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THE EFFECT OF DEMOGRAPHICS AND PLAN CHARACTERISTICS ON THE COST OF PHARMACEUTICALS IN A PRIVATE THIRD-PARTY PRESCRIPTION PROGRAM

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THE EFFECT OF DEMOGRAPHICS AND PLAN CHARACTERISTICS

ON THE COST OF PHARMACEUTICALS

IN A PRIVATE THIRD-PARTY PRESCRIPTION PROGRAM

BY

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ABSTRACT

Objective: Using prescription claims data, the objectives of this study were: (1) to compare the proportion of variation in cost of pharmaceuticals that could be explained by available demographic variables and plan characteristics within various therapeutic categories; (2) to examine the relationships among plan characteristics and cost of pharmaceuticals; and (3) to evaluate whether utilization differed among various demographic variables and plan characteristics after controlling for appropriate covariates.

Design: Retrospective, cross-sectional study.

Data Collection: Data for this study were obtained from 1996 prescription claims information for the commercial population administered by a Rhode Island-based pharmacy benefit management company. Six therapeutic categories with the highest expenditures were analyzed.

Methodology: Information on claims for six drug categories was extracted using database management software. Statistical analyses utilizing multiple regression and analysis of covariance were carried out.

Results: Plan characteristics out-performed demographic variables sixteen-fold for all drug categories combined in explaining variance in cost of pharmaceuticals among plan enrollees. Significant associations were found among plan characteristics and cost of pharmaceuticals. Utilization differed among various demographic variables and plan

characteristics after controlling for average wholesale price and days supply. Demographic variables included age, gender, place of employment and place of residence while plan characteristics included variables such as co-payment, mode of payment, formulary status and pharmacy type.

Conclusions: The results obtained in this study have practical significance in the determination of capitation rates when utilization history of prospective members is not available. In this situation pharmacy benefit managers may have to set capitation rates based solely on eligibility data. In addition to highlighting the importance of utilization history in setting capitation rates for new enrollees the study results have other ramifications. PBMs contract with commercial clients to provide pharmacy benefits to their employees irrespective of their occupation. Significant differences in utilization among the members based on place of employment suggest that benefit managers should consider differentiating capitation rates according to their clients' business. Finally, the data from this study indicated that commercial members residing in Tennessee had the lowest level of drug utilization among all states evaluated. The fact that one PBM manages over 80% of the TennCare prescription program along with a significant commercial client base suggests that a "spillover effect" may exist.

Results may be helpful in understanding some of the factors associated with cost of pharmaceuticals. For example, the inverse relationship of pharmaceutical cost with eligible days may be helpful in budgeting program costs while the non-significant association of pharmaceutical cost with number of members eligible suggests a lack of importance of group size in negotiating pharmacy benefit contracts.

Differences in utilization among various co-payment levels suggest the effectiveness of different co-payment levels in promoting use of generic products. Lower utilization found under capitation may be encouraging to those PBMs accepting a capitation method of reimbursement. Association of closed formularies with higher utilization indicates the importance of adjusting cost data for rebates before evaluating formulary strategies. Finally, differences in utilization between independent and chain pharmacies suggest the importance of careful provider contract negotiation.

ACKNOWLEDGEMENTS

PREFACE

This work has been prepared in accordance with the manuscript format option for thesis preparation, as outlined in section 11-3 of the Graduate Manual of the University of Rhode Island. Contained within is a body of work divided in two sections.

Included within section I are two manuscripts, containing the findings of the research which comprise this thesis. These manuscripts are presented in the format required by the journal to which they will, or have been, submitted.

Section II is comprised of an appendix containing a SAS program. This thesis closes with a complete listing of all references cited in this thesis, arranged in alphabetic order by the author's last name.

TABLE OF CONTENTS

LIST OF TABLES

MANUSCRIPT II

SECTION I

MANUSCRIPT I

The Effect of Demographics on the Cost of Pharmaceuticals in a Private Third-Party Prescription Program

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ABSTRACT:

Objective: The primary objective of this study was to compare variance in cost of pharmaceuticals explained by demographic variables with variance explained by plan characteristics within various therapeutic categories using prescription claims data. The secondary objective was to examine differences in utilization among demographic variables after controlling for covariates.

Design: Retrospective, cross-sectional study.

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Conclusions: The results obtained in this study have practical significance in the determination of capitation rates when utilization history of prospective members is not available. In this situation PBMs may have to set capitation rates based solely on eligibility data. In addition to highlighting the importance of utilization history in setting capitation rates for new enrollees the study results have other ramifications. PBMs contract with commercial clients to provide pharmacy benefits to their employees irrespective of their occupation. Significant differences in utilization among the members based on place of employment suggest that benefit managers should consider differentiating capitation rates according to their clients' business. Finally, the data from this study indicated that commercial members residing in Tennessee had the lowest level of drug utilization among all states evaluated. The fact that one PBM manages over 80% of the TennCare prescription program along with a significant commercial client base suggests that a "spillover effect" may exist.

Key Words:

Cost of pharmaceuticals, Demographics, Plan characteristics, Utilization, Confounding variables, Prescription claims data, Capitation rate, PBM, Pharmacy benefit, Multiple regression, Analysis of covariance, Place of employment

INTRODUCTION:

Managed care has become an ever-increasing force in the health care market. The most recent Foster Higgins survey of employer-sponsored health plans found that 85% of workers at firms with 10 or more employees are now enrolled in managed health plans, a significant increase from 1996 figures of 77%.[1] In 1996, 94 % of commercial/group members had a pharmacy benefit, a percentage that is expected to remain stable through 1999.[1] Over the last few decades, there has been a constant awareness of the rapid escalation in prescription drug costs. These increases can be explained in large part by therapeutic innovations, increased utilization related to demographics and increased coverage under drug benefit programs. Prescription drugs are an essential part of current medical treatment technology, which is why virtually all private insurance plans, managed care organizations and state Medicaid programs cover prescription drugs for their enrollees.

The emergence of pharmacy benefit management companies (PBMs) constitutes a major structural change that has occurred in the distribution of pharmaceuticals during the 1990s.[2] Because monitoring, managing, and implementing a pharmacy benefit requires a considerable commitment of time and resources, many health maintenance organizations (HMOs) and self-insured employers turn to PBMs for assistance in managing all or part of their pharmacy benefit programs. Almost 90% of the employers responding to a trends & forecasts survey reported that they take an active role in managing their pharmacy benefits. Of those, 70.6 % contracted directly with a PBM, 5.9% said their providers contracted with a PBM and 23.5 % reported that their health

plan provides pharmacy benefit without referring to a PBM.[1] Some analysts expect that PBMs will control nearly three-quarters of the U.S. pharmaceutical market within the next five years.[3]

Prescription drug benefits are one of the few areas in health care in which health plans have continued to maintain and manage financial risk rather than share it with providers. PBMs provide a variety of services designed to influence outpatient prescription drug utilization and costs. Employers and insurers contract with PBMs in an effort to provide accessible and cost-effective benefits to their members. PBMs are sometimes offered risk-based capitation payment programs as an alternative to fee-for-service (FFS) for a variety of population groups and benefit packages. Contracts based on capitation reimbursement limit the payers' financial risk by setting a fixed dollar amount per member per unit of time. The PBM must provide all the contracted services for the specified amount of money or suffer a financial loss.

With capitation payments linked to HMO premiums, and with HMO premiums dropping in response to market pressure from employers, PBMs are coming under increased financial pressure to reduce their costs. It is essential that the capitation rates accurately reflect actual drug utilization if the reimbursement is to be fair to both the provider and the payer. Previous research has found that factors affecting use of health services are not limited to the characteristics of the service but often extend to the characteristics of the user.[4] Those persons pricing, selling and administering prescription drug benefit programs should be aware of the effects of members' demographics on their prescription

benefit costs. Amendments to HMO laws in 1981 have allowed the adjustment of capitation rates for demographic variables of the subscribers.[5] There is a debate about whether the usual underwriting factors such as age, sex, occupation and residence are sufficient for establishing annual premiums.[6] A study examining demographic variables as predictors of annual outpatient expenditures concluded that demographic characteristics perform very poorly as underwriting factors.[7]

Still, the extent of drug use by patients of all ages is an important issue. Age-specific utilization rates have shown to be the most important determinant of overall expenditures on prescription drugs.[8] While the consequences of extensive drug therapy have attracted much attention, few definitive studies have been carried out to examine the number, types of drugs prescribed, and its association with cost within different age groups. Cross-sectional studies have consistently indicated that prescription drug use increases with age.[9] For example, one study assessing the relationship of demographics to prescription drug use among elderly Pennsylvanians who had enrolled in the Pharmaceutical Assistance Contract for the Elderly (PACE) program found that prescription utilization rises with age.[10] In another study, annual drug expenditures varied significantly by age and sex categories.[11] These qualitative differentials have been validated in national data [12], which show mean expenditures for women to be 54% above men, and children's expenditures only half that of males. Gender differentials in prescription drug use have been reported to persist even after controlling for disease severity, the nature of the medical problem (acute or chronic), age, and other factors considered to be medically relevant.[13] Specifically, both age and sex appear to be

strongly associated with antihypertensive, antidepressant and H2-antagonist drug use.[14,15,16]

Employment is associated with a lower incidence and prevalence of drug use for men but not for women.[17] While employment has a differential effect on men's and women's drug use, it does not affect the extent of prescription drug use.[17] As the risk factor levels for cardiovascular disorders, depression and ulcers differ among occupation groups, further research is needed to determine how people in diverse occupations differ in their prescription drug use.

In 1993, Smith found that the cost of pharmaceutical services was correlated with geographic region.[18] However, other studies have found little regional variation in drug use based on age-gender adjusted prescription costs.[19]

There is presently an increasing interest in the assessment of ambulatory health care databases. Much of this interest is centered around health-system administrators who wish to better understand their cost structures in an attempt to control costs and improve quality of care.[20] Also, research has shown that outpatient services are generally more predictable than inpatient services.[7]

PBMs have emerged as a key manager of information in today's world of health care. PBMs can link networks of pharmacies through tele-communication lines to a processor for the point-of-service (POS) evaluation of prescription claims. Information is

transmitted electronically to the pharmacy about member eligibility, benefit coverage and prescription pricing. The resulting central claims database becomes a rich source of information for both the PBM and the payer about cost, utilization and overall benefit management. Claims data have traditionally been used for accounting purposes. However, as the structure of PBMs has evolved, many have begun to build additional data repositories. This has allowed easy access and manipulation through the use of high level languages such as standard query language (SQL).

Claims data can provide accurate information on drugs dispensed. In addition, claims data is not subject to the recall problems that are found with self-reported data and can provide a more representative picture of drug utilization than provider-based studies.[21] Though these data sets are somewhat limited in that they often do not consistently identify the prescribing physician and do not have accurate diagnosis information, they do provide excellent population profiles of drug utilization. These profiles, once created, can be easily supplemented with additional information to improve their utility.

Using prescription claims data, the objectives of this study were: (1) to compare the proportion of variation in cost of pharmaceuticals that could be explained by available demographic variables and plan characteristics within various therapeutic categories; and (2) to evaluate whether utilization differed among various demographic variables after controlling for appropriate covariates.

METHODOLOGY:

Study Description:

Data for this study were obtained from prescription claims information compiled during 1996 for the commercial population administered by MIM Health Plans, Inc., a Rhode Island-based pharmacy benefit management company. These data were collected from pharmacies at the point of service during the routine filling of commercial members' prescriptions. Data elements conformed to National Council on Prescription Drug Processing (NCPDP) standards for pharmacy claims adjudication. Algorithms to assure data accuracy were applied at the point of service and retrospectively by the PBM. All data were blinded as to patient name assuring confidentiality of medical information. The study was approved by the University of Rhode Island Institutional Review Board on human subjects.

Measures:

Each record in a claims file represented a prescription dispensed to a member. The information in the record included: pharmacy identification (NABP) number, date of service, national drug code (NDC) for the medication, Generic Product Identifier (GPI), generic name, number of prescriptions, quantity dispensed, amount paid by the member (co-payment), amount reimbursed to the pharmacy provider, member identification number, gender, age, carrier name, account name, group name, and number of days supply.

NABP number was used to link claims files with pharmacy files to get information on the name of the pharmacy and the state in which it is located. The unique combination of carrier, account and group representing a particular plan was used to determine place of the members' employment. Based on the National Occupational Classification [22], members were assigned to one of the following employment categories: management, commerce, health, social sciences, lawyers & educators, art, sales & services, trade & transport, primary industries, manufacturing and contractors.

The database contained no information on the member's place of residence, race/ethnicity, educational level and income so measuring the effect of these demographic variables on the cost of pharmaceuticals was not possible. However, members are likely to present their prescriptions in the vicinity of their homes. Therefore, pharmacy location was used as a proxy variable for their residences.

In addition to demographic information, a file on member eligibility contained each member's enrollment history. Each member was identified by a member number and may be the original enrollee (subscriber) or a dependent . Questions on continuity of coverage can be answered from the information in this file, which maintains a temporal view of the member's activity within the system. Member identification number was utilized as a common field to link claims files with eligibility files to determine the members' eligibility.

Because claims data were never structured to answer specific questions of this study, algorithms were designed for extracting appropriate subsets of claims using database management software (Dbase 2.6). The Generic Product Identifier codes (Medispan, Inc.) were used to divide prescription drugs into major therapeutic categories. Using pre-collected data necessitated careful selection and examination of the data. Claims files were indexed with reversed claims, marked manually and deleted to ensure that the data for analysis did not include any denied or reversed claims. A claim reversal occurs when a pharmacist has to resubmit a claim due to entering the wrong information in the system such as a coding error or a claim with a missing drug identification code. The error is corrected by entering a claim identical to the first claim but with negative financial values. The third record reflects the correct information.

Six therapeutic categories with the highest expenditures during fiscal year 1996 were selected for the analysis. These included calcium channel blocking agents, angiotensin converting enzyme (ACE) inhibitors, lipotropics, antidepressants, histamine H2-blockers, and beta-adrenergic blocking agents.

Member-specific prescription data were extracted from the computerized records for the period of January 1 through December 31, 1996. All members who received at least one prescription for these therapeutic drug categories were included in the analysis. The total value of claims used in the analysis was $1.5 million with an average of $ 0.15 per member per eligible day.

Outline of Statistical Analysis:

The SAS program for windows (version 6.12) was used for all statistical analyses. Frequency analysis for categorical variables and univariate analysis for continuous variables was carried out. PROC UNIVARIATE and PROC PLOT were performed to assess the assumptions of normality, linearity and homoscedasticity.

Members differed in number of days eligible during fiscal year 1996. There were cases where the utilization data did not reflect a full year's experience. To adjust for this, the cost of prescription was divided by eligible days resulting in an estimate of the amount that members cost the plan per day. Therefore, the cost per member per eligible day was used as the dependent variable for statistical analyses. Frequency analysis revealed relatively few claims in states other than Tennessee. To avoid the problem of small numbers and unstable estimates, claims from states other than Tennessee were combined to form one category of "other states". Other states included: Rhode Island, Virginia, Georgia, New Jersey etc. Depending upon the drug category that was reviewed, the same strategy was followed for place of employment. For example, claims for members employed in management, commerce, social sciences, lawyers, education, art, primary industries and trade & transport businesses were combined to form one category of "other" and compared with those employed in manufacturing, contractors, health, and sales and services businesses for Ca-channel blockers.

Claims for Ca-channel blockers, lipotropics, ACE inhibitors and beta-blockers were combined and designated as claims for cardiovascular drugs. Claims for the remaining

two drug categories (antidepressants and histamine H2-blockers) were also combined. Finally claims for all six-drug categories were combined which resulted in nine sets of claims for analysis after considering each drug category individually.

Three sets of multiple regression analyses were carried out. The first set using PROC REG was performed to determine the proportion of variation in the cost of pharmaceuticals that could be explained by age, gender, location and place of employment for the six drug categories and their combinations. For these analyses, dummy variables were used for gender, location and place of employment.

The gender variable was dummy coded as male=1 and female=0. Location was dummy coded as Tennessee=1 and other states=0. Dummy coding for place of employment differed for some drug categories. For example four dummy variables were used (X1, X2, X3, X4) for place of employment in Ca-channel blockers; Manufacturing (X1=1, X2=0, X3=0, X4=0), Health (X1=0, X2=1, X3=0, X4=0), Sales & Services (X1=0, X2=0, X3=1, X4=0), Contractors (X1=0, X2=0, X3=0, X4=1), and Other (X1=0, X2=0, X3=0, X4=0). Interaction terms were added to determine whether the explained variance could be significantly improved by accounting for interaction effects between the independent variables. Variance inflation factor tests were used to determine if multicollinearity problems existed.

The second set of multiple regression analyses was carried out to examine the proportion of variation in the cost of pharmaceuticals that could be explained by plan characteristics.

The independent variables included in the analyses were number of days eligible, number of members eligible, average wholesale price, out-of-pocket expense, number of days supply and quantity dispensed. Variance inflation factor tests were used to determine if problems with multicollinearity existed.

The third set of multiple regression analyses was carried out to examine the proportion of variation in the cost of pharmaceuticals that could be explained by both demographic variables and plan characteristics.

In order to ensure a valid comparison, analyses of covariance (ANCOVA) were used to evaluate the differences in utilization among demographic variables using cost of pharmaceuticals per member per eligible day as the dependent variable. ANCOVA allowed us to hold factors that might influence the cost of pharmaceuticals constant and to observe the differences only due to patient demographics. The last two digits of the member identification number facilitated the separation of claims of subscriber (card holder) from their dependents. For testing our hypotheses regarding place of employment and cost of pharmaceuticals, only claims by subscribers were selected. Age was analyzed after being categorized into five groups; 1-5, 6-20, 21-40, 41-64, and >64 years old.

The control variables were member age, group size, average wholesale price and number of days supply. Changes in the average wholesale price (AWP) that manufacturers charge for each unit of their product is an indicator of price inflation while days supply reflects the quantity dispensed. In some cases we found significant interaction between variables

of interest (grouping variables) and the covariate indicating violation of the assumption of homogeneity of regression. Effect sizes of interactions between grouping variables and the covariate were calculated. To understand the relative differences between groups, we also computed least square adjusted means which held the covariates constant. A value of $p <= 0.05$ was chosen as the a priori level of significance.

RESULTS:

Sample Description:

Table 1 provides information about the characteristics of enrollees. There were 29,211 subscribers (card holders) representing 64,815 enrollees eligible during fiscal year 1996. 33,131 prescription records for six drug categories were evaluated. The mean age of enrollees was 31.5 years. Females comprised 52.8 % of the eligible population and males comprised 47.2 %. Subscribers were mainly employed in health (39.8%), sales and services (17.7%) and manufacturing (10.3%).

Results of Multiple Regression Models:

Table 2 summarizes results of the multiple regression using cost per member per eligible day as a dependent variable and age, gender, location and place of employment as independent variables. The regression models were significant at the 0.001 level of significance for all drug categories and their combinations. The explained variance in the cost of pharmaceuticals by therapeutic category ranged from 1.6% to 13.7 %. This variance was lowest for antidepressants and highest for H2-blockers. Interactions among independent variables were added in the models to improve the explained variance. For

example, interactions among gender, location, and place of employment were included in the model. Addition of interaction terms did not significantly improve the explained variance with the exception of all drug categories combined. Explained variance for all drug categories combined in presence of the interaction terms was 9.6% in comparison to 3.9% without the addition of interaction terms. The improvement in explained variance was associated with multicollinearity problems as indicated by variance inflation factors and high standard errors of beta coefficients. Keeping the problems of multicollinearity in mind, regression analyses were carried out excluding interaction terms. For the purpose of this study, cost of pharmaceuticals was defined as the dollar expenditure per member per eligible day for prescription drugs.

Age was positively associated with the cost of pharmaceuticals for all drug categories except for beta-blockers and antidepressants. Males were positively associated with the cost of pharmaceuticals for Ca-channel blockers and beta-blockers and negatively associated with lipotropics and antidepressants. This relationship was not significant for ACE inhibitors and H2-blockers. Residence in the state of Tennessee, which comprised the majority of our population, was negatively associated with cost of pharmaceuticals for all drug categories.

Cost of pharmaceuticals was positively associated with manufacturing employees versus employees of other businesses for Ca-channel blockers, lipotropics and H2-blockers. It was negatively associated for antidepressants. The relationship was not significant for ACE inhibitors and beta-blockers. Cost of pharmaceuticals was negatively associated

with members employed in the health professions for Ca-channel blockers, ACE inhibitors and beta-blockers. The relationship was insignificant for lipotropics, H2-blockers and antidepressants.

Cost of pharmaceuticals was negatively associated with sales and services employees for all drug categories except for the H2-blockers, where the relationship was nonsignificant. Cost of pharmaceuticals was positively associated with contracting and commerce employees for Ca-channel blockers and antidepressants respectively. Cost of pharmaceuticals was positively associated with management employees for ACE inhibitors and H2- blockers.

Table 4 provides the results of multiple regressions using cost per member per eligible day as a dependent variable and plan characteristics as independent variables for six drug categories and their combinations. Regression models were significant at the 0.001 level of significance. Explained variance ranged between 34 % to 87 %. Explained variance was lowest for beta-blockers and highest for antidepressants. Small variance inflation factors indicated absence of multicollinearity. (table 5)

Table 6 and table 7 summarizes results of multiple regressions using both demographic variables and plan characteristics for six drug categories and their combinations. Explained variance did not significantly vary from using plan characteristics alone as independent variables.

Results of Analyses of Covariance:

For the purpose of this study, utilization was defined as the <u>average</u> dollar expenditure per member per eligible day for prescription drugs. Average wholesale price and days supply were selected as covariates because controlling for age and number of members eligible did not significantly improve the model fit (R^2). In some cases, interactions between average wholesale price and grouping variables as well as days supply and grouping variables were significant. Effect sizes of these interactions were calculated. Values of these effect sizes, which approached zero, allowed the use of average wholesale price and days supply as covariates without violating the assumptions of ANCOVA.(table 14, 15) Least square means (LSMEANS) adjusted for average wholesale price and days supply were examined.

There were significant differences in utilization among members in various age groups. Members in the 65 and older age group were the highest utilizers of all drug categories except for beta-blockers and antidepressants. (table 9)

There were significant differences in utilization between males and females. Males were higher utilizers of all drug categories except for lipotropics and antidepressants. For these two categories, females showed significantly higher utilization. (table 10)

There were significant differences in utilization among members residing in Tennessee and those residing in other states. Considering all of the states together with the exception

of Tennessee, residents of Tennessee were the lowest utilizers for all drug categories. (table 11)

Table 12 presents the results of analyses of covariance using cost per member per eligible day as a dependent variable and place of employment as an independent variable for six drug categories and their combinations.

There were significant differences in utilization among members employed in different occupations. For the six drug categories combined, members employed in contracting were the highest utilizers and members employed in health care were the lowest utilizers. Members employed in art, trade & transport, primary industries and social sciences were the highest utilizers of cardiovascular drugs while those employed in health care were the lowest utilizers. Combining H2-blockers and antidepressants together, members employed in art, trade & transport, primary industries and social sciences were the highest utilizers while those employed in commerce were the lowest utilizers.

Two-way analyses of covariance were conducted using cost per member per eligible day as a dependent variable with place of employment and gender as the independent variables. For the six drug categories combined, males employed in contracting were the highest utilizers and females employed in health care were the lowest utilizers. Looking at cardiovascular drugs as a combined category, females employed in art, trade & transport, primary industries and social sciences were the highest utilizers and males employed in health care were the lowest. Combining antidepressants and H2-blockers,

males employed in health care were the highest utilizers while males employed in manufacturing were the lowest. (table 13)

DISCUSSION:

Several limitations should be considered before discussing the results of this study. The major limitation relates to the comprehensiveness of the data. The database includes only drug products covered by the drug benefit plans. Thus, non-prescription drugs, drug samples and non-formulary drugs (when paid for with cash by members) are typically not included. In addition, if a prescription drug is less expensive than the member's copayment, the member may pay cash and a claim may not be recorded. Underreporting occurs with most third-party prescription databases [23] and may be a limitation in this study. Lastly, prescriptions filled from "out-of-network" pharmacies were not captured. The study may also be limited in terms of generalizability. It is possible that the general population behaves differently from the study population. Therefore, careful consideration should be used before extrapolating these findings beyond the study population. Although our data are cross-sectional and do not allow causal inferences, there are several possible explanations for the findings of the study.

One of the objectives of the study was to examine the proportion of variation in cost of pharmaceuticals that could be explained by demographic variables. In effect, we wanted to evaluate whether demographic variables could be used to determine capitation rates for new enrollees. Place of employment was selected as one of the independent variables in the regression models. Pharmacy benefit managers provide prescription drug benefits to

employees of commercial clients irrespective of members' occupation. As a result, place of employment becomes a more relevant variable to evaluate than occupation.

In spite of the large sample size (N=33,131), available demographic variables only explained 3.9 % of variance in cost of pharmaceuticals for all drug categories combined. A study that used multiple regression analysis to determine the proportion of variance in aggregated clinic, referral and hospital costs found that 20 % of variation in cost could be explained by sex and coverage type of the enrollees.[5] The lowest explained variance among all therapeutic categories was for antidepressants (1.6%). This may be explained in part by the availability of relatively new products, increased public awareness, acceptance of depression as a disease, physician education programs and mass media attention.[24]

Our study demonstrated that plan characteristics accounted for most of the variance unexplained by demographic variables. These plan characteristics were comprised of number of days eligible, number of members eligible, average wholesale price of drugs dispensed, out-of-pocket expense, number of days supply and quantity dispensed. When taking only plan characteristics into account, the explained variance for antidepressants increased to 87%. These results strongly indicate that data on service use and cost experience of individuals to be covered by a risk-based capitation payment program are much better predictors of costs of pharmaceuticals than simple demographics. Wouters in 1991 found that prior-year outpatient drug expenditures were the strongest predictors of

future annual outpatient drug expenditures and thus, should be considered as important information to include in determination of capitation rates.[7]

Effect of Member Demographics on Costs of Pharmaceuticals:

Age:

Members over the age of 65 were the highest utilizers of all drug categories except for beta-blockers and antidepressants. This is consistent with previous studies that show prescription drug use generally increases with age.[25,26] A study assessing the importance of demographics in the selection of antihypertensives concluded that Ca-channel blockers were more effective in patients over 60 years of age.[27] Nichol et al. in their study of factors associated with antihypertensive prescribing found that elderly patients (>65 years) were 78 % more likely and patients between the ages of 40 and 65 years were nearly 50 % more likely to receive an antihypertensive than those younger than 40 years.[28]

Younger members were associated with high utilization of antidepressants and beta-blockers. This was somewhat surprising, as increasing age has been reported to be associated with a higher rate of depressive symptoms.[29] The results for beta-blockers may be explained in part by results of previous studies that show beta-blockers to be more effective in younger patients than elderly patients.[30]

Gender:

Males were higher utilizers than females for all drug categories except for lipotropics and antidepressants. The results contradict the findings of a study that show females use more types of medications and use them to a greater extent than males do.[31]

The utilization of H2-blockers is consistent with results of a study examining the prescribing of antacids and ulcer-healing drugs in primary care in the north of England. This study found that prescribing rates of H2-blockers were higher in males than in females. The disparity between the genders was attributable to males being prescribed H2-blockers for the treatment of ulcers.[16]

Higher utilization of beta-blockers may be explained by results of previous studies. Fewer data are available, but beta-blockers have shown to be less effective in females than males.[27] Akoki et al. found that beta-blockers were one of the few drug categories which were clearly prescribed more often for males.[32]

Many studies have shown that females were more likely than males to receive prescriptions for antidepressants.[33,34,35] Rosholm et al., in their study of outpatient utilization of antidepressants using a prescription database, found that women constituted a disproportionately large percentage of antidepressants users.[36] High utilization of lipotropics among females was not found in the literature and, therefore, needs further research.

Location:

Of all the states evaluated, members residing in Tennessee were the lowest utilizers of pharmaceuticals in all six therapeutic categories. These results may be explained by location characteristics. Tennessee is well known for TennCare, the health care system reform plan implemented in Tennessee on January 1, 1994. The program was developed with the dual objectives of controlling rapidly rising costs of the state's Medicaid program and extending health insurance coverage to Tennesseans who did not have access to employer-sponsored or other government-sponsored health insurance.[37] More than a quarter of the total population of Tennessee is currently enrolled in TennCare and the program has been successful in controlling costs in the Medicaid program. The state claims that in the first 18 months, TennCare saved an estimated $1.6 billion in state and federal funds based on the expected growth rate in conventional Medicaid expenditures. [37] MIM Health Plans, Inc. (TennCare's primary PBM) provides prescription benefit services for about 80 percent of Tennessee's Medicaid prescriptions. MIM Health Plans's strong presence in the TennCare Program along with the provision of pharmacy benefits for commercial clients in Tennessee may be related to what known as "spillover effect". The spillover concept arises from the application of the transfer of learning theory to health care providers. That is, spillover occurs when a health care provider's behavior transfers from one segment of patient population to another. Techniques utilized to control utilization in the TennCare program include a highly managed formulary, extensive prior authorization and medical necessity protocols and dispensing limitations. These efforts have substantially altered provider prescribing patterns for TennCare enrollees. The prescribing habits of physicians that affect the TennCare population may

be transferred to the Tennessee commercial population. Cost consciousness of pharmacy providers in Tennessee and the staff at the PBM towards TennCare might have resulted in changes in their professional behavior. These changes might have benefited the commercial population administered by the PBM in Tennessee.

The transfer of learning from Medicaid to non-Medicaid sector has already been shown in the Iowa Capitation Study. The results demonstrated "spill over" of generic substitution habits from Medicaid to non-Medicaid prescriptions. The study concluded that non-Medicaid patients benefited from pharmacists' cost-containment attitudes towards the Medicaid drug program.[38]

Place of Employment:

Members employed in art, trade & transport, primary industries and social sciences were the highest utilizers of cardiovascular drugs. This high utilization may be explained by high morbidity, prevalence, and mortality rates for cardiovascular disease among workers in the transportation industry.[39] This industry has been known for its low level of physical activity, irregular work schedules and high level of psychological stress.

Members employed in sales & services were the lowest utilizers of antidepressants. This is contradictory to the results of a study that assessed crude prevalence rates for major depression. The study demonstrated that people employed in sales had high prevalence rates of depression.[40]

Members employed in art, trade & transport, primary industries and social sciences were the highest utilizers of beta-blockers. Beta-blockers are widely used in post myocardial infarction. The only research that was found to support or refute these results was a case-referent study estimating the relative risk of myocardial infarction which found increased incidence for male employed in transport work.[41]

Alsted in 1942 showed a higher incidence of peptic ulcer in medical doctors and other persons considered as "higher office workers".[42] From the results of this study one might expect high utilization of H2-blockers for members employed in health care. However, this study showed that health care employees were the lowest utilizers of H2-blockers. High utilization of H2-blockers among members employed in manufacturing may be explained by characteristics of their occupation. Studies have found that persons working in a hectic and irregular environment may be particularly disposed to peptic ulcer disease.[43]

CONCLUSION:

The primary objective of this study was to compare the variance in cost of pharmaceuticals that is explained by demographic variables with the variance that is explained by plan characteristics within various therapeutic categories using prescription claims data. The secondary objective was to examine whether there were differences in utilization among various demographic variables after controlling for appropriate covariates.

Information for six drug categories was extracted from claims data using database management software. Statistical analyses utilizing multiple regression and analysis of covariance were carried out. Two sets of multiple regression analyses were conducted, one using demographic variables and the other using plan characteristics. Plan characteristics out-performed demographic variables sixteen-fold (4% vs. 64%) for all drug categories combined in explaining variance in cost of pharmaceuticals among plan enrollees. While significant differences in utilization were found among the various demographic variables (e.g. age, gender), continuous variables such as number of days supplied, quantity dispensed, number of days eligible, average wholesale price and co-payment amount were found to be much more powerful predictors.

The results obtained in this study have practical significance in the determination of capitation rates when the utilization history of prospective members is not available. In this situation, pharmacy benefit managers may have to set capitation rates based solely on eligibility data. Furthermore, if utilization data are available, there is a temptation to manipulate these data to influence capitation rates. In this scenario, enrolling the members initially under a FFS arrangement is a viable option. Data collected under a FFS arrangement may then be used to set capitation rates.

In addition to highlighting the importance of utilization history in setting capitation rates for new enrollees, the study results have other ramifications. Pharmacy benefit managers contract with commercial clients to provide pharmacy benefits to their employees irrespective of their occupation. Significant differences in utilization among the members

based on place of employment may be a relevant finding for a pharmacy benefit manager. The implications of these findings suggest that benefit managers should consider differentiating capitation rates according to their clients' business. Finally, the data from this study indicated that commercial members in the State of Tennessee had the lowest level of drug utilization among all states evaluated. The unique dynamics of the Tennessee marketplace suggests that a "spillover effect" may exist due to transfer of learning from the Medicaid to the commercial population.

TABLE: 1 CHARACTERISTICS OF ENROLLEES IN A PRIVATE THIRD-PARTY PRESCRIPTION PROGRAM: [*]

	# OF PARTICIPANTS (%) (N= 64815)
MEMBER AGE[†]	
1-5	5666 (8.8)
6-20	13947 (21.6)
21-40	23739 (36.8)
41-64	18788 (29.1)
>64	2352 (3.6)
Mean	31.5
MEMBER GENDER[‡]	
FEMALE	34145 (52.8)
MALE	30584 (47.2)
PLACE OF EMPLOYMENT OF PRIMARY CARDHOLDER	# OF PARTICIPANTS (%) (N=29211)
MANAGEMENT	1236 (4.2)
MANUFACTURING	3018 (10.3)
CONTRACTORS	1374 (4.7)
COMMERCE	2043 (7.0)
HEALTH	11634 (39.8)
SOCIAL SCIENCES, LAWYERS AND EDUCATORS	2579 (8.8)
ART	671 (2.3)
SALES AND SERVICES	5156 (17.7)
TRADE AND TRANSPORT	682 (2.3)
PRIMARY INDUSTRIES	818 (2.8)

*: As of December 31, 1996

†: 323 missing age records

‡: 86 missing gender records

TABLE: 2 MULTIPLE REGRESSION MODEL OF COST OF PHARMACEUTICALS FOR VARIOUS DRUG CATEGORIES.
REGRESSION COEFFICIENTS (STANDARD ERROR) FOR COST OF PHARMACEUTICALS BY MEMBER DEMOGRAPHICS:

VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
INTERCEPT	-	-	-	-	-	-	-	-	-
MEMBER AGE	0.0813^*	0.0769^*	0.0855^*	$-0.0323^†$	0.1288^*	-0.0736^*	0.0660^*	0.0126	$0.0135^†$
	(0.0003)	(0.0006)	(0.0003)	(0.0008)	(0.0004)	(0.0005)	(0.0003)	(0.0003)	(0.0002)
MEMBER GENDER	0.0603^*	-0.0623^*	0.0159	0.0445^*	0.0104	-0.0297^*	0.0073	0.0241^*	$0.0128^†$
	(0.0085)	(0.0134)	(0.0089)	(0.0215)	(0.0124)	(0.0170)	(0.0070)	(0.0116)	(0.0062)
MEMBER LOCATION	-0.3294^*	-0.3464^*	-0.2774^*	-0.2669^*	-0.3351^*	-0.0846^*	-0.2444^*	-0.1582^*	-0.1947^*
	(0.0116)	(0.0162)	(0.0127)	(0.0259)	(0.0170)	(0.0244)	(0.0092)	(0.0166)	(0.0086)
PLACE OF EMPLOYMENT									
MANUFACTURING/OTHER	0.0748^*	$0.0409^†$	-0.0044	-0.0113	0.0472^*	-0.0379^*	$0.0206^†$	-0.0287	$0.0245^†$
	(0.0145)	(0.0221)	(0.0160)	(0.0393)	(0.0232)	(0.0290)	(0.0121)	(0.0206)	(0.0167)
HEALTH/OTHER	$-0.0375^†$	-0.0399	-0.1089^*	-0.2220^*	0.0017	0.0273	-0.1177^*	-0.0075	-0.0103
	(0.0120)	(0.0182)	(0.0127)	(0.0310)	(0.0182)	(0.0217)	(0.0098)	(0.0155)	(0.0153)
SALES & SERVICES/OTHER	$-0.0315^†$	$-0.0455^†$	-0.1004^*	$-0.0524^†$	-0.0021	$-0.0253^†$	-0.0742^*	-0.0275^*	$-0.0204^†$
	(0.0164)	(0.0232)	(0.0167)	(0.0381)	(0.0247)	(0.0323)	(0.0128)	(0.0225)	(0.0173)
CONTRACTORS/OTHER	0.0548^*	-	-	-	-	-	-	-	0.0408^*
	(0.0195)								(0.0196)
COMMERCE/OTHER	-	0.0121	-	-	-	0.0435^*	-	0.0023	0.0235^*
		(0.0278)				(0.319)		(0.0241)	(0.0188)
MANAGEMENT/OTHER	-	-	$0.0365^†$	-0.0417	0.0900^*	-	-0.0020	-	0.0218^*
			(0.0193)	(0.0455)	(0.0271)		(0.0157)		(0.0189)
N	6763	3462	5783	3631	4297	8690	19642	13488	33131
F	150.87^*	76.45^*	93.43^*	61.30^*	110.47^*	21.47^*	236.80^*	53.11^*	151.46^*
R2	0.1352	0.1341	0.1017	0.1059	0.1390	0.0170	0.0778	0.0268	0.0395
ADJ.R2	0.1343	0.1324	0.1006	0.1042	0.1377	0.0162	0.0775	0.0263	0.0393

1: Ca CHANNEL BLOCKERS

2: LIPOTROPICS

3: ACE INHIBITORS

4: BETA-BLOCKERS

5: H2-BLOCKERS

6: ANTIDEPRESSANTS

7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)

8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)

9: COMBINING ALL SIX DRUG CATEGORIES

*: significant at 0.001

†: significant at 0.05

TABLE: 3 MULTICOLLINEARITY DIAGNOSTIC
VARIANCE INFLATION FACTOR OF INDEPENDENT VARIABLES FOR MULTIPLE REGRESSION MODELS:

VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
MEMBER AGE	1.0937	1.1011	1.0963	1.0451	1.0294	1.0170	1.0608	1.0275	1.0760
MEMBER GENDER	1.0300	1.0502	1.0302	1.0266	1.0182	1.0049	1.0206	1.0130	1.0182
MEMBER LOCATION	1.0408	1.0469	1.0860	1.0440	1.0337	1.0317	1.0529	1.0324	1.0545
PLACE OF EMPLOYMENT									
MANUFACTURING/OTHER	1.6777	1.5836	1.6237	1.6583	1.6838	1.6047	1.6181	1.5889	3.6775
HEALTH/OTHER	2.0730	1.9048	2.0732	2.1704	2.2207	2.1431	1.9968	2.0744	6.3104
SALES & SERVICES/OTHER	1.5511	1.5825	1.6218	1.7368	1.5850	1.4388	1.5720	1.4586	3.3051
CONTRACTORS/OTHER	1.3699	-	-	-	-	-	-	-	2.2556
COMMERCE/OTHER	-	1.3219	-	-	-	1.4719	-	1.3913	2.3724
MANAGEMENT/OTHER	-	-	1.3665	1.3915	1.4460	-	1.3054	-	2.3790

1: Ca CHANNEL BLOCKERS
2: LIPOTROPICS
3: ACE INHIBITORS
4: BETA-BLOCKERS
5: H2-BLOCKERS
6: ANTI DEPRESSANTS
7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)
9: COMBINING ALL SIX DRUG CATEGORIES

**TABLE: 4 MULTIPLE REGRESSION MODEL OF COST OF PHARMACEUTICALS FOR VARIOUS DRUG CATEGORIES.
REGRESSION COEFFICIENTS (STANDARD ERROR) FOR COST OF PHARMACEUTICALS BY PLAN CHARACTERISTICS:**

VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
INTERCEPT	-	-	-	-	-	-	-	-	-
# OF DAYS ELIGIBLE	-0.4589*	-0.3722*	-0.4697*	-0.2053*	-0.3726*	-0.2547*	-0.3105*	-0.2670*	-0.2785*
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
# OF MEMBERS ELIGIBLE	0.0228*	0.0557*	0.0629*	-0.0452*	0.0236†	0.0146*	0.0042	0.0185*	0.0059
	(0.0033)	(0.0054)	(0.0036)	(0.0160)	(0.0062)	(0.0040)	(0.0035)	(0.0045)	(0.0029)
AVERAGE WHOLESALE PRICE	0.6216*	0.6764*	0.3327*	0.3291*	0.3940*	0.9571*	0.6376*	0.7164*	0.6405*
	(0.0043)	(0.0042)	(0.0305)	(0.0390)	(0.0073)	(0.0089)	(0.0083)	(0.0092)	(0.0027)
OUT OF POCKET EXPENSE	0.0018	0.0493*	-0.1721*	0.2076*	0.1695*	-0.0258*	0.0824*	0.1171*	0.1284*
	(0.0097)	(0.0165)	(0.0105)	(0.0412)	(0.0170)	(0.0160)	(0.0097)	(0.0150)	(0.0084)
# OF DAYS SUPPLY	0.1324*	0.2761*	0.0306*	0.1210*	0.0535*	-0.0143*	0.0696*	-0.0116	0.0453*
	(0.0170)	(0.0238)	(0.0001)	(0.0091)	(0.0043)	(0.0028)	(0.0023)	(0.0029)	(0.0018)
QUANTITY DISPENSED	0.4721*	0.2101*	0.6542*	0.2673*	0.5520*	0.4293*	0.3792*	0.4765*	0.3937*
	(0.0144)	(0.0186)	(0.0147)	(0.0557)	(0.0271)	(0.0145)	(0.0141)	(0.0157)	(0.0105)
N	6519	3343	5651	3184	4462	7809	18700	12372	31073
F	3800.21*	1752.17*	2993.54*	278.68*	1251.00*	9361.93*	5058.47*	5032.43*	9109.77*
R2	0.7778	0.7591	0.7609	0.3448	0.6275	0.8780	0.6188	0.7094	0.6376
ADJ.R2	0.7776	0.7586	0.7606	0.3435	0.6270	0.8779	0.6187	0.7093	0.6375

1: Ca CHANNEL BLOCKERS
2: LIPOTROPICS
3: ACE INHIBITORS
4: BETA-BLOCKERS
5: H2-BLOCKERS
6: ANTI DEPRESSANTS
7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)
9: COMBINING ALL SIX DRUG CATEGORIES

*: significant at 0.001
†: significant at 0.05

TABLE: 5 MULTICOLLINEARITY DIAGNOSTIC
VARIANCE INFLATION FACTOR OF INDEPENDENT VARIABLES FOR MULTIPLE REGRESSION MODELS:

VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
INTERCEPT	-	-	-	-	-	-	-	-	-
# OF DAYS ELIGIBLE	1.0380	1.0297	1.0704	1.0646	1.0669	1.0974	1.0471	1.0851	1.0588
# OF MEMBERS ELIGIBLE	1.0344	1.0632	1.0648	1.1546	1.0971	1.1068	1.0622	1.1008	1.0713
AVERAGE WHOLESALE PRICE	1.1336	1.3307	1.0058	1.1064	1.2471	2.0345	1.1584	1.5358	1.1852
OUT OF POCKET EXPENSE	1.0677	1.0724	1.0347	1.1636	1.0910	1.8163	1.0775	1.3917	1.1368
# OF DAYS SUPPLY	1.9464	1.16673	1.8436	1.9198	2.4860	1.4767	1.9350	1.6233	1.6813
QUANTITY DISPENSED	2.0193	1.7769	1.8077	1.8827	2.4676	1.6724	1.9749	1.7419	1.7239

1: Ca CHANNEL BLOCKERS
2: LIPOTROPICS
3: ACE INHIBITORS
4: BETA-BLOCKERS
5: H2-BLOCKERS
6: ANTI DEPRESSANTS
7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)
9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 6 MULTIPLE REGRESSION MODEL OF COST OF PHARMACEUTICALS FOR VARIOUS DRUG CATEGORIES. REGRESSION COEFFICIENTS (STANDARD ERROR) FOR COST OF PHARMACEUTICALS BY MEMBER DEMOGRAPHICS AND PLAN CHARACTERISTICS:

VARIABLE	DRUG CATEGORY					
	1	2	3	4	5	6
INTERCEPT	-	-	-	-	-	-
MEMBER AGE	0.0423* (0.0001)	0.0052 (0.0003)	0.0002 (0.0002)	0.0064 (0.008)	0.0493* (0.0002)	0.0039 (0.0002)
MEMBER GENDER	-0.0137† (0.0043)	-0.0639* (0.0072)	0.0081 (0.0046)	-0.0054 (0.0203)	-0.0241* (0.0075)	-0.0112* (0.0063)
MEMBER LOCATION	0.0574* (0.0081)	-0.0019 (0.0120)	0.0613* (0.0099)	0.0209 (0.0384)	0.0023 (0.0141)	0.0236* (0.0128)
MANUFACTURING	-0.0377* (0.0080)	-0.0465* (0.0125)	0.0715* (0.0085)	0.0084 (0.0396)	0.0810* (0.0142)	-0.0001 (0.0113)
HEALTH	-0.1172* (0.0074)	-0.0737* (0.0115)	0.0563* (0.0076)	-0.1285* (0.0371)	-0.0230 (0.0127)	-0.0123 (0.0098)
SALES & SERVICES	-0.0023 (0.0088)	-0.0194 (0.0133)	0.0468* (0.0092)	0.0651* (0.0419)	0.0730* (0.0153)	-0.0021 (0.0132)
CONTRACTORS	-0.0606* (0.0109)	-	-	-	-	-
MANAGEMENT	-	-	0.0308* (0.0122)	0.0652* (0.0563)	0.2432* (0.0179)	-
COMMERCE	-	-0.0201† (0.0153)	-	-	-	-0.0214* (0.0122)
# OF DAYS ELIGIBLE	-0.4538* (0.0000)	-0.3647* (0.0000)	-0.4778* (0.0000)	-0.1939* (0.0001)	-0.3810* (0.0000)	-0.2556* (0.0000)
# OF MEMBERS ELIGIBLE	0.0793* (0.0041)	0.0771* (0.0067)	0.0492* (0.0043)	0.0471† (0.0193)	0.1148 (0.0070)	0.0134* (0.0047)
AVERAGE WHOLESALE PRICE	0.6149* (0.0043)	0.6739* (0.0043)	0.3326* (0.0314)	0.3202* (0.0394)	0.3586† (0.0069)	0.9553* (0.0093)
OUT OF POCKET EXPENSE	0.0281* (0.0101)	0.0569* (0.0172)	-0.1609* (0.0139)	0.2103* (0.0429)	0.2658* (0.0176)	-0.0223* (0.0166)
# OF DAYS SUPPLY	0.1613* (0.0191)	0.2726* (0.0268)	0.0723* (0.0002)	0.1462* (0.0120)	0.0494* (0.0048)	-0.0007 (0.0036)
QUANTITY DISPENSED	0.4906* (0.0145)	0.2207* (0.0195)	0.6597* (0.0147)	0.2927* (0.0555)	0.5548* (0.0253)	0.4346* (0.0146)
N	6477	3328	5617	3167	4421	7766
F	1842.60*	828.99*	1408.23*	145.33*	745.37*	4314.64*
R2	0.7875	0.7648	0.7656	0.3746	0.6873	0.8786
ADJ.R2	0.7871	0.7638	0.7651	0.3720	0.6864	0.8784

1: Ca CHANNEL BLOCKERS *: significant at 0.001
2: LIPOTROPICS †: significant at 0.05
3: ACE INHIBITORS
4: BETA-BLOCKERS
5: H2-BLOCKERS
6: ANTI DEPRESSANTS

TABLE: 7 MULTIPLE REGRESSION MODEL OF COST OF PHARMACEUTICALS FOR COMBINED DRUG CATEGORIES.
REGRESSION COEFFICIENTS (STANDARD ERROR) FOR COST OF PHARMACEUTICALS BY MEMBER DEMOGRAPHICS AND PLAN CHARACTERISTICS:

VARIABLE	DRUG CATEGORY		
	7	8	9
INTERCEPT	-	-	-
MEMBER AGE	0.0091 (0.0002)	0.0075 (0.0002)	0.0230* (0.0001)
MEMBER GENDER	-0.0042 (0.0045)	-0.0085 (0.0064)	0.0008 (0.0038)
MEMBER LOCATION	0.0723* (0.0089)	0.0298* (0.0127)	0.0635* (0.0075)
MANUFACTURING	0.0155* (0.0081)	-0.0673* (0.0117)	-0.0261* (0.0107)
HEALTH	-0.0539* (0.0073)	-0.1113* (0.0102)	-0.0923* (0.0102)
SALES & SERVICES	0.0409* (0.0088)	-0.0381* (0.0135)	0.0060 (0.0110)
CONTRACTORS	-	-	-0.0270* (0.0129)
MANAGEMENT	0.1199* (0.0118)	-	0.1218* (0.0125)
COMMERCE	-	-0.0795* (0.0135)	-0.0366* (0.0116)
# OF DAYS ELIGIBLE	-0.3051* (0.0000)	-0.2608* (0.0000)	-0.2801* (0.0000)
# OF MEMBERS ELIGIBLE	0.0568* (0.0042)	0.0378* (0.0053)	0.0653* (0.0035)
AVERAGE WHOLESALE PRICE	0.6165* (0.0083)	0.7010* (0.0094)	0.6153* (0.0027)
OUT OF POCKET EXPENSE	0.1506* (0.0108)	0.1378* (0.0154)	0.2044* (0.0092)
# OF DAYS SUPPLY	0.1246* (0.0028)	0.0087 (0.0037)	0.0878* (0.0022)
QUANTITY DISPENSED	0.3950* (0.0139)	0.4763* (0.0156)	0.4044* (0.0103)
N	18592	12288	30881
F	2520.71*	2381.87*	4005.60*
R2	0.6382	0.7161	0.6606
ADJ.R2	0.6379	0.7158	0.6605

7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)
9: COMBINING ALL SIX DRUG CATEGORIES
*: significant at 0.001
†: significant at 0.05

TABLE: 8 MULTICOLLINEARITY DIAGNOSTIC
VARIANCE INFLATION FACTOR OF INDEPENDENT VARIABLES FOR MULTIPLE REGRESSION MODELS:

VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
INTERCEPT	-	-	-	-	-	-	-	-	-
MEMBER AGE	1.1504	1.1758	1.1452	1.1518	1.1380	1.0562	1.1082	1.0762	1.1367
MEMBER GENDER	1.0464	1.0673	1.0361	1.0444	1.0253	1.0159	1.0258	1.0297	1.0278
MEMBER LOCATION	2.0564	2.0214	2.4930	2.6712	2.0427	2.0279	2.3694	2.0736	2.2378
MANUFACTURING/OTHER	2.0953	1..8443	1.7580	2.1368	1.8199	1.9799	1.8399	1.8340	4.2755
HEALTH/OTHER	3.1012	2.6738	2.7950	3.5233	2.9847	3.2179	2.7506	2.9503	7.6687
SALES&SERVICES/OTHER	1.6409	1.8521	1.7823	2.1006	1.6224	1.5428	1.7100	1.5703	3.3600
CONTRACTORS/OTHER	1.6130	-	-	-	-	-	-	-	2.2596
MANAGEMENT/OTHER	-	-	2.0963	1.5359	1.7186	-	1.6352	-	2.5854
COMMERCE/OTHER	-	1.4413	-	-	-	1.7421	-	1.5504	2.5765
# OF DAYS ELIGIBLE	1.1655	1.0927	1.1732	1.1513	1.1650	1.1495	1.1341	1.1423	1.1566
# OF MEMBERS ELIGIBLE	1.6290	1.6547	1.5934	1.7396	1.6759	1.5223	1.5849	1.5628	1.6493
AVERAGE WHOLESALE PRICE	1.1693	1.3939	1.0754	1.1520	1.2970	2.1712	1,2059	1.6086	1.2329
OUT OF POCKET EXPENSE	1.2009	1.1854	1.8220	1.3076	1.3648	1.9625	1.3815	1.5067	1.4262
# OF DAYS SUPPLY	2.5431	2.1614	3.0074	3.4301	3.6240	2.4261	3.0238	2.6047	2.7301
QUANTITY DISPENSED	2.1329	1.9821	1.8398	1.9083	2.5243	1.6970	2.0006	1.7706	1.7505

1: Ca CHANNEL BLOCKERS

2: LIPOTROPICS

3: ACE INHIBITORS

4: BETA-BLOCKERS

5: H2-BLOCKERS

6: ANTI DEPRESSANTS

7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)

8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)

9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 9 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY MEMBER AGE FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	38.13 (0.0001)	7.95 (0.0001)	27.77 (0.0001)	16.61 (0.0001)	35.80 (0.0001)	30.39 (0.0001)	43.85 (0.0001)	10.94 (0.0001)	6.91 (0.0001)
R^2	0.0165	0.0090	0.0141	0.0134	0.0287	0.0137	0.0088	0.0032	0.0008
ANCOVA (COVARIATE)									
# OF MEMBERS ELIGIBLE									
F (p)	30.25 (0.0001)	9.22 (0.0001)	20.71 (0.0001)	24.20 (0.0001)	30.06 (0.0001)	27.62 (0.0001)	38.71 (0.0001)	9.97 (0.0001)	8.77 (0.0001)
R^2	0.0175	0.0132	0.0142	0.0260	0.0304	0.0157	0.0097	0.0036	0.0013
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	1151.32 (0.0001)	945.07 (0.0001)	492.97 (0.0001)	148.17 (0.0001)	320.56 (0.0001)	2674.27 (0.0001)	2469.39 (0.0001)	2164.83 (0.0001)	4481.56 (0.0001)
R^2	0.4584	0.6203	0.2976	0.1689	0.2845	0.6506	0.4286	0.4890	0.4465
LSMEANS									
1-5	-	-	-	-	0.1429	-	-	0.1000	0.0785
6-20	0.0901	0.1288	0.0466	0.0336	0.1737	0.0657	0.0638	0.1058	0.0809
21-40	0.0876	0.1260	0.0647	0.0159	0.1427	0.1014	0.0624	0.0974	0.0782
41-64	0.0932	0.1274	0.0645	0.0261	0.1521	0.0805	0.0700	0.1041	0.0821
>64	0.1042	0.1355	0.0745	0.0219	0.2224	0.0519	0.0728	0.1391	0.0899

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 10 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY MEMBER GENDER FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	34.05 (0.0001)	18.06 (0.0001)	0.16 (0.6937)	4.26 (0.0390)	4.13 (0.0422)	8.85 (0.0029)	5.90 (0.0152)	10.15 (0.0014)	0.56 (0.4541)
R^2	0.0049	0.0051	0.0000	0.0011	0.0008	0.0010	0.0002	0.0007	0.0000
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	75.30 (0.0001)	31.16 (0.0001)	60.00 (0.0001)	2.13 (0.1184)	58.47 (0.0001)	23.39 (0.0001)	100.36 (0.0001)	11.31 (0.0001)	5.60 (0.0037)
R^2	0.0217	0.0176	0.0202	0.0011	0.0236	0.0053	0.0100	0.0016	0.0003
# OF MEMBERS ELIGIBLE									
F (p)	16.60 (0.0001)	11.96 (0.0001)	1.15 (0.3160)	20.58 (0.0001)	2.71 (0.0668)	7.63 (0.0005)	18.80 (0.0001)	8.75 (0.0002)	9.17 (0.0001)
R^2	0.0049	0.0069	0.0004	0.0112	0.0011	0.0017	0.0019	0.0013	0.0005
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	1893.35 (0.0001)	1887.08 (0.0001)	802.65 (0.0001)	227.09 (0.0001)	584.34 (0.0001)	5253.35 (0.0001)	4897.30 (0.0001)	4160.03 (0.0001)	8851.10 (0.0001)
R^2	0.4559	0.6205	0.2936	0.1576	0.2662	0.6473	0.4273	0.4796	0.4441
LSMEANS									
FEMALE	0.0919	0.1335	0.0648	0.0230	0.1571	0.0867	0.0689	0.1015	0.0810
MALE	0.0973	0.1245	0.0665	0.0247	0.1612	0.0784	0.0701	0.1164	0.0848

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 11 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY MEMBER LOCATION FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	841.03 (0.0001)	468.03 (0.0001)	488.25 (0.0001)	251.33 (0.0001)	621.87 (0.0001)	43.99 (0.0001)	1229.91 (0.0001)	347.91 (0.0001)	1216.82 (0.0001)
R^2	0.1102	0.1187	0.0775	0.0646	0.1146	0.0050	0.0587	0.0250	0.0353
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	447.95 (0.0001)	245.34 (0.0001)	266.15 (0.0001)	128.31 (0.0001)	357.59 (0.0001)	50.93 (0.0001)	653.30 (0.0001)	174.47 (0.0001)	612.00 (0.0001)
R^2	0.1166	0.1238	0.0839	0.0659	0.1296	0.0115	0.0621	0.0251	0.0355
# OF MEMBERS ELIGIBLE									
F (p)	421.30 (0.0001)	235.29 (0.0001)	242.39 (0.0001)	154.79 (0.0001)	318.41 (0.0001)	25.36 (0.0001)	637.81 (0.0001)	181.09 (0.0001)	621.59 (0.0001)
R^2	0.1110	0.1201	0.0778	0.0790	0.1183	0.0058	0.0612	0.0263	0.0363
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	1894.45 (0.0001)	1883.16 (0.0001)	808.52 (0.0001)	240.93 (0.0001)	591.26 (0.0001)	5272.03 (0.0001)	4912.06 (0.0001)	4176.50 (0.0001)	8875.28 (0.0001)
R^2	0.4558	0.6194	0.2947	0.1659	0.2697	0.6477	0.4278	0.4809	0.4448
LSMEANS									
OTHER	0.1734	0.2111	0.1086	0.0477	0.3402	0.1559	0.1193	0.2121	0.1460
TENNESSEE	0.0838	0.1126	0.0599	0.0198	0.1388	0.0802	0.0618	0.0960	0.0743

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 12 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY PLACE OF EMPLOYMENT FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	14.4 (0.0001)	3.01 (0.0173)	10.52 (0.0001)	23.19 (0.0001)	3.46 (0.0079)	7.56 (0.0001)	34.64 (0.0001)	0.17 (0.9531)	8.42 (0.0001)
R^2	0.0133	0.0053	0.0105	0.0388	0.0041	0.0051	0.0105	0.0000	0.0022
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	29.57 (0.0001)	10.15 (0.0001)	28.00 (0.0001)	18.55 (0.0001)	17.46 (0.0001)	14.56 (0.0001)	60.77 (0.0001)	0.55 (0.7404)	7.95 (0.0001)
R^2	0.0334	0.0223	0.0342	0.0389	0.0257	0.0123	0.0228	0.0003	0.0025
# OF MEMBERS ELIGIBLE									
F (p)	11.89 (0.0001)	2.21 (0.0506)	8.71 (0.0001)	18.55 (0.0001)	3.52 (0.0036)	6.94 (0.0001)	28.63 (0.0001)	0.29 (0.9205)	7.59 (0.0001)
R^2	0.0138	0.0049	0.0109	0.0392	0.0053	0.0059	0.0109	0.0001	0.0024
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	608.03 (0.0001)	617.01 (0.0001)	281.24 (0.0001)	103.04 (0.0001)	197.29 (0.0001)	1675.61 (0.0001)	1625.96 (0.0001)	1366.68 (0.0001)	2248.52 (0.0001)
R^2	0.4609	0.6251	0.2992	0.2125	0.2637	0.6373	0.4286	0.4734	0.4484
LSMEANS									
MANAGEMENT	-	-	0.0736	0.0264	0.1904	-	0.0737	-	0.0941
MANUFACTURING	0.0944	0.1313	0.0654	0.0190	0.1923	0.0914	0.0692	0.1144	0.0834
HEALTH	0.0812	0.1197	0.0604	0.0159	0.1493	0.0858	0.0590	0.1047	0.0756
SALES & SERVICES	0.0995	0.1194	0.0621	0.0361	0.1703	0.0857	0.0730	0.1186	0.0877
COMMERCE	-	0.1336	-	-	-	0.0884	-	0.0993	0.0861
CONTRACTORS	0.1250	-	-	-	-	-	-	-	0.1135
OTHERS	0.0938	0.1342	0.0725	0.0402	0.1563	0.1226	0.0835	0.1338	0.0929

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 13 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY PLACE OF EMPLOYMENT AND MEMBER GENDER FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
ANOVA	1	2	3	4	5	6	7	8	9
F (p)	8.9(0.0001)	3.8(0.0001)	6.9(0.0001)	14.2(0.0001)	8.0(0.0001)	6.0(0.0001)	19.6(0.0001)	7.4(0.0001)	6.9(0.0001)
R^2	0.0185	0.0153	0.0155	0.0532	0.0214	0.0092	0.0134	0.0073	0.0040
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	18.8(0.0001)	7.1(0.0001)	16.6(0.0001)	12.8(0.0001)	14.1(0.0001)	8.9(0.0001)	34.2(0.0001)	6.8(0.0001)	7.0(0.0001)
R^2	0.0423	0.0315	0.0407	0.0533	0.0410	0.0153	0.0257	0.0075	0.0044
# OF MEMBERS ELIGIBLE									
F (p)	8.1(0.0001)	3.3(0.0001)	6.3(0.0001)	12.8(0.0001)	7.6(0.0001)	5.7(0.0001)	18.2(0.0001)	6.8(0.0001)	6.9(0.0001)
R^2	0.0189	0.0150	0.0160	0.0535	0.0230	0.0098	0.0139	0.0076	0.0044
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	339.5 (0.0001)	352.5 (0.0001)	153.5 (0.0001)	58.3 (0.0001)	114.5 (0.0001)	936.0 (0.0001)	884.0 (0.0001)	761.9 (0.0001)	1199.9 (0.0001)
R^2	0.4674	0.6377	0.3010	0.2195	0.2766	0.6440	0.4290	0.4799	0.4496
LSMEANS									
MANAGEMENT – F*	-	-	0.0699	0.0279	0.2189	-	0.0725	-	0.0888
MANAGEMENT – M†	-	-	0.0770	0.0259	0.1770	-	0.0737	-	0.0973
MANUFACTURING–F*	0.1081	0.1713	0.0651	0.0168	0.2447	0.1075	0.0731	0.1340	0.0943
MANUFACTURING –M†	0.0881	0.1099	0.0657	0.0211	0.1504	0.0758	0.0671	0.0620	0.0761
COMMERCE – FEMALE	-	0.1836	-	-	-	0.0882	-	0.0997	0.0912
COMMERCE – MALE	-	0.1075	-	-	-	0.0904	-	0.0993	0.0794
HEALTH – FEMALE	0.0790	0.1195	0.0615	0.0174	0.1405	0.0813	0.0597	0.0990	0.0741
HEALTH – MALE	0.0927	0.1209	0.0571	0.0115	0.1902	0.1205	0.0565	0.1548	0.0843
SALES & SERVICES- F*	0.0886	0.1273	0.0693	0.0349	0.1630	0.1007	0.0717	0.1150	0.0873
SALES & SERVICES-M†	0.1073	0.1179	0.0598	0.0366	0.1736	0.0731	0.0738	0.1255	0.0887
CONTRACTORS – F*	0.1353	-	-	-	-	-	-	-	0.1018
CONTRACTORS – M†	0.1212	-	-	-	-	-	-	-	0.1194
OTHER – FEMALE	0.0987	0.1226	0.0700	0.0458	0.1667	0.1410	0.0863	0.1241	0.1020
OTHERS – MALE	0.0900	0.1388	0.0745	0.0373	0.1479	0.1292	0.0817	0.1445	0.0869

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)   *: FEMALE
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS   †: MALE
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 14 EFFECT SIZE OF INTERACTION BETWEEN DAYS SUPPLY (COVARIATE) AND GROUPING VARIABLE FOR VARIOUS DRUG CATEGORIES:

GROUPING VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
MEMBER AGE	0.0023	0.0007	0.0007	0.0036	0.0095	0.0023	0.0007	0.0031	0.0017
PLACE OF EMPLOYMENT	0.0003	-0.0001	0.0038	0.0044	0.0034	0.0006	0.0010	0.0001	0.0002
LOCATION OF MEMBER	0.0037	0.0011	0.0012	-0.0001	0.0014	0.0007	0.0000	0.0002	0.0000
MEMBER GENDER	0.0001	0.0000	0.0000	0.0000	-0.0001	0.0000	0.0000	0.0000	0.0000
PLACE OF EMPLOYMENT AND MEMBER GENDER	0.0014	0.0014	0.0036	0.0096	0.0050	0.0020	0.0019	0.0008	0.0004

1: Ca CHANNEL BLOCKERS 4: BETA-BLOCKERS 7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS 5: H2-BLOCKERS 8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS 6: ANTI DEPRESSANTS 9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 15 EFFECT SIZE OF INTERACTION BETWEEN AVERAGE WHOLESALE PRICE (COVARIATE) AND GROUPING VARIABLE FOR VARIOUS DRUG CATEGORIES:

GROUPING VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
MEMBER AGE	0.0054	0.0000	0.0037	0.0088	0.0034	0.0024	0.0027	0.0029	0.0007
PLACE OF EMPLOYMENT	0.0032	0.0125	0.0034	0.0156	-0.0001	0.0123	0.0036	0.0031	0.0268
LOCATION OF MEMBER	0.0008	0.0032	-0.0001	0.0000	0.0013	0.0000	0.0006	0.0000	0.0007
MEMBER GENDER	-0.0001	0.0009	-0.0001	0.0004	0.0002	0.0020	0.0000	0.0012	0.0006
PLACE OF EMPLOYMENT AND MEMBER GENDER	0.0067	0.0130	0.0079	0.0151	0.0014	0.0195	0.0043	0.0078	0.0058

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

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MANUSCRIPT II

The Effect of Plan Characteristics on the Cost of Pharmaceuticals in a Private Third-Party Prescription Program

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ABSTRACT:

Objective: Using prescription claims data, the primary objective of this study was to evaluate whether utilization differed among various plan characteristics after controlling for covariates. The secondary objective was to examine the relationships among plan characteristics and cost of pharmaceuticals within various therapeutic categories.

Design: Retrospective, cross-sectional study.

Data Collection: Data for this study were obtained from 1996 prescription claims information for a commercial population administered by a Rhode Island-based PBM. Six therapeutic categories were analyzed.

Methodology: Information on claims for six drug categories was extracted using database management software. Statistical analyses utilizing multiple regression and analysis of covariance were carried out.

Results: Significant associations were found between plan characteristics and cost of pharmaceuticals. Utilization differed among various plan characteristics such as co-payment, mode of payment, formulary status and pharmacy type after controlling for average wholesale price and days supply.

Conclusion: Results obtained in this study may be helpful in understanding some of the factors associated with cost of pharmaceuticals. For example, the inverse relationship of

pharmaceutical cost with eligible days may be helpful in budgeting program costs while the non-significant association of pharmaceutical cost with number of members eligible suggests a lack of importance of group size in negotiating pharmacy benefit contracts. Differences in utilization among various co-payment levels suggest the effectiveness of different co-payment levels in promoting use of generic products. Lower utilization found under capitation may be encouraging to those pharmacy benefit management companies accepting a capitation method of reimbursement. Association of closed formularies with higher utilization indicates the importance of adjusting cost data for rebates before evaluating formulary strategies. Finally, differences in utilization between independent and chain pharmacies suggest the importance of careful contract negotiation.

INTRODUCTION:

In 1996, third-party payers processed 55% of the prescription volume and 58.5% of the dollar volume. [1] Large purchasers of pharmaceutical benefits (e.g. government, employers) are experiencing a higher rate of inflation in their prescription program expenditures than seen in their medical care expenditures. [2] While product price increases are an issue, IMS America, a leading provider of sales management and market research information to the pharmaceutical industry, has estimated that only 1.6% of the 11.7% growth in pharmaceutical dollars spent in 1996 can be attributed to manufacturer price increases of existing products. [3] In the past, costs of administering third-party prescriptions averaged only about 5% of the total prescription price and has primarily been for claims processing. [4] The administrative component of the prescription drug benefit has expanded significantly in recent years. Functions now include activities such as pharmacy network management, prior approval mechanisms, formulary development, rebate contracting, rebate administration, therapeutic alternative programs, pharmacoeconomic studies and disease state management programs.

Analysts believe that increased product costs are in part due to the availability and use of newer and more expensive medications. Many of these products are superior to older formulations in terms of safety and efficacy. New products may be used for previously untreated or under-treated diseases. Harvard Pilgrim Health Care has projected that by the year 2002 drug costs will grow to 22% of total medical costs exceeding hospital expenditures. [5]

In a recent survey of employer benefit managers and directors of employer coalitions, cost was ranked first among the 23 factors influencing health plan selection. [6] High demand among employees has led their employers to choose a carefully designed, cost-effective pharmacy benefit that is comprehensive enough to meet their employees' diverse needs. More recently, corporations utilize pharmacy benefit management companies (PBMs) for their employees' prescription benefits. As the transition towards managed care continues, the standard services offered by PBMs (e.g. pharmacy networks, claims-processing, formulary management) have become commonplace. This has forced the PBM industry to expand its product lines and create an expectation of reduced drug expenditures. [2]

Pharmaceutical benefit managers have both the incentive and the ability to deliver cost savings to their clients. Many managed care organizations and employers have segregated the pharmacy benefit from the general health plan by using separate management and fee structures. This carve-out approach has allowed PBM managers to focus on drug costs independent of all related health care costs. This is achieved through various cost-management techniques. The primary strategies include contracting with pharmacies, member co-payment, drug utilization review (DUR) and formularies.

According to a study conducted in 1994, over two-thirds of all HMOs used formularies to help manage their prescription costs. [7] HMOs and employers choose from various formulary options. The design of formularies continues to evolve by becoming more flexible and less easily categorized as strictly open (both formulary and non-formulary

drugs are covered) or closed (only formulary drugs are covered). A recent survey of PBMs reported a definitive trend toward selective/partially closed formulary designs (formulary drugs and selected non-formulary drugs are covered). In 1996, 80% of surveyed PBMs described their formulary design as open with the remaining 20% evenly divided between closed and selective/partially closed designs. In 1997, the PBMs utilizing the open formulary concept underwent a noticeable shift in their formulary designs.   In that year, only 50% of the formularies remained open, while selective/partially closed designs increased to 41.7%, and 8.3% remained closed. It is predicted that by 1999, over 80% of PBMs will have selective/partially-closed designs and less than 20% will have either open or closed designs. [6]

An association exists between a well-controlled formulary and decreased costs. [8] Drug formularies have been implemented in a variety of health care environments with the objective of providing cost-effective prescription coverage by controlling drug utilization and expenditures. Although there have been numerous studies that document savings associated with hospital formularies, few studies have been conducted on ambulatory patients showing that formularies result in cost savings. An ambulatory patient drug formulary was shown to be cost effective in the 1993 study of Well Point's prescription claims database. [7]

PBMs are sometimes offered capitation payment as an alternative to fee for service for a variety of population groups and benefit packages. In this way, the payer limits financial risk by paying the PBM a specified amount for each member per unit of time. The PBM

must provide all of the contracted services for that fixed amount thereby assuming a substantial level of financial risk. To accomplish this, PBMs need to encourage new physician practice patterns and monitor drug utilization. With capitation payments linked to HMO premiums for commercial enrollees and HMO premiums having dropped in response to market pressure from employers, PBMs are coming under increased financial pressure. [9] A detailed analysis of current utilization data can identify the current cost of the products/services to be capitated, allowing an educated assessment of whether a capitated arrangement is financially viable.

Managed health care plans are increasing consumer cost-sharing provisions in response to rising health care costs. Cost sharing for the prescription drug benefit is widespread and usually in the form of co-payments. Approximately 80% of all HMO members in the U.S. who are insured for prescription benefits have some form of prescription cost-sharing provisions. [10, 6] Requiring beneficiaries to pay small dollar amounts each time a prescription is received theoretically inhibits unnecessary utilization, thereby containing the overall cost of drug benefit programs.

Previous studies in other settings have shown that patients with no cost sharing provisions utilize more services, including prescription drugs, than those who are subject to cost sharing. [11] Few formal studies have researched the impact of drug co-payments in managed care settings. Empirical investigations of co-payments have been seriously limited by research design. It is important to examine the effects of co-payments on different therapeutic classes of drugs because their effects may vary among different

types of medications. A study by Harris et al. showed that cost-sharing in the form of prescription co-payments ranging from $1.50 to $3.00 had a significant impact on reducing drug utilization and drug expenditures. [12]

PBMs often establish agreements that offer clients a network of pharmacies geographically accessible to their members. Typically, the pharmacies in these agreements are stores belonging to national or regional chains or independent community pharmacies. The pharmacies' incentive to participate is based upon their access to the large customer base. In exchange, the pharmacies agree to a reimbursement formula established by the PBM. This generally is expressed as a discount off the average wholesale price (AWP) plus a dispensing fee for each prescription filled. PBMs responding to a survey in 1997 indicated that 71% of the prescriptions dispensed to their members were through network pharmacies. [1]

Providing better access to quality pharmacies has become one of the most important ways to improve patient satisfaction with the pharmacy benefit. MCOs, employers, and third-party administrators are beginning to recognize that a network having convenient, courteous and service oriented pharmacies translates into more satisfied customer base. In one study, respondents rated independent pharmacies higher than chains. [13] This growing realization of the influence of pharmaceutical services on patient satisfaction comes at a time when contracting with chain pharmacies is growing as a cost-containment measure. Such business decisions assume that one pharmacy is as good as another. Previous studies of pharmacy patronage have found that personal factors

including age, sex, occupation, income, and use of medication for acute or chronic conditions affect pharmacy selection and consumer loyalty. [14] In addition, pharmacy location has always played a vital role in the selection of a pharmacy.

Managing the pharmacy benefit is an increasingly complex challenge and understanding the impact of various plan characteristics is the first step needed to develop a well-managed prescription benefit program. This can enable pharmacy benefit managers to monitor the complex effects of various plan features and to evaluate which mechanisms are the most effective in accomplishing desired goals. Using prescription claims data, the objectives of this study were: (1) to examine the relationships among plan characteristics and cost of pharmaceuticals within various therapeutic categories; and (2) to evaluate whether utilization differed among various plan characteristics after controlling for appropriate covariates.

METHODOLOGY:

Study Description:

Data for this study were obtained from prescription claims information compiled during 1996 for the commercial population administered by MIM Health Plans, Inc., a Rhode Island-based pharmacy benefit management company. These data were collected from pharmacies at the point of service during the routine filling of commercial members' prescriptions. Data elements conformed to National Council on Prescription Drug Processing (NCPDP) standards for pharmacy claims adjudication. Algorithms to assure data accuracy were applied at the point of service and retrospectively by the PBM. All

data were blinded as to patient name assuring confidentiality of medical information. The study was approved by the University of Rhode Island Institutional Review Board on human subjects.

Measures:

Each record in a claims file represented a prescription dispensed to a member. The information in the record included: pharmacy identification (NABP) number, date of service, national drug code (NDC) for the medication, Generic Product Identifier (GPI), generic name, number of prescriptions, quantity dispensed, amount paid by the member (co-payment), amount reimbursed to pharmacy provider, member identification number, gender, age, carrier name, account name, group name, and number of days supply.

NABP number was used to link claims files with pharmacy files to get information on the name of the pharmacy, type (chain/independent) and the state in which it is located. The unique combination of carrier, account and group representing a particular plan was used to determine plan attributes such as mode of payment (FFS/capitation) and formulary status (open/closed/mandatory generic substitution).

In addition to demographic information, a file on member eligibility contained each member's enrollment history. Each member was identified by a member number and may be the original enrollee (subscriber) or a dependent . Questions on continuity of coverage can be answered from the information in this file, which maintains a temporal view of the member's activity within the system. Member identification number was

used as a common field to link claims files with eligibility files to determine the members' eligibility.

Because claims data were never structured to answer specific questions of this study, algorithms were designed for extracting appropriate subsets of claims using database management software (Dbase 2.6). The Generic Product Identifier codes (Medispan, Inc.) were used to divide prescription drugs into major therapeutic categories. Using pre-collected data necessitated careful selection and examination of the data. Claims files were indexed with reversed claims, marked manually and deleted to ensure that the data for analysis did not include any denied or reversed claims. A claim reversal occurs when a pharmacist has to resubmit a claim due to entering the wrong information in the system such as a coding error or a claim with a missing drug identification code. The error is corrected by entering a claim identical to the first claim but with negative financial values. The third record reflects the correct information.

Six therapeutic categories with the highest expenditures during fiscal year 1996 were selected for the analysis. These included calcium channel blocking agents, angiotensin converting enzyme (ACE) inhibitors, lipotropics, antidepressants, histamine H2-blockers, and beta-adrenergic blocking agents.

Member-specific prescription data were extracted from the computerized records for the period of January 1 through December 31, 1996. All members who received at least one prescription for these therapeutic drug categories were included in the analysis. The total

value of claims used in the analysis was $1.5 million with an average of $ 0.15 per member per eligible day.

Outline of Statistical Analysis:

The SAS program for windows (version 6.12) was used for all statistical analyses. Frequency analysis for categorical variables and univariate analysis for continuous variables was carried out. PROC UNIVARIATE and PROC PLOT were performed to assess the assumptions of normality, linearity and homoscedasticity.

Members differed in number of days eligible during fiscal year 1996. There were cases where the utilization data did not reflect a full year's experience. To adjust for this, the cost of prescription was divided by eligible days resulting in an estimate of the amount that members cost the plan per day. Therefore, the cost per member per eligible day was used as the dependent variable for statistical analyses. Frequency analysis revealed relatively few claims in states other than Tennessee. To avoid the problem of small numbers and unstable estimates, claims from states other than Tennessee were combined to form one category of "other states". Other states included: Rhode Island, Virginia, Georgia, New Jersey etc.

Claims for Ca-channel blockers, lipotropics, ACE inhibitors and beta-blockers were combined and designated as claims for cardiovascular drugs. Claims for the remaining two drug categories (antidepressants and histamine H2-blockers) were also combined.

Finally claims for all six-drug categories were combined which resulted in nine sets of claims for analysis after considering each drug category individually.

Multiple regression analyses using PROC REG were carried out to examine the relationships among plan characteristics and cost of pharmaceuticals for six drug categories and their combinations. The independent variables included in the analyses were number of days eligible, number of members eligible (group size), average wholesale price, out of pocket expense, number of days supply and quantity dispensed. Variance inflation factor tests were used to determine if multicollinearity problems existed.

In order to ensure a valid comparison, analyses of covariance (ANCOVA) were used to evaluate the differences in utilization among plan characteristics using cost of pharmaceuticals per member per eligible day as the dependent variable. ANCOVA allowed us to hold factors that might influence the cost of pharmaceuticals constant and to observe the differences only due to plan characteristics. Out-of-pocket expense was analyzed after being categorized into four (dollar) groups; 0-3, >3-9, >9-12, >12. The control variables were member age, group size, average wholesale price and number of days supply. Changes in the average wholesale price (AWP) that manufacturers charge for each unit of their product is an indicator of price inflation while days supply reflects the quantity dispensed. In some cases we found significant interaction between variables of interest (grouping variables) and the covariate indicating violation of the assumption of homogeneity of regression. Effect sizes of interactions between grouping variables and

the covariate were calculated. To understand the relative differences between groups, we also computed least square adjusted means which held the covariates constant. A value of $p <= 0.05$ was chosen as the a priori level of significance.

Two-way ANCOVAs between pharmacy type and location and between out of pocket expense and quantity dispensed were also carried out.

RESULTS:

Sample Description:

Table 1 provides information about the characteristics of enrollees. There were 29,211 subscribers (card holders) representing 64,815 enrollees eligible during fiscal year 1996. The mean age of enrollees was 31.5 years. Females comprised 52.8 % of the eligible population and males comprised 47.2 %. There were 58.2% of members in capitation plans and rest in FFS plans. Members were mainly enrolled in plans with open formulary (79%) followed by mandatory generic substitution (19.6%) and closed formulary (1.4%).

Results of Multiple Regression Models:

Table 2 summarizes results of the multiple regression using cost per member per eligible day as the dependent variable. Number of days eligible, number of members eligible, average wholesale price, out of pocket expense, number of days supply and quantity dispensed were used as independent variables. The regression models were significant at the 0.001 level of significance for all drug categories and their combinations. The explained variance in the cost of pharmaceuticals by therapeutic category ranged from

34.3% to 87.7%. This variance was lowest for beta-blockers and highest for antidepressants. Variance inflation factor tests indicated absence of multicollinearity. (table 3) For the purpose of this study, cost of pharmaceuticals was defined as the dollar expenditure per member per eligible day for prescription drugs.

Based upon this analysis, it was found that:

Number of days eligible was negatively associated with the cost of pharmaceuticals for all drug categories and their combinations.

The relationship between number of members eligible (group size) and cost of pharmaceuticals was not significant for all drug categories combined.

Cost of pharmaceuticals was positively associated with out of pocket expense for all drug categories except for ACE inhibitors and antidepressants.

Number of days supply was positively associated with cost of pharmaceuticals for all drug categories except for antidepressants.

Cost of pharmaceuticals was positively associated with quantity dispensed for all drug categories and their combinations.

Results of Analyses of Covariance:

For the purpose of this study, utilization was defined as the <u>average</u> dollar expenditure per member per eligible day for prescription drugs. Average wholesale price and days supply were selected as covariates because controlling for age and number of members eligible did not significantly improve the model fit (R^2). In some cases, interactions between average wholesale price and grouping variables as well as days supply and grouping variables were significant. Effect sizes of these interactions were calculated.

Values of these effect sizes, which approached zero, allowed the use of average wholesale price and days supply as covariates without violating the assumptions of ANCOVA. (table 10, 11) Least square means (LSMEANS) adjusted for average wholesale price and days supply were examined.

There were significant differences in utilization among various co-payment levels. Utilization was lowest for co-pay level of $>3-9 for all drug categories except for ACE inhibitors. (table 4) Significant differences in utilization were observed between the capitation and FFS mode of reimbursement. Utilization was consistently lower under capitation payment for all drug categories and their combinations. (table 5) In addition, there were significant differences in utilization among various formulary strategies. (table 6) Utilization was consistently lowest for members whose plans included mandatory generic substitution and highest for those in closed formularies.

Table 7 presents the results of analyses of covariance using cost per member per eligible day as a dependent variable and type of pharmacy as an independent variable for six drug categories and their combinations. There were significant differences in utilization between independent pharmacies and chain pharmacies; independent pharmacies being consistently lower. Two-way analyses of covariance were conducted with type of pharmacy and location of pharmacy as the independent variables. Considering all of the states together with the exception of Tennessee, utilization was highest for independent pharmacies located in the states as a group other than Tennessee. (table 8)

Least square means adjusted for average wholesale price showed that utilization was highest for co-payment levels greater than $12.00 combined with prescriptions for more than 30 days supply for all drug categories except ACE inhibitors. (table 9)

DISCUSSION:

Several limitations should be considered before discussing the results of this study. The major limitation is the comprehensiveness of the data. The database includes only products covered by the drug benefit plans. Non-prescription drugs, samples and non-formulary items (when paid for with cash by members) are typically not included. In cases where the cost of the prescription is less than the member's co-payment, the claim may not be recorded. Underreporting occurs with most third-party prescription databases [15] and may be a limitation in this study. Lastly, prescriptions filled from "out-of-network" pharmacies were not captured. Once coverage under a plan is established, the pharmacist submits a claim directly to the PBM for each prescription filled. Since pharmacy reimbursement is dependent on the submission of a claim, there are clear incentives for pharmacists to submit all eligible claims. The accuracy of the claim is monitored by the PBM through various audit checks. These data provide an accurate estimate of prescription drug expenditures under a defined coverage package. The study is also limited in terms of generalizability and it is possible that the general population behaves differently from the study population. Therefore, careful consideration should be used before extrapolating these findings beyond the study population.

It was not possible to separate out the impact of individual plan characteristics on the cost of pharmaceuticals due to the limitations of data provided. For example, plans with capitation as a mode of payment had various formulary strategies. Therefore, the impact of mode of payment on the cost of pharmaceuticals may be confounded by the effect of various formulary strategies. It should be noted that drug benefit plans differ not only in various features but also in population characteristics. The effect of a particular plan feature on the cost of pharmaceuticals may not be due to that feature alone but may be caused by differences in population characteristics. In this scenario, a prospective and experimentally controlled design may be more desirable than the retrospective and observational design of this study. This study sheds light on effect of plan characteristics on the cost of pharmaceuticals. The results should be representative of what happens when various pharmaceutical cost-containment measures are used.

The variance in the cost of pharmaceuticals explained by plan characteristics ranged from 34% to 87%. This is unusually high for regression models in which the unit of observation is the individual member's costs. It is well recognized that individuals' health care costs are largely random and reflect the unpredictability of illnesses which require care. The explained variance for antidepressants (87%) is impressive since this drug category has been associated with strong growth in recent years. [5, 1]

Number of days eligible was negatively associated with the cost of pharmaceuticals. This inverse relationship between cost of pharmaceuticals and the length of time that an individual has been eligible may be an important finding for pharmacy benefit managers

in budgeting for program costs. Stuart et al. in 1993 found a strong positive relationship between drug use and the length of time members were in the PACE (Pharmaceuticals Assistance Contract for the Elderly) program. [16] However, this result was not comparable with the results of our study. Unlike the employed population of our study, PACE is a voluntary social service program which is comprised of elderly people. For all drug categories combined, the relationship between cost of pharmaceuticals and number of members eligible was not significant. This finding shows the relative unimportance of group size on cost of pharmaceuticals and indicates business opportunity for PBMs to contract with employers irrespective of company size.

Number of days supply was positively associated with cost of pharmaceuticals. This is consistent with the experience that Express Scripts/ValueRx had with their clients. [5]

Effect of Plan Characteristics on the Cost of Pharmaceuticals:

Co-payment:

The co-payment amount for different plans ranged from $1.00 to $9.00 for generics and greater than $9.00 for brand name products. The co-payment amount of >$3.00-9.00 was associated with lowest utilization for all drug categories except for ACE inhibitors. This can be partially explained by the co-payment structure encouraging the use of generics. This co-payment structure might have resulted in the prescribing and dispensing of lower-cost generic products and ultimately lower utilization for co-payments ranging between S3.00 and $9.00. This explanation is supported by the results of a study which demonstrated that cost-sharing differentials between generic and brand name products

were associated with higher rates of generic drug use. [15] It is logical to expect prescribers to increase the average prescription size as a result of co-payment. An increased prescription size means that members receive a longer duration of therapy, thereby reducing the number of members' co-payments and increasing the average cost. Two-way analyses of covariance between co-payment and days supply showed that higher copay (greater than $12.00) and higher days supply (more than 30 days) was associated with highest utilization for all drug categories except ACE inhibitors. Ingredient cost inflation could counter the net effect of co-payment. By controlling for days supply and average wholesale price the confounding of results was prevented.

Mode of Payment:

Utilization was consistently lower for capitation than FFS for all drug categories and their combinations. The results may be encouraging for those PBMs who are accepting capitation as a mode of payment. The difference in utilization between capitated and FFS plans may be attributable to the reimbursement differences between them. Under capitation, PBMs' revenue is a function of the number of members eligible and not the number of prescriptions dispensed. As a consequence it is anticipated under capitation that PBMs would make an effort, when appropriate, to alter physician prescribing and pharmacist dispensing behavior in an effort to minimize program costs.

Formulary Status:

Plans with mandatory generic substitution demonstrated the lowest utilization among all drug categories and their combinations. These utilization patterns are likely attributable to

the lower costs of ingredients for generic drugs. These results are promising for pharmacy benefit managers since patents for a large number of commercially important drugs are scheduled to expire within the next few years thereby making generic substitution an important source of savings in drug benefit expenditures in the near future. Analysts project that generics may account for up to 65% of all prescriptions dispensed by the end of the decade. [17]

Closed formularies were associated with the highest utilization for all drug categories and their combinations. This is contradictory to the literature on formulary research which shows that an association exists between decreased cost and a well-controlled formulary. [8, 18, 19] The results have practical significance since there is a trend towards the development of more restrictive formularies. [20, 6] There are two possible explanations for the finding that closed formularies were associated with high utilization. First, the number of members enrolled in plans with closed formularies was significantly lower (1.4%) than members enrolled in plans with open formularies and mandatory generic substitution. Higher utilization among a small number of members may have resulted in higher utilization. However, the number of members eligible was used as one of the covariates and did not significantly improve explained variance.

Second, and most important, drug product manufacturers enter into rebate contracts with PBMs. The rebate amount paid by a manufacturer to a PBM is based on formulary exclusivity, sales volume and market share movement. The traditional rebate contracts are for brand name drugs. A study indicated that rebates for a specific product may be as

high as 22.5% of the product's sales. [2] The cost data used in this study have not been adjusted for rebates and, therefore, may be overestimates of the true costs.

Pharmacy Type:

Utilization was lower for independent pharmacies than chain pharmacies for all drug categories and their combinations. There are two possible explanations for this finding. First, network participation, drug availability, convenience and cost may be influential on patients' choice of pharmacies. There is a possibility that certain pharmacies may be selected by members requiring high-cost medications, resulting in high utilization for those pharmacies. Second, pharmacies vary with regard to the amount below AWP that they were paid for ingredient costs. These results indicate to PBMs and network pharmacies the importance of contract negotiation. Two-way analyses of covariance between pharmacy type and location indicated pharmacies located in Tennessee, irrespective of type, were lower utilizers than pharmacies located in other states (evaluated as a group) for all drug categories except for ACE inhibitors.

CONCLUSION:

The primary objective of this study was to evaluate whether there were differences in utilization among various plan characteristics after controlling for appropriate covariates using prescription claims data. The secondary objective was to assess the relationship among plan characteristics and cost of pharmaceuticals within various therapeutic categories.

Information for six drug categories was extracted from claims data using database management software. Statistical analyses utilizing multiple regression and analysis of covariance were carried out. Plan characteristics explained 34-87% of variance in the cost of pharmaceuticals. These included number of days eligible, number of members eligible, average wholesale price, member co-payment, number of days supply and quantity dispensed. This is unusually high for regression models where unit of observation is the individual member's costs. An inverse relationship was found between cost of pharmaceuticals and the length of time that an individual is eligible. This finding may help PBMs in budgeting by knowing that people who remain in a prescription benefit program for a long period of time tend to have lower drug costs. Also, the non-significant relationship that was found between cost of pharmaceuticals and number of members eligible indicated a lack of importance of group size in contracting with a client. Number of days supply was positively associated with cost of pharmaceuticals. This association may justify days supply limits imposed by PBMs in an effort to contain cost.

The co-payment amount for different plans ranged from $1.00 to $9.00 for generics and greater than $9.00 for brand name products. Utilization was lowest for co-payments ranging between $3.00 and $9.00. This may have resulted from more use of lower cost generic products due to co-payment differentials between generic and brand name products. Capitation as a mode of payment was associated with lower utilization than FFS. This finding may be encouraging to those PBMs who are accepting the capitation method of reimbursement. Closed formularies were associated with higher utilization than open formularies or mandatory generic substitution. This result indicates the

importance of adjusting cost of pharmaceuticals for rebates before evaluating various formulary strategies. Significant differences in utilization were found between independent pharmacies and chain pharmacies. The implications of these findings suggest the importance of contract negotiation with pharmacies.

TABLE: 1 CHARACTERISTICS OF ENROLLEES IN A PRIVATE THIRD-PARTY PRESCRIPTION PROGRAM: [*]

	# OF PARTICIPANTS (%) (N= 64815)
MEMBER AGE[†]	
1-5	5666 (8.8)
6-20	13947 (21.6)
21-40	23739 (36.8)
41-64	18788 (29.1)
>64	2352 (3.6)
Mean	31.5
MEMBER GENDER[‡]	
FEMALE	34145 (52.8)
MALE	30584 (47.2)
MODE OF PAYMENT	
CAPITATION	37696 (58.2)
FEE FOR SERVICE	27119 (41.8)
FORMULARY STATUS	
CLOSED	906 (1.4)
MANDATORY GENERIC SUBSTITUTION	12679 (19.6)
OPEN	51230 (79.0)

*: As of December 31, 1996

†: 323 missing age records

‡: 86 missing gender records

TABLE: 2 MULTIPLE REGRESSION MODEL OF COST OF PHARMACEUTICALS FOR VARIOUS DRUG CATEGORIES.
REGRESSION COEFFICIENTS (STANDARD ERROR) FOR COST OF PHARMACEUTICALS BY PLAN CHARACTERISTICS:

VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
INTERCEPT	-	-	-	-	-	-	-	-	-
# OF DAYS ELIGIBLE	-0.4589*	-0.3722*	-0.4697*	-0.2053*	-0.3726*	-0.2547*	-0.3105*	-0.2670*	-0.2785*
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
# OF MEMBERS ELIGIBLE	0.0228*	0.0557*	0.0629*	-0.0452*	0.0236†	0.0146*	0.0042	0.0185*	0.0059
	(0.0033)	(0.0054)	(0.0036)	(0.0160)	(0.0062)	(0.0040)	(0.0035)	(0.0045)	(0.0029)
AVERAGE WHOLESALE PRICE	0.6216*	0.6764*	0.3327*	0.3291*	0.3940*	0.9571*	0.6376*	0.7164*	0.6405*
	(0.0043)	(0.0042)	(0.0305)	(0.0390)	(0.0073)	(0.0089)	(0.0083)	(0.0092)	(0.0027)
OUT OF POCKET EXPENSE	0.0018	0.0493*	-0.1721*	0.2076	0.1695*	-0.0258*	0.0824*	0.1171*	0.1284*
	(0.0097)	(0.0165)	(0.0105)	(0.0412)	(0.0170)	(0.0160)	(0.0097)	(0.0150)	(0.0084)
# OF DAYS SUPPLY	0.1324*	0.2761*	0.0306*	0.1210*	0.0535*	-0.0143*	0.0696*	-0.0116	0.0453*
	(0.0170)	(0.0238)	(0.0001)	(0.0091)	(0.0043)	(0.0028)	(0.0023)	(0.0029)	(0.0018)
QUANTITY DISPENSED	0.4721*	0.2101*	0.6542*	0.2673*	0.5520*	0.4293*	0.3792*	0.4765*	0.3937*
	(0.0144)	(0.0186)	(0.0147)	(0.0557)	(0.0271)	(0.0145)	(0.0141)	(0.0157)	(0.0105)
N	6519	3343	5651	3184	4462	7809	18700	12372	31073
F	3800.21*	1752.17*	2993.54*	278.68*	1251.00*	9361.93*	5058.47*	5032.43*	9109.77*
R2	0.7778	0.7591	0.7609	0.3448	0.6275	0.8780	0.6188	0.7094	0.6376
ADJ.R2	0.7776	0.7586	0.7606	0.3435	0.6270	0.8779	0.6187	0.7093	0.6375

1: Ca CHANNEL BLOCKERS
2: LIPOTROPICS
3: ACE INHIBITORS
4: BETA-BLOCKERS
5: H2-BLOCKERS
6: ANTI DEPRESSANTS
7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)
9: COMBINING ALL SIX DRUG CATEGORIES

*: significant at 0.001
†: significant at 0.05

TABLE: 3 MULTICOLLINEARITY DIAGNOSTIC
VARIANCE INFLATION FACTOR OF INDEPENDENT VARIABLES FOR MULTIPLE REGRESSION MODELS:

VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
INTERCEPT	-	-	-	-	-	-	-	-	-
# OF DAYS ELIGIBLE	1.0380	1.0297	1.0704	1.0646	1.0669	1.0974	1.0471	1.0851	1.0588
# OF MEMBERS ELIGIBLE	1.0344	1.0632	1.0648	1.1546	1.0971	1.1068	1.0622	1.1008	1.0713
AVERAGE WHOLESALE PRICE	1.1336	1.3307	1.0058	1.1064	1.2471	2.0345	1.1584	1.5358	1.1852
OUT OF POCKET EXPENSE	1.0677	1.0724	1.0347	1.1636	1.0910	1.8163	1.0775	1.3917	1.1368
# OF DAYS SUPPLY	1.9464	1.16673	1.8436	1.9198	2.4860	1.4767	1.9350	1.6233	1.6813
QUANTITY DISPENSED	2.0193	1.7769	1.8077	1.8827	2.4676	1.6724	1.9749	1.7419	1.7239

1: Ca CHANNEL BLOCKERS
2: LIPOTROPICS
3: ACE INHIBITORS
4: BETA-BLOCKERS
5: H2-BLOCKERS
6: ANTI DEPRESSANTS
7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS (5,6)
9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 4 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY OUT OF POCKET EXPENSE FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	93.63 (0.0001)	86.22 (0.0001)	30.92 (0.0001)	146.61 (0.0001)	227.15 (0.0001)	1549.18 (0.0001)	475.73 (0.0001)	1209.26 (0.0001)	1535.40 (0.0001)
R^2	0.0396	0.0692	0.0156	0.1076	0.1234	0.3473	0.0673	0.2108	0.1214
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	90.42 (0.0001)	74.11 (0.0001)	48.47 (0.0001)	110.01 (0.0001)	188.32 (0.0001)	1181.42 (0.0001)	410.31 (0.0001)	953.86 (0.0001)	1167.29 (0.0001)
R^2	0.0504	0.0786	0.0322	0.1077	0.1347	0.3511	0.0767	0.2194	0.1228
# OF MEMBERS ELIGIBLE									
F (p)	70.39 (0.0001)	64.82 (0.0001)	23.22 (0.0001)	113.16 (0.0001)	160.83 (0.0001)	1175.38 (0.0001)	360.53 (0.0001)	901.96 (0.0001)	1143.89 (0.0001)
R^2	0.0399	0.0699	0.0159	0.1111	0.1185	0.3520	0.0685	0.2116	0.1216
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	1157.39 (0.0001)	1158.52 (0.0001)	548.27 (0.0001)	205.48 (0.0001)	457.15 (0.0001)	3466.12 (0.0001)	3082.62 (0.0001)	2612.05 (0.0001)	5638.42 (0.0001)
R^2	0.4597	0.6252	0.3203	0.2199	0.3209	0.6679	0.4383	0.4903	0.4582
LSMEANS									
0-3	0.0947	0.1311	0.0885	0.0191	0.1877	0.0969	0.0599	0.0954	0.0688
>12	0.0976	0.1301	0.0527	0.0544	0.2034	0.1047	0.0740	0.1384	0.0971
>3-9	0.0855	0.1123	0.0730	0.0189	0.1037	0.0496	0.0601	0.0780	0.0663
>9-12	0.0974	0.1355	0.0631	0.0462	0.1784	0.0909	0.0779	0.1168	0.0939

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 5 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY MODE OF PAYMENT FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
$F(p)$	227.30 (0.0001)	30.65 (0.0001)	169.32 (0.0001)	123.66 (0.0001)	255.07 (0.0001)	35.55 (0.0001)	333.13 (0.0001)	9.31 (0.0023)	152.81 (0.0001)
R^2	0.0323	0.0087	0.0282	0.0327	0.0500	0.0040	0.0165	0.0006	0.0045
ANCOVA (COVARIATE)									
MEMBER AGE									
$F(p)$	139.91 (0.0001)	30.78 (0.0001)	117.17 (0.0001)	66.63 (0.0001)	157.06 (0.0001)	33.08 (0.0001)	210.73 (0.0001)	7.66 (0.0005)	76.50 (0.0001)
R^2	0.0395	0.0174	0.0387	0.0352	0.0609	0.0075	0.0208	0.0011	0.0045
# OF MEMBERS ELIGIBLE									
$F(p)$	131.40 (0.0001)	26.76 (0.0001)	91.82 (0.0001)	61.98 (0.0001)	143.68 (0.0001)	30.35 (0.0001)	167.79 (0.0001)	5.34 (0.0048)	76.63 (0.0001)
R^2	0.0374	0.0152	0.0309	0.0331	0.0566	0.0069	0.0168	0.0007	0.0046
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
$F(p)$	2074.86 (0.0001)	1901.51 (0.0001)	841.65 (0.0001)	306.46 (0.0001)	828.36 (0.0001)	5518.96 (0.0001)	5115.96 (0.0001)	4357.58 (0.0001)	9197.68 (0.0001)
R^2	0.4778	0.6215	0.3026	0.2014	0.3393	0.6576	0.4372	0.4905	0.4529
LSMEANS									
CAPITATION	0.0812	0.1213	0.0603	0.0157	0.1160	0.0736	0.0607	0.0901	0.0722
FEE FOR SERVICE	0.1054	0.1336	0.0708	0.0310	0.2072	0.1009	0.0768	0.1238	0.0921

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 6 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY FORMULARY STATUS FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	155.63 (0.0001)	107.77 (0.0001)	114.42 (0.0001)	19.94 (0.0001)	302.29 (0.0001)	24.37 (0.0001)	63.21 (0.0001)	117.29 (0.0001)	261.53 (0.0001)
R^2	0.0437	0.0584	0.0378	0.0108	0.1110	0.0055	0.0063	0.0169	0.0154
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	125.00 (0.0001)	82.76 (0.0001)	100.53 (0.0001)	13.32 (0.0001)	209.02 (0.0001)	41.40 (0.0001)	90.58 (0.0001)	79.08 (0.0001)	175.70 (0.0001)
R^2	0.0522	0.0667	0.0492	0.0108	0.1147	0.0140	0.0135	0.0171	0.0155
# OF MEMBERS ELIGIBLE									
F (p)	108.46 (0.0001)	72.41 (0.0001)	80.96 (0.0001)	17.16 (0.0001)	213.45 (0.0001)	16.28 (0.0001)	60.44 (0.0001)	79.56 (0.0001)	183.71 (0.0001)
R^2	0.0459	0.0592	0.0405	0.0140	0.1180	0.0056	0.0091	0.0174	0.0164
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	1573.79 (0.0001)	1433.91 (0.0001)	683.38 (0.0001)	223.60 (0.0001)	709.22 (0.0001)	4517.24 (0.0001)	3933.52 (0.0001)	3626.74 (0.0001)	7420.19 (0.0001)
R^2	0.4806	0.6228	0.3197	0.1970	0.3696	0.6771	0.4434	0.5166	0.4710
LSMEANS									
CLOSED	0.6534	0.3526	0.2442	0.0611	0.7353	0.3733	0.2751	0.4360	0.3389
OPEN	0.0942	0.1300	0.0652	0.0296	0.1495	0.0857	0.0728	0.1048	0.0847
MANDATORY GENERIC SUBSTITUTION	0.0900	0.1226	0.0626	0.0147	0.1418	0.0703	0.0565	0.0872	0.0669

1: Ca CHANNEL BLOCKERS
2: LIPOTROPICS
3: ACE INHIBITORS
4: BETA-BLOCKERS
5: H2-BLOCKERS
6: ANTI DEPRESSANTS
7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 7 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY PHARMACY TYPE FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
$F(p)$	76.40 (0.0001)	39.77 (0.0001)	47.92 (0.0001)	44.00 (0.0001)	61.46 (0.0001)	0.28 (0.5936)	132.71 (0.0001)	9.84 (0.0017)	116.44 (0.0001)
R^2	0.0111	0.0113	0.0081	0.0119	0.0125	0.0000	0.0066	0.0007	0.0034
ANCOVA (COVARIATE)									
MEMBER AGE									
$F(p)$	97.08 (0.0001)	42.32 (0.0001)	77.57 (0.0001)	22.11 (0.0001)	85.07 (0.0001)	23.24 (0.0001)	159.15 (0.0001)	9.51 (0.0001)	61.76 (0.0001)
R^2	0.0277	0.0237	0.0259	0.0119	0.0339	0.0052	0.0158	0.0013	0.0036
# OF MEMBERS ELIGIBLE									
$F(p)$	39.98 (0.0001)	23.91 (0.0001)	25.30 (0.0001)	43.25 (0.0001)	33.28 (0.0001)	2.80 (0.0610)	80.57 (0.0001)	8.05 (0.0003)	66.01 (0.0001)
R^2	0.0116	0.0136	0.0087	0.0233	0.0137	0.0006	0.0081	0.0011	0.0039
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
$F(p)$	1894.87 (0.0001)	1886.60 (0.0001)	805.63 (0.0001)	227.82 (0.0001)	584.22 (0.0001)	5294.23 (0.0001)	4912.71 (0.0001)	4180.80 (0.0001)	8884.24 (0.0001)
R^2	0.4552	0.6196	0.2935	0.1579	0.2659	0.6482	0.4273	0.4802	0.4443
LSMEANS									
CHAIN	0.0969	0.1336	0.0672	0.0252	0.1620	0.0860	0.0714	0.1057	0.0838
INDEPENDENTS	0.0833	0.1054	0.0598	0.0185	0.1439	0.0831	0.0617	0.1052	0.0761

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 8 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY PHARMACY TYPE AND LOCATION FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	288.25 (0.0001)	165.01 (0.0001)	202.23 (0.0001)	89.06 (0.0001)	217.67 (0.0001)	15.21 (0.0001)	435.46 (0.0001)	117.04 (0.0001)	425.23 (0.0001)
R^2	0.1130	0.1248	0.0946	0.0685	0.1197	0.0052	0.0621	0.0253	0.0369
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	230.29 (0.0001)	130.10 (0.0001)	164.37 (0.0001)	67.74 (0.0001)	185.72 (0.0001)	25.90 (0.0001)	346.77 (0.0001)	88.03 (0.0001)	320.65 (0.0001)
R^2	0.1195	0.1304	0.1019	0.0694	0.1340	0.0117	0.0657	0.0253	0.0371
# OF MEMBERS ELIGIBLE									
F (p)	216.79 (0.0001)	123.99 (0.0001)	150.90 (0.0001)	82.12 (0.0001)	167.42 (0.0001)	13.15 (0.0001)	338.06 (0.0001)	91.55 (0.0001)	325.72 (0.0001)
R^2	0.1139	0.1259	0.0951	0.0835	0.1237	0.0060	0.0647	0.0266	0.0380
AVERAGE WHOLESALE PRICE AND DAYS SUPPLY									
F (p)	1139.29 (0.0001)	1133.13 (0.0001)	486.68 (0.0001)	145.64 (0.0001)	356.45 (0.0001)	3171.99 (0.0001)	2947.01 (0.0001)	2524.06 (0.0001)	5327.21 (0.0001)
R^2	0.4565	0.6202	0.2954	0.1670	0.2708	0.6484	0.4278	0.4827	0.4449
LSMEANS									
CHAIN – OTHER	0.0946	0.1289	0.0624	0.0337	0.1881	0.0881	0.0714	0.1223	0.0881
CHAIN – TN[*]	0.0943	0.1303	0.0659	0.0222	0.1548	0.0848	0.0686	0.1007	0.0810
INDEPENDENT –OTHER	0.1329	0.1534	0.0504	0.0514	0.2832	0.1568	0.0735	0.1971	0.1009
INDEPENDENTS – TN[*]	0.0928	0.1206	0.0677	0.0198	0.1522	0.0861	0.0689	0.1159	0.0829

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)   *: TENNESSEE
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 9 ANALYSIS OF COVARIANCE OF COST OF PHARMACEUTICALS BY OUT OF POCKET EXPENSE AND # OF DAYS SUPPLY FOR VARIOUS DRUG CATEGORIES:

	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
ANOVA									
F (p)	174.59 (0.0001)	166.97 (0.0001)	134.84 (0.0001)	106.44 (0.0001)	200.82 (0.0001)	714.02 (0.0001)	452.78 (0.0001)	619.26 (0.0001)	919.70 (0.0001)
R^2	0.1523	0.2519	0.1396	0.1698	0.2252	0.3641	0.1383	0.2421	0.1619
ANCOVA (COVARIATE)									
MEMBER AGE									
F (p)	163.46 (0.0001)	153.46 (0.0001)	129.81 (0.0001)	93.18 (0.0001)	184.23 (0.0001)	632.73 (0.0001)	423.15 (0.0001)	561.07 (0.0001)	808.26 (0.0001)
R^2	0.1613	0.2613	0.1515	0.1699	0.2336	0.3670	0.1463	0.2485	0.1625
# OF MEMBERS ELIGIBLE									
F (p)	155.59 (0.0001)	145.41 (0.0001)	119.87 (0.0001)	100.44 (0.0001)	177.32 (0.0001)	638.44 (0.0001)	417.35 (0.0001)	548.05 (0.0001)	817.73 (0.0001)
R^2	0.2231	0.3107	0.2145	0.2199	0.4714	0.5037	0.2437	0.4248	0.2839
AVERAGE WHOLESALE PRICE									
F (p)	593.03 (0.0001)	689.34 (0.0001)	275.23 (0.0001)	124.53 (0.0001)	233.39 (0.0001)	2065.26 (0.0001)	1791.25 (0.0001)	1533.64 (0.0001)	3299.19 (0.0001)
R^2	0.4110	0.6138	0.2747	0.2148	0.2786	0.6573	0.4205	0.4748	0.4419
LSMEANS									
(0-3) – 30	0.0910	0.1137	0.0785	0.0165	0.1798	0.0936	0.0556	0.0921	0.0652
(0-3) - >30	0.1831	0.2933	0.2797	0.0429	0.1805	0.1279	0.1091	0.1174	0.1084
(>12) – 30	0.0836	0.1066	0.0456	0.0443	0.1811	0.0994	0.0620	0.1278	0.0844
(>12) - >30	0.2931	0.3607	0.1635	0.1713	0.6477	0.2455	0.2199	0.3761	0.2760
(>3-9) – 30	0.0760	0.0963	0.0644	0.0154	0.0918	0.0449	0.0523	0.0707	0.0589
(>3-9) - >30	0.1067	0.2665	0.1155	0.0423	0.1494	0.1189	0.0973	0.1206	0.1103
(>9-12) – 30	0.0871	0.1165	0.0570	0.0414	0.1582	0.0858	0.0692	0.1073	0.0847
(>9-12) - >30	0.2058	0.2986	0.1249	0.0778	0.4965	0.1952	0.1558	0.2971	0.1253

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI-DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 10 EFFECT SIZE OF INTERACTION BETWEEN DAYS SUPPLY (COVARIATE) AND GROUPING VARIABLE FOR VARIOUS DRUG CATEGORIES:

GROUPING VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
MODE OF PAYMENT	0.0003	0.0004	0.0005	0.0051	0.0030	0.0008	0.0005	0.0015	0.0010
OUT OF POCKET EXPENSE	0.0035	0.0004	0.0011	0.0013	0.0093	0.0013	0.0012	0.0019	0.0008
FORMULARY STATUS	0.0004	-0.0002	0.0012	0.0027	0.0022	0.0000	0.0005	0.0004	0.0004
PHARMACY TYPE	0.0004	0.0025	-0.0001	0.0001	0.0002	0.0000	0.0009	0.0000	0.0002
PHARMACY TYPE AND LOCATION	0.0063	0.0030	0.0018	-0.0001	0.0016	0.0005	0.0010	0.0002	0.0002

1: Ca CHANNEL BLOCKERS 4: BETA-BLOCKERS 7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS 5: H2-BLOCKERS 8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS 6: ANTI DEPRESSANTS 9: COMBINING ALL SIX DRUG CATEGORIES

TABLE: 11 EFFECT SIZE OF INTERACTION BETWEEN AVERAGE WHOLESALE PRICE (COVARIATE) AND GROUPING VARIABLE FOR VARIOUS DRUG CATEGORIES:

GROUPING VARIABLE	DRUG CATEGORY								
	1	2	3	4	5	6	7	8	9
MODE OF PAYMENT	0.0024	0.0004	0.0000	0.0003	0.0002	0.0166	0.0019	0.0005	0.0003
OUT OF POCKET EXPENSE	0.0092	0.0133	0.0045	0.0034	-0.0001	0.0106	0.0049	0.0229	0.0268
FORMULARY STATUS	0.0015	0.0026	0.0002	0.0011	0.0004	0.0065	0.0021	0.0070	0.0028
PHARMACY TYPE	0.0000	0.0001	-0.0001	0.0048	-0.0001	0.0001	0.0001	0.0082	0.0004
PHARMACY TYPE AND LOCATION	0.0006	0.0038	-0.0003	0.0053	0.0007	0.0002	0.0007	0.0085	0.0012
OUT OF POCKET EXPENSE AND # OF DAYS SUPPLY	0.0084	0.0151	0.0065	0.0122	-0.0010	0.0112	0.0055	0.0231	0.0265

1: Ca CHANNEL BLOCKERS   4: BETA-BLOCKERS   7: COMBINING CARDIOVASCULAR DRUGS (1,2,3,4)
2: LIPOTROPICS   5: H2-BLOCKERS   8: COMBINING H2-BLOCKERS AND ANTI DEPRESSANTS
3: ACE INHIBITORS   6: ANTI DEPRESSANTS   9: COMBINING ALL SIX DRUG CATEGORIES

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SECTION II

APPENDIX

.

SAS PROGRAM:

```
OPTIONS LS=65 PS=60;
LIBNAME ALMAS'C:\SEPTEM';

DATA ALMAS.BETA1;
SET WORK.BETA1;
IF NRXS=-1 THEN DELETE;
RUN;
PROC CONTENTS DATA=ALMAS.BETA1;
RUN;


PROC FREQ DATA=ALMAS.BETA1 ORDER=FREQ;
TABLES CACCOUNT CBRANDNA CCARRIER CCATCODE CCHAINCO CDAWIND
CDOSEFOR CGENIND CGENNAME CGENPROD CGROUP CLTC CMACIND
CMCO CMEMGEND CNAME COCCUPAT CPRODTYP CREFILL CSTATE
CSTRENGT FFSCAP FORMULAR MANFGNAM  NDAYSUPP NQTYDISP
NRXS REGION TYPE NCOPAYAM;
RUN;


OPTIONS FMTSEARCH=(ALMAS);
PROC FORMAT LIBRARY= ALMAS;
VALUE SCSTATE 'AL'='SE' 'KY'='SE' 'MS'='SE' 'TN'='SE'

              'AK'='WT' 'AZ'='WT' 'CO'='WT' 'ID'='WT'
              'MT'='WT' 'NM'='WT' 'ND'='WT' 'OR'='WT'
              'SD'='WT' 'UT'='WT' 'WA'='WT' 'WY'='WT'

              'CA'='PC' 'HI'='PC' 'NV'='PC'

              'CT'='NE' 'ME'='NE' 'MA'='NE' 'NH'='NE'
              'NY'='NE' 'RI'='NE' 'VT'='NE'

              'DE'='MA' 'DC'='MA' 'MD'='MA' 'NJ'='MA'
              'PA'='MA' 'VA'='MA' 'WV'='MA'

              'FL'='SA' 'GA'='SA' 'NC'='SA' 'PR'='SA'
              'SC'='SA' 'VI'='SA'

              'IL'='NC' 'IN'='NC' 'MI'='NC' 'MN'='NC'
              'OH'='NC' 'WI'='NC'

              'AR'='SC' 'IA'='SC' 'KS'='SC' 'LA'='SC'
              'MO'='SC' 'NE'='SC' 'OK'='SC' 'TX'='SC';


VALUE SCGENNAME 'CIMETIDINE TAB'='CIMETIDINE'
                'FAMOTIDINE TAB'='FAMOTIDINE'
                'NIZATIDINE CAP'='NIZATIDINE'
                'FAMOTIDINE SUS'='FAMOTIDINE'
                'RANITIDINE TAB'='RANITIDINE';
```

88

```
VALUE $CBRANDNA 'METOPROLOL TARTRATE'='METOPROLOL TARTRATE'
                'PROPRANOLOL   TAB 10MG'='PROPRANOLOL'
                'PROPRANOLOL   TAB 20MG'='PROPRANOLOL';
VALUE $CDOSEFOR 'TBCR'='CONTROLLED RELEASE TABLETS'
                'CPCR'='CONTROLLED RELEASE CAPSULES'
                'TABS'='TABLETS'
                'CAPS'='CAPSULES'
                'POWD'='POWDER'
                'PACK'='POWDER,PACKET'
                'GRAN'='GRANULES'
                'SOLN'='SOLUTION'
                'SYRP'='SYRUP'
                'SUSP'='SUSPENSION';


VALUE $MEMGEND 'F'='FEMALE'
               'M'='MALE';

VALUE $CDAWIND 'O'='NO'
               '1'='YES';

VALUE $CMACIND '1'='NO'
               'Y'='YES';

VALUE $CPRODTYP 'F'='PRESCRIPTION'
                'O'='OVER THE COUNTER';

VALUE $CGENPROD '1'='GENERIC'
                '3'='GENERIC'
                '2'='BRAND';

VALUE $CGENIND '1'='MULTIPLE SOURCE'
               '2'='SINGLE SOURCE';

VALUE $FFSCAP 'F'='FEE FOR SERVICE'
              'C'='CAPITATION';

VALUE $FROMULAR 'C'='CLOSED'
                'O'='OPEN'
                'M'='MENDATORY GENERIC SUBSTITUTION';

VALUE $COCCUPAT '1'='MANAGEMENT'
                '2'='COMMERCE'
                '3'='SCIENCES'
                '4'='HEALTH'
                '5'='SOCIAL SCIENCES, LAWYERS, EDUCATORS'
                '6'='ART'
                '7'='SALES AND SERVICES'
                '8'='TRADES AND TRANSPORT'
                '9'='PRIMARY INDUSTRIES'
                '10'='MANUFACTURING'
                '11'='CONTRACTORS';

VALUE $CCHAINCO '    '='INDEPENDENT';

RUN;
```

```
DATA ALMAS.BETA2;
SET ALMAS.BETA1;
IF CGROUP='8018' THEN DELETE;


LABEL CACCOUNT='ACCOUNT NUMBER'
      CBRANDNA='BRAND NAME'
      CCARRIER='CARRIER NAME'
      CCATCODE='EXCEPTIONAL DRUG CATEGORY CODE'
      CCHAINCO='PHARMACY CHAIN CODE'
      CDAWIND='DISPENSED AS WRITTEN INDICATOR'
      CDOSEFOR='DOSAGE FORM'
      CGENIND='SOURCE OF THE DRUG'
      CGENNAME='GENERIC NAME'
      CGENPROD='BRAND/GENERIC'
      CGROUP='GROUP NUMBER'
      CLTC='LONG TERM CARE INDICATOR'
      CMACIND='MAXIMUM ALLOWABLE COST INDICATOR'
      CMCO='MANAGED CARE ORGANIZATION'
      CMEMGEND='MEMBER GENDER'
      CMEMID='MEMBER IDENTIFICATION NUMBER'
      CNAME='PHARMACY CHAIN NAME'
      COCCUPAT='OCCUPATION OF THE MEMBER'
      CPHARMNO='PHARMACY NUMBER'
      CPRODTYP='PRESCRIPTION/OTC'
      CREFILL='NUMBER OF REFILLS'
      CSTATE='LOCATION OF THE PHARMACY'
      CSTRENGT='STRENGTH OF THE DOSAGE FORM'
      DAWP1='DATE OF AVERAGE WHOLESALE PRICE'
      DSERVICE='DATE OF SERVICE'
      FFSCAP='FEE FOR SERVICE/CAPITATION'
      FROMULAR='FORMULARY'
      MANFGNAM='NAME OF THE MANUFACTURER'
      NAWP1='AVERAGE WHOLESALE PRICE'
      NBDINGRE='BILLED INGREDIENT SUBMITTED BY PHARMACY'
      NCOPAYAM='COPAYMENT'
      NMEMAGE='AGE OF THE MEMBER'
      NPAIDAMT='AMOUNT PAID TO PHARMACY'
      NPAYINGR='AMOUNT PAID TO PHARMACY FOR INGREDIENT'
      NPROFFEE='FEE CHARGED BY PHARMACY FOR FILLING THE RX'
      NQTYDISP='TOTAL UNITS DISPENSED'
      NRXS='NUMBER OF PRESCRIPTION'
      REGION='PLAN REGION'
      TYPE='HMO/PPO'
      NDAYSUPP='NUMBER OF DAYS SUPPLY'
      NELIG='NUMBER OF MEMBERS ELIGIBLE'
      NPHARMAM='COST OF RX TO PRO-MARK'
      TOTDELIG='NUMBER OF DAYS ELIGIBLE FOR MEMBER'

      SQCOPAY='SQRT(COPAYMENT)'
      LCOPAYAM='LOG(COPAYMENT)'

      SQDAYSUP='SQRT(NUMBER OF DAYS SUPPLY)'
      LDAYSUPP='LOG(NUMBER OF DAYS SUPPLY)'

      SQRTELIG='SQRT(NUMBER OF MEMBERS ELIGIBLE)'
      LELIG='LOG(NUMBER OF MEMBERS ELIGIBLE)'
```

```
        SQMEMAGE='SQRT(MEMBER AGE)'
        LMEMAGE='LOG(MEMBER AGE)'

        SQPHARAM='SQRT(COST OF RX TO PRO-MARK)'
        LPHARMAM='LOG(COST OF RX TO PRO-MARK)'

        SQTYDISP='SQRT(TOTAL UNITS DISPENSED)'
        LQTYDISP='LOG(TOTAL UNITS DISPENSED)'

        SQTOTDEL='SQRT(NUMBER OF DAYS ELIGIBLE FOR MEMBER)'
        LTOTDELI='LOG(NUMBER OF DAYS ELIGIBLE FOR MEMBER)'
        RFTOTDEL='REFLECTED NUMBER OF DAYS ELIGIBLE FOR MEMBER'
        SQRFTOTD='SQRT(REFLECTED NUMBER OF DAYS ELIGIBLE FOR MEMBER'
        LRFTOTDE='LOG(REFLECTED NUMBER OF DAYS ELIGIBLE FOR MEMBER'
        INRFTOTD='INV(REFLECTED NUMBER OF DAYS ELIGIBLE FOR MEMBER'

        SNAWP1='SQRT(NAWP1)'
        LNAWP1='LOG(NAWP1)'

        CMEMGEN1='DUMMY VAR. FOR GENDER'

        CCOPAYAM='CAT. VAR FOR COPAYMENT'

        LPHAR='LOCATION OF PHARMACY (STATE)'

        CHAINCO='MODIFIED VAR. FOR PHARMACY TYPE'

        SUPPLY='MODIFIED VAR. FOR DAYS SUPPLY';

FROMULAR=FORMULAR;
NAWP2=NAWP1;
CGENNAME=SCAN(CGENNAME,1);

IF NMEMAGE=996 THEN DELETE;
IF TOTDELIG>366 THEN TOTDELIG=366;

SQCOPAY=SQRT(NCOPAYAM);
LCOPAYAM=LOG10(NCOPAYAM);

SQDAYSUP=SQRT(NDAYSUPP);
LDAYSUPP=LOG10(NDAYSUPP);

SQRTELIG=SQRT(NELIG);
LELIG=LOG10(NELIG);

SQMEMAGE=SQRT(NMEMAGE);
LMEMAGE=LOG10(NMEMAGE);

SQPHARAM=SQRT(NPHARMAM);
LPHARMAM=LOG10(NPHARMAM);

SQTYDISP=SQRT(NQTYDISP);
LQTYDISP=LOG10(NQTYDISP);

SQTOTDEL=SQRT(TOTDELIG);
LTOTDELI=LOG10(TOTDELIG);
```

```
RFTOTDEL=367- TOTDELIG;
SQRFTOTD=SQRT(RFTOTDEL);
LRFTOTDE=LOG10(RFTOTDEL);
INRFTOTD=1/RFTOTDEL;

SNAWP1=SQRT(NAWP1);
LNAWP1=LOG10(NAWP1);

IF CMEMGEND='F' THEN MEMGEN1=0;
IF CMEMGEND='M' THEN MEMGEN1=1;

LENGTH CCOPAYAM $10;
IF 0<=NCOPAYAM<=3 THEN CCOPAYAM='0-3';
IF 3<NCOPAYAM<=9 THEN CCOPAYAM='>3-9';
IF 9<NCOPAYAM<=12 THEN CCOPAYAM='>9-12';
IF 12<NCOPAYAM THEN CCOPAYAM='>12';

LENGTH LPHAR $10;
LPHAR=CSTATE;

LENGTH CHAINCO $10;
CHAINCO=CCHAINCO;
IF CCHAINCO='    ' THEN CHAINCO='IN';
ELSE CHAINCO='CH';

LENGTH SUPPLY $10;
SUPPLY=NDAYSUPP;
IF 0<NDAYSUPP<=30 THEN SUPPLY='=>30';
IF 31<=NDAYSUPP<=180 THEN SUPPLY='<30';

LENGTH STATE $10;
IF CSTATE='AL' THEN STATE='OTHER';
IF CSTATE='KY' THEN STATE='OTHER';
IF CSTATE='MS' THEN STATE='OTHER';
IF CSTATE='TN' THEN STATE='TN';

IF CSTATE='AK' THEN STATE='OTHER';
IF CSTATE='AZ' THEN STATE='OTHER';
IF CSTATE='CO' THEN STATE='OTHER';
IF CSTATE='ID' THEN STATE='OTHER';
IF CSTATE='MT' THEN STATE='OTHER';
IF CSTATE='NM' THEN STATE='OTHER';
IF CSTATE='ND' THEN STATE='OTHER';
IF CSTATE='OR' THEN STATE='OTHER';
IF CSTATE='SD' THEN STATE='OTHER';
IF CSTATE='UT' THEN STATE='OTHER';
IF CSTATE='WA' THEN STATE='OTHER';
IF CSTATE='WY' THEN STATE='OTHER';

IF CSTATE='CA' THEN STATE='OTHER';
IF CSTATE='HI' THEN STATE='OTHER';
IF CSTATE='NV' THEN STATE='OTHER';

IF CSTATE='CT' THEN STATE='OTHER';
IF CSTATE='ME' THEN STATE='OTHER';
IF CSTATE='MA' THEN STATE='OTHER';
IF CSTATE='NH' THEN STATE='OTHER';
```

```
IF CSTATE='NY' THEN STATE='OTHER';
IF CSTATE='RI' THEN STATE='OTHER';
IF CSTATE='VT' THEN STATE='OTHER';

IF CSTATE='DE' THEN STATE='OTHER';
IF CSTATE='DC' THEN STATE='OTHER';
IF CSTATE='MD' THEN STATE='OTHER';
IF CSTATE='NJ' THEN STATE='OTHER';
IF CSTATE='PA' THEN STATE='OTHER';
IF CSTATE='VA' THEN STATE='OTHER';
IF CSTATE='WV' THEN STATE='OTHER';

IF CSTATE='FL' THEN STATE='OTHER';
IF CSTATE='GA' THEN STATE='OTHER';
IF CSTATE='NC' THEN STATE='OTHER';
IF CSTATE='PR' THEN STATE='OTHER';
IF CSTATE='SC' THEN STATE='OTHER';
IF CSTATE='VI' THEN STATE='OTHER';

IF CSTATE='IL' THEN STATE='OTHER';
IF CSTATE='IN' THEN STATE='OTHER';
IF CSTATE='MI' THEN STATE='OTHER';
IF CSTATE='MN' THEN STATE='OTHER';
IF CSTATE='OH' THEN STATE='OTHER';
IF CSTATE='WI' THEN STATE='OTHER';

IF CSTATE='AR' THEN STATE='OTHER';
IF CSTATE='IA' THEN STATE='OTHER';
IF CSTATE='KS' THEN STATE='OTHER';
IF CSTATE='LA' THEN STATE='OTHER';
IF CSTATE='MO' THEN STATE='OTHER';
IF CSTATE='NE' THEN STATE='OTHER';
IF CSTATE='OK' THEN STATE='OTHER';
IF CSTATE='TX' THEN STATE='OTHER';


LENGTH OCCUPAT1 $10;
LABEL OCCUPAT1='MODIFIED VAR. FOR OCCUPATION';

IF COCCUPAT='1' THEN OCCUPAT1='1';
IF COCCUPAT='4' THEN OCCUPAT1='4';
IF COCCUPAT='7' THEN OCCUPAT1='7';
IF COCCUPAT='10' THEN OCCUPAT1='10';
IF COCCUPAT='11' THEN OCCUPAT1='OTHER';
IF COCCUPAT='2' THEN OCCUPAT1='OTHER';
IF COCCUPAT='6' THEN OCCUPAT1='OTHER';
IF COCCUPAT='8' THEN OCCUPAT1='OTHER';
IF COCCUPAT='9' THEN OCCUPAT1='OTHER';
IF COCCUPAT='5' THEN OCCUPAT1='OTHER';


LABEL STATE1='DUMMY FOR LOCATION'
      OCCUP1='DUMMY FOR MANFG.'
      OCCUP2='DUMMY FOR HEALTH'
      OCCUP3='DUMMY FOR S&S'
      OCCUP4='DUMMY FOR MGMT.';
```

93

```
IF STATE='TN' THEN STATE1=1;
IF STATE='OTHER' THEN STATE1=0;

IF OCCUPAT1='10' THEN OCCUP1=1;
IF OCCUPAT1='10' THEN OCCUP2=0;
IF OCCUPAT1='10' THEN OCCUP3=0;
IF OCCUPAT1='10' THEN OCCUP4=0;
IF OCCUPAT1='4'  THEN OCCUP1=0;
IF OCCUPAT1='4'  THEN OCCUP2=1;
IF OCCUPAT1='4'  THEN OCCUP3=0;
IF OCCUPAT1='4'  THEN OCCUP4=0;
IF OCCUPAT1='7'  THEN OCCUP1=0;
IF OCCUPAT1='7'  THEN OCCUP2=0;
IF OCCUPAT1='7'  THEN OCCUP3=1;
IF OCCUPAT1='7'  THEN OCCUP4=0;
IF OCCUPAT1='1' THEN OCCUP1=0;
IF OCCUPAT1='1' THEN OCCUP2=0;
IF OCCUPAT1='1' THEN OCCUP3=0;
IF OCCUPAT1='1' THEN OCCUP4=1;
IF OCCUPAT1='OTHER' THEN OCCUP1=0;
IF OCCUPAT1='OTHER' THEN OCCUP2=0;
IF OCCUPAT1='OTHER' THEN OCCUP3=0;
IF OCCUPAT1='OTHER' THEN OCCUP4=0;


LABEL NMEMAGE1='CAT. VAR FOR AGE';
LENGTH NMEMAGE1 $15;
IF 0<=NMEMAGE<=5 THEN NMEMAGE1='1-5';
IF 6<=NMEMAGE<=20 THEN NMEMAGE1='6-20';
IF 21<=NMEMAGE<=40 THEN NMEMAGE1='21-40';
IF 41<=NMEMAGE<=64 THEN NMEMAGE1='41-64';
IF 65<=NMEMAGE THEN NMEMAGE1='>65';


LABEL CPD='COST PER DAY'
      SCPD='SQRT(COST PER DAY)'
      LCPD='LOG10(COST PER DAY)';
CPD=NPHARMAM/TOTDELIG;
SCPD=SQRT(CPD);
LCPD=LOG10(CPD);



LABEL INTGENST='INTERACTION GENDER & STATE'
      INTGENO1='INTERACTION GENDER & OCCUPATION1'
      INTGENO2='INTERACTION GENDER & OCCUPATION2'
      INTGENO3='INTERACTION GENDER & OCCUPATION3'
      INTGENO4='INTERACTION GENDER & OCCUPATION4';

INTGENST=MEMGEN1*STATE1;
INTGENO1=MEMGEN1*OCCUP1;
INTGENO2=MEMGEN1*OCCUP2;
INTGENO3=MEMGEN1*OCCUP3;
INTGENO4=MEMGEN1*OCCUP4;
```

```
FORMAT CSTATE $CSTATE. CBRANDNA $CBRANDNA.
         CDOSEFOR $CDOSEFOR. CMEMGEND $MEMGEND. CDAWIND $CDAWIND.
         CMACIND $CMACIND. CPRODTYP $CPRODTYP. CGENPROD $CGENPROD.
         CGENIND $CGENIND. FFSCAP $FFSCAP. FROMULAR $FROMULAR.
         COCCUPAT $COCCUPAT. CCHAINCO $CCHAINCO.;

RUN;


PROC CONTENTS DATA=ALMAS.BETA2;
RUN;


PROC FREQ DATA=ALMAS.BETA2 ORDER=FREQ;
TABLES CACCOUNT CBRANDNA CCARRIER CCATCODE CCHAINCO CDAWIND
CDOSEFOR CGENIND CGENNAME CGENPROD CGROUP CLTC CMACIND
CMCO CMEMGEND CNAME COCCUPAT CPRODTYP CREFILL CSTATE
CSTRENGT FFSCAP FROMULAR MANFGNAM  NDAYSUPP NQTYDISP
NRXS REGION TYPE NCOPAYAM;
RUN;


PROC UNIVARIATE DATA=ALMAS.BETA2 NORMAL PLOT;
VAR NCOPAYAM SQCOPAY LCOPAYAM NDAYSUPP SQDAYSUP LDAYSUPP
NELIG SQRTELIG LELIG NMEMAGE SQMEMAGE LMEMAGE
NPHARMAM SQPHARAM LPHARMAM NQTYDISP SQTYDISP LQTYDISP
TOTDELIG SQTOTDEL LTOTDELI SQRFTOTD LRFTOTDE INRFTOTD
NAWP1 SNAWP1 LNAWP1;
RUN;


PROC UNIVARIATE DATA=ALMAS.BETA2 NORMAL PLOT;
VAR NPAYINGR;
RUN;


PROC UNIVARIATE DATA=ALMAS.BETA2 NORMAL PLOT;
VAR CPD SCPD LCPD;
RUN;


PROC PLOT DATA=ALMAS.BETA2;
PLOT SQPHARAM*LCOPAYAM SQPHARAM*SQDAYSUP SQPHARAM*LELIG
     SQPHARAM*NMEMAGE SQPHARAM*LQTYDISP SQPHARAM*TOTDELIG
     SQPHARAM*SNAWP1;
RUN;


DATA ALMAS.BETA3;
SET ALMAS.BETA2;

LABEL CMEMID1='PROCESS VARIABLE FOR MEMID'
      CMEMID2='VARIABLE FOR SUBSCRIBER ONLY';

CMEMID1=SUBSTR(CMEMID,10,2);
CMEMID2=CMEMID1;
```

```
IF CCARRIER='RIP001' AND CMEMID1='  ' THEN CMEMID2='01';
IF CCARRIER='TNC012' AND CMEMID1='E1' THEN CMEMID2='01';
IF CCARRIER='TNC019' AND CMEMID1='e ' THEN CMEMID2='01';
IF CCARRIER='TNC100' AND CMEMID1='OO' THEN CMEMID2='01';
IF CCARRIER='TNC107' AND CACCOUNT='716' AND CMEMID1='E'  THEN CMEMID2='01';
IF CCARRIER='TNC107' AND CACCOUNT='CORR' AND CMEMID1='OO' THEN CMEMID2='01';
IF CCARRIER='TNC107' AND CACCOUNT='CSA' AND CMEMID1='E'  THEN CMEMID2='01';
IF CCARRIER='TNC107' AND CACCOUNT='GGCI' AND CMEMID1='OO' THEN CMEMID2='01';
RUN;


DATA ALMAS.BETA4;
SET ALMAS.BETA3;
IF CMEMID2='01';


LENGTH OCCUPAT1 $10;
LABEL OCCUPAT1='MODIFIED VAR. FOR OCCUPATION';

IF COCCUPAT='1' THEN OCCUPAT1='1';
IF COCCUPAT='4' THEN OCCUPAT1='4';
IF COCCUPAT='7' THEN OCCUPAT1='7';
IF COCCUPAT='10' THEN OCCUPAT1='10';
IF COCCUPAT='11' THEN OCCUPAT1='OTHER';
IF COCCUPAT='2' THEN OCCUPAT1='OTHER';
IF COCCUPAT='6' THEN OCCUPAT1='OTHER';
IF COCCUPAT='8' THEN OCCUPAT1='OTHER';
IF COCCUPAT='9' THEN OCCUPAT1='OTHER';
IF COCCUPAT='5' THEN OCCUPAT1='OTHER';


LABEL CPD='COST PER DAY'
      SCPD='SQRT(COST PER DAY)'
      LCPD='LOG10(COST PER DAY)';
CPD=NPHARMAM/TOTDELIG;
SCPD=SQRT(CPD);
LCPD=LOG10(CPD);
RUN;


PROC UNIVARIATE DATA=ALMAS.BETA4 NORMAL PLOT;
VAR CPD SCPD LCPD;
RUN;


PROC PRINT DATA=ALMAS.BETA4 (FIRSTOBS=1 OBS=100);
VAR CCARRIER CACCOUNT CGROUP CMEMID CMEMID1 CMEMID2;
RUN;


PROC FREQ DATA=ALMAS.BETA4 ORDER=FREQ;
TABLES CACCOUNT CBRANDNA CCARRIER CCATCODE CCHAINCO CDAWIND
CDOSEFOR CGENIND CGENNAME CGENPROD CGROUP CLTC CMACIND
CMCO CMEMGEND CNAME COCCUPAT CPRODTYP CREFILL CSTATE
CSTRENGT FFSCAP FROMULAR MANFGNAM  NDAYSUPP NQTYDISP
NRXS REGION TYPE;
RUN;
```

```
PROC UNIVARIATE DATA=ALMAS.BETA4 NORMAL PLOT;
VAR NCOPAYAM SQCOPAY LCOPAYAM NDAYSUPP SQDAYSUP LDAYSUPP
NELIG SQRTELIG LELIG NMEMAGE SQMEMAGE LMEMAGE
NPHARMAM SQPHARAM LPHARMAM NQTYDISP SQTYDISP LQTYDISP
TOTDELIG SQTOTDEL LTOTDELI SQRFTOTD LRFTOTDE INRFTOTD
NAWP1 SNAWP1 LNAWP1;
RUN;


PROC PLOT DATA=ALMAS.BETA4;
PLOT LPHARMAM*LCOPAYAM LPHARMAM*SQDAYSUP LPHARMAM*LELIG
     LPHARMAM*NMEMAGE LPHARMAM*LQTYDISP LPHARMAM*TOTDELIG
     LPHARMAM*SNAWP1;
RUN;


PROC CORR DATA=ALMAS.BETA2;
VAR  LCOPAYAM SQDAYSUP LELIG NMEMAGE SQPHARAM
     LQTYDISP TOTDELIG SNAWP1;
     TITLE 'CORR. MATRIX FOR DATABASE WITHOUT RIPAE';
RUN;


PROC CORR DATA=ALMAS.BETA4;
VAR  LCOPAYAM SQDAYSUP LELIG NMEMAGE LPHARMAM
     LQTYDISP TOTDELIG SNAWP1;
TITLE 'CORR. MATRIX FOR ONLY SUBSCRIBERS';
RUN;


PROC FREQ DATA=ALMAS.BETA2;
TABLES STATE1 OCCUP1 OCCUP2 OCCUP3 OCCUP4;
RUN;


PROC REG DATA=ALMAS.BETA2;
MODEL LCPD=NMEMAGE MEMGEN1 STATE1 OCCUP1 OCCUP2 OCCUP3
           OCCUP4 INTGENST INTGENO1 INTGENO2 INTGENO3 INTGENO4 / STB
               COLLIN TOL VIF;
TITLE1 'REGRESSION USING DEMOGRAPHIC VARS.';
RUN;


PROC REG DATA=ALMAS.BETA2;
MODEL LCPD=TOTDELIG LELIG SNAWP1 LCOPAYAM
               SQDAYSUP LQTYDISP/ STB
               COLLIN TOL VIF;
TITLE1 'REGRESSION USING VAR. FOR PLAN CHARACTERISTICS';
RUN;

PROC REG DATA=ALMAS.BETA2;
MODEL LCPD=NMEMAGE MEMGEN1 STATE1 OCCUP1 OCCUP2 OCCUP3
               OCCUP4 TOTDELIG LELIG SNAWP1 LCOPAYAM
               SQDAYSUP LQTYDISP/ STB
               COLLIN TOL VIF;
TITLE1 'REGRESSION USING ALL VARS.';
RUN;
```

```
PROC FREQ DATA=ALMAS.BETA2;
TABLES NMEMAGE1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS NMEMAGE1;
MODEL LCPD=NMEMAGE1;
MEANS NMEMAGE1/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS NMEMAGE1;
MODEL LCPD=NMEMAGE1 LELIG SQDAYSUP SNAWP1
NMEMAGE1*LELIG NMEMAGE1*SQDAYSUP
NMEMAGE1*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS NMEMAGE1;
MODEL LCPD=NMEMAGE1 SQDAYSUP/SOLUTION;
LSMEANS NMEMAGE1/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS NMEMAGE1;
MODEL LCPD=NMEMAGE1 LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS NMEMAGE1;
MODEL LCPD=NMEMAGE1 SNAWP1 /SOLUTION;
LSMEANS NMEMAGE1/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS NMEMAGE1;
MODEL LCPD=NMEMAGE1 SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS NMEMAGE1/STDERR;
RUN;

PROC REG DATA=ALMAS.BETA2;
MODEL SQPHARAM=NMEMAGE TOTDELIG LELIG SNAWP1 LCOPAYAM
              SQDAYSUP LQTYDISP MEMGEN1/ STB
              COLLIN TOL VIF;
RUN;

PROC GLM DATA=ALMAS.BETA4;
CLASS COCCUPAT;
MODEL LCPD=COCCUPAT;
MEANS COCCUPAT/TUKEY ALPHA=.01;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA4;
CLASS COCCUPAT;
MODEL LCPD=COCCUPAT NMEMAGE LELIG SQDAYSUP SNAWP1
COCCUPAT*NMEMAGE COCCUPAT*LELIG COCCUPAT*SQDAYSUP
COCCUPAT*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS COCCUPAT;
MODEL LCPD=COCCUPAT NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS COCCUPAT;
MODEL LCPD=COCCUPAT LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS COCCUPAT;
MODEL LCPD=COCCUPAT SQDAYSUP/SOLUTION;
LSMEANS COCCUPAT/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS COCCUPAT;
MODEL LCPD=COCCUPAT SNAWP1 /SOLUTION;
LSMEANS COCCUPAT/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS COCCUPAT;
MODEL LCPD=COCCUPAT SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS COCCUPAT/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1;
MODEL LCPD=OCCUPAT1;
MEANS OCCUPAT1/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1;
MODEL LCPD=OCCUPAT1 NMEMAGE LELIG SQDAYSUP SNAWP1
OCCUPAT1*NMEMAGE OCCUPAT1*LELIG OCCUPAT1*SQDAYSUP
OCCUPAT1*SNAWP1;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1;
MODEL LCPD=OCCUPAT1 NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1;
MODEL LCPD=OCCUPAT1 LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1;
MODEL LCPD=OCCUPAT1 SQDAYSUP/SOLUTION;
LSMEANS OCCUPAT1/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1;
MODEL LCPD=OCCUPAT1 SNAWP1 /SOLUTION;
LSMEANS OCCUPAT1/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1;
MODEL LCPD=OCCUPAT1 SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS OCCUPAT1/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FFSCAP;
MODEL LCPD=FFSCAP;
MEANS FFSCAP/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FFSCAP;
MODEL LCPD=FFSCAP NMEMAGE LELIG SQDAYSUP SNAWP1
FFSCAP*NMEMAGE FFSCAP*LELIG FFSCAP*SQDAYSUP
FFSCAP*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FFSCAP;
MODEL LCPD=FFSCAP SQDAYSUP/SOLUTION;
LSMEANS FFSCAP/STDERR;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA2;
CLASS FFSCAP;
MODEL LCPD=FFSCAP NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FFSCAP;
MODEL LCPD=FFSCAP LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FFSCAP;
MODEL LCPD=FFSCAP SNAWP1 /SOLUTION;
LSMEANS FFSCAP/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FFSCAP;
MODEL LCPD=FFSCAP SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS FFSCAP/STDERR;
RUN;


PROC FREQ DATA=ALMAS.BETA2;
TABLES CCOPAYAM LPHAR CHAINCO SUPPLY;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM;
MODEL LCPD=CCOPAYAM;
MEANS CCOPAYAM/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM;
MODEL LCPD=CCOPAYAM NMEMAGE LELIG SQDAYSUP SNAWP1
CCOPAYAM*NMEMAGE CCOPAYAM*LELIG CCOPAYAM*SQDAYSUP
CCOPAYAM*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM;
MODEL LCPD=CCOPAYAM SQDAYSUP/SOLUTION;
LSMEANS CCOPAYAM/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM;
MODEL LCPD=CCOPAYAM NMEMAGE /SOLUTION;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM;
MODEL LCPD=CCOPAYAM LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM;
MODEL LCPD=CCOPAYAM SNAWP1 /SOLUTION;
LSMEANS CCOPAYAM/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM;
MODEL LCPD=CCOPAYAM SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS CCOPAYAM/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FROMULAR;
MODEL LCPD=FROMULAR;
MEANS FROMULAR/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FROMULAR;
MODEL LCPD=FROMULAR NMEMAGE LELIG SQDAYSUP SNAWP1
FROMULAR*NMEMAGE FROMULAR*LELIG FROMULAR*SQDAYSUP
FROMULAR*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FROMULAR;
MODEL LCPD=FROMULAR SQDAYSUP/SOLUTION;
LSMEANS FROMULAR/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS FROMULAR;
MODEL LCPD=FROMULAR NMEMAGE /SOLUTION;
RUN;

PROC GLM DATA=ALMAS.BETA2;
CLASS FROMULAR;
MODEL LCPD=FROMULAR LELIG /SOLUTION;
RUN;

PROC GLM DATA=ALMAS.BETA2;
CLASS FROMULAR;
MODEL LCPD=FROMULAR SNAWP1 /SOLUTION;
LSMEANS FROMULAR/STDERR;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA2;
CLASS FROMULAR;
MODEL LCPD=FROMULAR SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS FROMULAR/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS STATE;
MODEL LCPD=STATE;
MEANS STATE/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS STATE;
MODEL LCPD=STATE NMEMAGE LELIG SQDAYSUP SNAWP1
STATE*NMEMAGE STATE*LELIG STATE*SQDAYSUP
STATE*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS STATE;
MODEL LCPD=STATE SQDAYSUP/SOLUTION;
LSMEANS STATE/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS STATE;
MODEL LCPD=STATE NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS STATE;
MODEL LCPD=STATE LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS STATE;
MODEL LCPD=STATE SNAWP1 /SOLUTION;
LSMEANS STATE/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS STATE;
MODEL LCPD=STATE SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS STATE/STDERR;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA2;
CLASS CMEMGEND;
MODEL LCPD=CMEMGEND;
MEANS CMEMGEND/TUKEY ALPHA=.O1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CMEMGEND;
MODEL LCPD=CMEMGEND NMEMAGE LELIG SQDAYSUP SNAWP1
CMEMGEND*NMEMAGE CMEMGEND*LELIG CMEMGEND*SQDAYSUP
CMEMGEND*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CMEMGEND;
MODEL LCPD=CMEMGEND SQDAYSUP/SOLUTION;
LSMEANS CMEMGEND/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CMEMGEND;
MODEL LCPD=CMEMGEND NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CMEMGEND;
MODEL LCPD=CMEMGEND LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CMEMGEND;
MODEL LCPD=CMEMGEND SNAWP1 /SOLUTION;
LSMEANS CMEMGEND/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CMEMGEND;
MODEL LCPD=CMEMGEND SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS CMEMGEND/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO;
MODEL LCPD=CHAINCO;
MEANS CHAINCO/TUKEY ALPHA=.O1;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO;
MODEL LCPD=CHAINCO NMEMAGE LELIG SQDAYSUP SNAWP1
CHAINCO*NMEMAGE CHAINCO*LELIG CHAINCO*SQDAYSUP
CHAINCO*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO;
MODEL LCPD=CHAINCO SQDAYSUP/SOLUTION;
LSMEANS CHAINCO/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO;
MODEL LCPD=CHAINCO NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO;
MODEL LCPD=CHAINCO LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO;
MODEL LCPD=CHAINCO SNAWP1 /SOLUTION;
LSMEANS CHAINCO/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO;
MODEL LCPD=CHAINCO SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS CHAINCO/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO STATE ;
MODEL LCPD=CHAINCO STATE CHAINCO*STATE;
MEANS CHAINCO STATE CHAINCO*STATE/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO STATE;
MODEL LCPD=CHAINCO STATE CHAINCO*STATE NMEMAGE
                 LELIG SQDAYSUP SNAWP1
CHAINCO*STATE*NMEMAGE CHAINCO*STATE*LELIG
CHAINCO*STATE*SQDAYSUP CHAINCO*STATE*SNAWP1;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO STATE;
MODEL LCPD=CHAINCO STATE CHAINCO*STATE SQDAYSUP/SOLUTION;
LSMEANS CHAINCO STATE CHAINCO*STATE/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO STATE;
MODEL LCPD=CHAINCO STATE CHAINCO*STATE NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO STATE;
MODEL LCPD=CHAINCO STATE CHAINCO*STATE LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO STATE;
MODEL LCPD=CHAINCO STATE CHAINCO*STATE SNAWP1 /SOLUTION;
LSMEANS CHAINCO STATE CHAINCO*STATE/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CHAINCO STATE;
MODEL LCPD=CHAINCO STATE CHAINCO*STATE SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS CHAINCO STATE CHAINCO*STATE/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1 CMEMGEND;
MODEL LCPD=OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND;
MEANS OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND/TUKEY ALPHA=.01;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1 CMEMGEND;
MODEL LCPD=OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND NMEMAGE
                 LELIG SQDAYSUP SNAWP1
OCCUPAT1*CMEMGEND*NMEMAGE OCCUPAT1*CMEMGEND*LELIG
OCCUPAT1*CMEMGEND*SQDAYSUP OCCUPAT1*CMEMGEND*SNAWP1;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1 CMEMGEND;
MODEL LCPD=OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND SQDAYSUP/SOLUTION;
LSMEANS OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND/STDERR;
RUN;
```

```
PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1 CMEMGEND;
MODEL LCPD=OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND NMEMAGE /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1 CMEMGEND;
MODEL LCPD=OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND LELIG /SOLUTION;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1 CMEMGEND;
MODEL LCPD=OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND SNAWP1 /SOLUTION;
LSMEANS OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA4;
CLASS OCCUPAT1 CMEMGEND;
MODEL LCPD=OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND SNAWP1 SQDAYSUP/SOLUTION;
LSMEANS OCCUPAT1 CMEMGEND OCCUPAT1*CMEMGEND/STDERR;
RUN;


PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM SUPPLY;
MODEL LCPD=CCOPAYAM SUPPLY CCOPAYAM*SUPPLY;
MEANS CCOPAYAM SUPPLY CCOPAYAM*SUPPLY/TUKEY ALPHA=.01;
RUN;

PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM SUPPLY;
MODEL LCPD=CCOPAYAM SUPPLY CCOPAYAM*SUPPLY
        NMEMAGE LELIG SNAWP1
CCOPAYAM*SUPPLY*NMEMAGE CCOPAYAM*SUPPLY*LELIG
CCOPAYAM*SUPPLY*SNAWP1;
RUN;

PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM SUPPLY;
MODEL LCPD=CCOPAYAM SUPPLY CCOPAYAM*SUPPLY NMEMAGE /SOLUTION;
RUN;

PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM SUPPLY;
MODEL LCPD=CCOPAYAM SUPPLY CCOPAYAM*SUPPLY LELIG /SOLUTION;
RUN;

PROC GLM DATA=ALMAS.BETA2;
CLASS CCOPAYAM SUPPLY;
MODEL LCPD=CCOPAYAM SUPPLY CCOPAYAM*SUPPLY SNAWP1 /SOLUTION;
LSMEANS CCOPAYAM SUPPLY CCOPAYAM*SUPPLY/STDERR;
RUN;
```

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