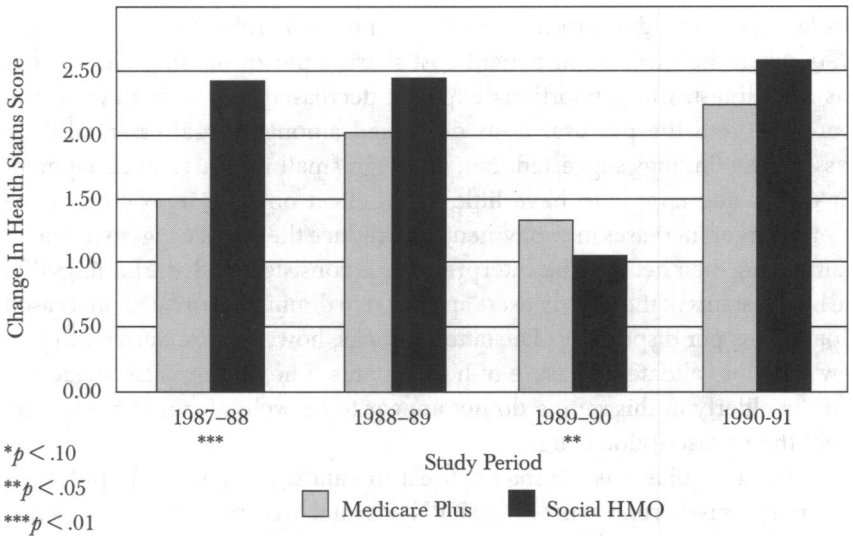
*Odds ratios calculated by exponentiating logistic regression maximum likelihood parameter estimates.

†n.s. = coefficient not significant, $p < .05$.

Speed, and Milliken 1980). The measure of health status was that developed from combining the scores from the CDS and DCGs, as previously described. The higher the value, the greater the decrease in health status.

During the 1987–1988 period, the difference in the mean change in health status was significant: the Social HMO group's per capita health appeared to decline more than the Medicare Plus group's. No significant difference in mean change in health status was observed in 1988–1989, although health status declined more in the Social HMO group, whose copayment per dispensing increased. In 1989–1990, the mean change in

Figure 1: Adjusted Change in Per Capita Health Status Measured by Combined Chronic Disease Score and Diagnostic Cost Groups



health status was significant; the Medicare Plus group's health status declined more than the Social HMO group's. In 1990–1991, in the absence of any changes in copayment, no difference was observed in mean change in health status between the groups.

DISCUSSION

This study examined the effect of increased copayments on the use and costs of various therapeutic classes of drugs and on the health status of two well-insured Medicare risk populations in the KPNW region. We found no consistent support across analysis periods for the hypotheses that exposure to, costs, and annual days of drug use for self-limiting conditions (discretionary drug use) would decrease, and that exposure to, costs, and annual days of drug use for progressive and life-threatening chronic conditions (essential drug use) would not decrease. We observed no consistent effect of increased copayment per dispensing on exposure to and costs of any therapeutic class of drug. In addition, while annual changes from increased copayment were either a reduction or no change in each of these measures, the significant changes

observed in any year were not consistent for either essential or discretionary drug classes, with two exceptions. It did appear that increased copayments reduced the total number of days of use of two essential classes of drugs: cardiac agents and diuretics in 1988–1989 and 1989–1990. Further, in 1989–1990, when the increase in patient cost sharing per dispensing and overall was the largest, the proportions exposed decreased, the total days of use decreased, and the per user costs decreased among several essential drug classes. The findings suggested that, although small increases in copayment per dispensing appear to have little or no effect on drug utilization of the elderly, larger increases in copayment may reduce the use of drugs essential to maintaining their health. This interpretation is consistent with the findings that the health status of the elderly users appeared to diminish more with increased copayments per dispensing. The latter findings, however, are derived from a new and not validated measure of health status. The findings also suggested that the elderly in this setting do not appear to be well-informed consumers about their prescription drugs.

Selection bias was the major threat to validity. The study populations were not precisely representative of KPNW's total Medicare population, since those selected during each study period had to have 24 months of continuous KPNW eligibility. This excluded those Social HMO enrollees who chose not to continue their HMO enrollment when the amount of copay was increased. However, since the percentage disenrolling each year was small, ranging from about 7 to 15 percent, and substantial proportions of those disenrollments were due to death and increases in premiums, the change in copayment was not a major influence on disenrolling from the HMO.

The exclusion of those who chose to disenroll had no direct effect on drug utilization and costs but does indicate a threshold of prescription drug benefit premium that some members are not willing to go beyond. Since the increase in copayment was only $2 per dispensing for the Social HMO populations, it was not likely that the threshold was exceeded for many enrollees. Not including those who died during the second 12-month period should not have influenced differences in the extent of change. This group could have had substantial prescription drug costs during their last year of life, so their exclusion could have had a conservative effect on utilization and cost estimates.

In addition, the special extended care benefit for Social HMO enrollees could have attracted elderly persons who were somewhat more frail than the Medicare Plus population. We attempted to deal with this possibility by using a multivariate analytic model to adjust findings for differences in

health status between Social HMO and Medicare Plus members. Since it was used on both populations, however, any potential shortcomings as a measure of health status would have been consistent between the populations and over time. Also, although the annual premium changed for the prepaid drug benefits over time, we submit that the total annual premium paid does not influence prescription drug use. Change in premium may influence whether one purchases the benefit, but not how one chooses to use the benefit.

The drug utilization examined was that of prescription drugs. Not included was over-the-counter (OTC) drug use and the potential of substituting OTC drugs for prescription drugs when patient cost sharing was increased. This could be an issue if the substitution were to lead to adverse health consequences (e.g., an ineffective substitute for an effective drug). While we do not know if this OTC substitution occurred, the adverse consequences, if they did occur, would have been noted as increased medical care utilization. No such increase was noted (Johnson et al. 1997). Further, medications received by injection from KPNW's nurse treatment rooms were not included as part of drug utilization. However, these represented only a small part of outpatient prescription drug use.

The health status measure was not a validated one, and it was not possible to interpret the clinical significance of differences observed. However, the measure did show the direction of change if not the magnitude of change in health status. In addition, since the CDS was derived solely from the drugs received, if altering copayment resulted in a person's not having a prescription dispensed (e.g., a cardiac agent), this would influence the CDS in a way to indicate that the patient had a better health status during the year than he or she actually had, thus making the extent of differences observed in change in health status a conservative estimate. However, a year is a long time for someone with a serious heart condition or any other serious chronic disease to go without any medication at all, and most of our findings tended to support this idea.

Our study design provided for a large number of comparisons that could have increased the probability of type 2 error, rejecting the hypothesis when it was true. However, having multiple study periods to observe the same phenomena basically avoided this type of error. The use of data from multiple periods allowed us to search for consistent patterns of significance. For example, while we observed a significant change in exposure to antiasthmatic medications among the Medicare Plus population in 1989–1990, consistent with our hypotheses, we observed no significant changes in the other analysis periods with changes in the copayment. This leads us to believe

that the significant result observed in 1989–1990 could have been spurious; as a result, our findings are robust and conservative.

The analysis design did not account for the inflation of prescription drug prices from 1987 through 1990, which increased the amount of copayment per dispensing for the Medicare Plus group even though the percentage of copayment did not change. The prescription drug index of the consumer price index went from 140.8 in 1987 to 181.7 in 1990. The inflation of prescription drug costs did not affect the amount of copayment of the Social HMO group since the amount per dispensing was fixed. The increase in prescription drug prices of about 8 percent from 1987 to 1988 and 9 percent from 1988 to 1989 could have influenced the drug utilization of the Medicare Plus group. The inability to account for this factor, however, could have affected our findings of differences in a conservative manner, and could have increased the difference in change between the groups in the third and fourth analysis periods, although very little difference in change was observed in the fourth analysis period.

CONCLUSIONS

When patient cost sharing per dispensing was increased by modest amounts in a well-insured elderly population over a three-year period, the changes in exposure, total days of use, and per user costs for most therapeutic classes of prescription drugs were not consistently lower than they would have been without an increase. With increases in the amount patients paid per dispensing, however, it did appear that health status may have been adversely affected.

More research is needed to assess the potential effects of shifting more drug costs to patients, particularly larger increases in copayment amounts. Up to now most copayments on dispensings have been modest, ranging from no copayment to $5. As prescription charges increase, however, higher copayments are becoming more common. The results of this study suggest possibly adverse consequences from shifting more prescription drug costs to the patient. But more rigorous indicators of health status are needed, as are research designs that can better assess the potential impact of these out-of-pocket increases on health and functioning. Research is needed to fully assess the effects on use, costs, and outcomes when copayments are large, particularly because such copayments can affect the elderly on fixed incomes.

REFERENCES

Ash, A., F. Porell, L. Gruenberg, E. Sawitz, and A. Beiser. 1989. "Adjusting Medicare Capitation Payments Using Prior Hospitalizations." *Health Care Financing Review* 10 (Summer): 17–29.

Campbell, D. T., and J. C. Stanley. 1963. *Experimental and Quasi-Experimental Designs for Research.* Chicago: Rand McNally College Publishing Company.

Department of Health and Human Services (DHHS). 1989. *Research Findings 3, Prescribed Medicines: A Summary of Use and Expenditures by Medicare Beneficiaries.* National Medical Expenditures Study, Publication No. (PHS)88–3348. Washington, DC: Government Printing Office.

Foxman, B., R. B. Valdez, K. N. Lohr, G. A. Goldberg, J. P. Newhouse, and R. H. Brook. 1987. "The Effect of Cost Sharing on the Use of Antibiotics in Ambulatory Care: Results from a Population-Based Randomized Controlled Trial." *Journal of Chronic Disease* 40 (5): 429–37.

Greenlick, M. R., and B. J. Darsky. 1968. "A Comparison of General Drug Utilization in a Metropolitan Community with Utilization under a Drug Prepayment Plan." *American Journal of Public Health* 58 (11): 2121–34.

Guralnik, J. M., M. Yanagishita, and E. L. Schneider. 1988. "Projecting the Older Population of the United States: Lessons from the Past and Prospects for the Future." *The Milbank Quarterly* 66 (2): 283–308.

Harris, B. L., A. Stergachis, and L. D. Ried. 1990. "The Effect of Drug Co-Payments on Utilization and Costs of Pharmaceuticals in a Health Maintenance Organization." *Medical Care* 28 (10): 907–17.

Johnson, R. E., M. J. Goodman, M. C. Hornbrook, and M. B. Eldredge. 1997. "The Effect of Increased Drug Cost-Sharing on Medical Care Utilization and Expenses of Elderly HMO Members." *Medical Care*: in press.

Johnson, R. E., M. C. Hornbrook, and G. A. Nichols. 1994. "Replicating the Chronic Disease Score (CDS) from Automated Pharmacy Data." *Journal of Clinical Epidemiology* 47 (10): 1191–99.

Lohr, K. N., R. H. Brook, C. J. Kamberg, G. A. Goldberg, A. Leibowitz, J. Keesey, D. Reboussin, and J. P. Newhouse. 1986. "Use of Selected Drugs and Procedures" (chapter 6). *Medical Care* 24 (9, Supplement): S39–50.

Long, S. H. 1994. "Prescription Drugs and the Elderly: Issues and Options." *Health Affairs* Spring (Part II): 158–74.

National Council on Patient Information and Education. 1988. *Priorities and Approaches for Improving Prescription Medicine Use by Older Americans.* Washington, DC.

Nelson, A. A., C. E. Reeder, and W. M. Dickson. 1984. "The Effect of Medicaid Drug Co-Payment Program on the Utilization and Cost of Prescription Services." *Medical Care* 22 (8): 724–36.

Ryan, M., and S. Birch. 1991. "Charging for Health Care: Evidence on the Utilization of NHS Prescribed Drugs." *Social Science and Medicine* 33 (6): 681–87.

Schultz, R. M., and N. J. W. Lewis. 1992. "Current Comment: Payment Restrictions for Prescription Drugs under Medicaid." *Pharmacoeconomics* 1 (3): 217–19.

Searle, S. R., F. M. Speed, and G. A. Milliken. 1980. "Population Marginal Means in the Linear Model: An Alternative to Least Squares Means." *The American Statistician* 34 (4): 216–21.

Smith, D. G., and D. M. Kirking. 1992. "Impact of Consumer Fees on Drug Utilization." *Pharmacoeconomics* 2 (4): 335–42.

Soumerai, S. B., D. Ross-Degnan, J. Avorn, T. J. McLaughlin, and I. Chodnovsky. 1991. "Effects of Medicaid Drug-Payment Limits on Admission to Hospitals and Nursing Homes." *The New England Journal of Medicine* 325 (15): 1072–77.

Stuart, B., F. Ahern, V. Rabatin, and A. Johnson. 1991. "Patterns of Outpatient Prescription Drug Use among Pennsylvania Elderly." *Health Care Financing Review* 12 (3): 61–72.

Stuart, B., and J. Grana. 1993. "Ability to Pay and the Decision to Medicate." Presented at a Poster Session at the 1993 Annual Meeting of the American Public Health Association, New York.

Sullivan, S. D. 1992. *The Demand for Prescription Drugs in Elderly Americans*. Ph.D. Diss., University of California, Berkeley.

VonKorff, M., E. H. Wagner, and K. Saunders. 1992. "A Chronic Disease Score from Automated Pharmacy Data." *Journal of Clinical Epidemiology* 45 (2): 197–203.

Weeks, H. A. 1973. "Changes in Prescription Drug Utilization after the Introduction of a Prepaid Drug Insurance Program." *Journal of the American Pharmaceutical Association* NS13 (4): 205–9.