THE EFFECT OF A CHANGE IN PRESCRIPTION DRUG INSURANCE BENEFITS ON CONSUMER PURCHASE OF GENERIC PRESCRIPTION DRUGS

BY

JULIE M. GANTHER

A thesis submitted in partial fulfillment of

the requirements for the degree of

MASTER OF SCIENCE

(Pharmacy Administration)

at the

UNIVERSITY OF WISCONSIN

1996

ACKNOWLEDGEMENTS

First, I would like to thank my advisor, Dr. David Kreling, for all of his help and support with this project. I would also like to thank my other committee members, Dr. Joseph Wiederholt and Dr. Mark Browne, for their valuable comments and suggestions. I am also grateful to Dr. Betty Chewning and Dr. David Mott for their help and support. In addition, I would like to thank John Demuth for his help with all of the computer programming that this project involved. I would also like to express my appreciation to my fellow graduate students for their willingness to listen, their suggestions and their friendship. Finally, I would especially like to thank my family and friends for the love and support they have given me during my graduate school endeavors.

TABLE OF CONTENTS

LIST OF TABLES

Table | Page

LIST OF FIGURES

ABSTRACT

The main objective of this study was to determine how implementing a full dollar differential generic substitution plan affected the generic dispensing rate. This allowed conclusions to be drawn about consumer sensitivity to the price of brand name prescription drugs. A secondary purpose was to measure the influence of therapeutic class, age, and price differential on generic dispensing rates. The implementation of the full dollar differential generic substitution plan was part of a change in prescription drug insurance benefits, and this change provided a natural experiment. Prior to the change in insurance benefits, customers had no out of pocket charge for either brand name or generic drugs after a small deductible was met. After the change, customers who wanted the brand name product for a substitutable drug had to pay the full cost differential between the brand name product and the generic version.

The study was a retrospective quasi-experimental design. The full dollar differential generic substitution plan was implemented at two different times for two groups of customers, and because of this, one group was able to be used as a control group for other. The main source of data was computerized prescription records from two pharmacies. Records were obtained for all prescriptions dispensed at the two pharmacies between July 1, 1991 and December 31, 1993.

The prescriptions were divided into the two study groups and a comparison group, which contained all other prescriptions dispensed at the pharmacy. Generic dispensing rates were calculated for both of the study plans and the comparison group for three time periods: the pre-change period, the period after one group had switched but the other had not, and the post-change period. Finally, logistic regression was used to determine the influence of the study plan, therapeutic class, age, and price differential on generic dispensing rate. A separate logistic regression equation was used for each time period.

When generic dispensing rates were determined for substitutable prescriptions, the combined study groups had an increase of 20.46 percentage points from the time period before the change to the time period after both plans had the change in benefits implemented. The generic dispensing rate for the comparison group had an increase of 13.05 percentage points during the same time period. Monthly generic dispensing rates increased for both study groups and the comparison group throughout the study period, but during the six months after only one plan had switched, generic dispensing rates for the group that had switched were significantly higher than rates for the other study group or the comparison group

The results of the logistic regression analysis showed that therapeutic class was a significant influence on plan ($p < .05$) during all three periods. Age was not significant during any periods, after controlling for therapeutic class. Price differential was not significant at the $p = .05$ level during the period after only one group had switched, but it was significant ($p < .05$) during the period after both plans had switched.

The main conclusion from this study was that the implementation of a full dollar generic substitution plan significantly increased generic dispensing rates. This indicates that customers are sensitive to the price of brand name prescription drugs. The other conclusion was that therapeutic class had a significant influence on generic dispensing rates, but age did not. Price differential was only a significant influence on generic dispensing rates after the full dollar generic substitution plan was implemented. The results of this study show the impact that the design of prescription drug insurance benefits can have on consumer decisions. This study can help employers, insurers, health care providers, pharmaceutical manufacturers, and consumers to better understand the potential effects of a change in prescription insurance benefits.

CHAPTER 1

INTRODUCTION

In recent years, there have been many changes in the retail prescription drug market. One change that has had a significant impact on this market is the change in payment sources. The sources of payment in the retail prescription drug market are private pay customers, private third party customers, and public third party customers (Medicaid). Previously, private pay customers constituted the largest percent of the market. However in recent years there has been a large increase in the proportion of prescriptions paid for by private third parties, from 22 percent in 1987 (Anon. 1992), to 49 percent in 1995 (Anon. 1995).

Another change in the retail prescription drug market is in the mix of prescription drugs dispensed, which has shifted toward generic prescriptions drugs. The generic substitution rate is defined as the percentage of multi-source prescriptions written by the physician for a brand name product, but dispensed with a generic product. This rate has increased from 22 percent in 1987 (Neff and Simpson 1992) to 41 percent in 1994 (Vaczek 1995). Both the shift toward generics products and the increased proportion of prescriptions reimbursed by third parties have affected consumer decisions about generic prescription drugs and together, they create a need to examine the effect of prescription drug insurance benefits on the purchase of generic prescription drugs. This thesis will examine how a change in prescription drug insurance benefits affected the proportion of prescription drugs dispensed in the generic form.

The majority of third party prescription insurance is paid for, at least in part, by employers. This has resulted in employers becoming increasingly concerned with the

rising costs of prescription drugs. In response to employer concerns about prescription drug costs, incentives to purchase generic products have become a common part of prescription drug insurance benefits. A 1992 survey found that two thirds of employers have either a lower dollar copayment or a lower coinsurance rate for generic prescription drugs as a part of their prescription insurance benefits (Moss 1993).

Another type of generic substitution plan that is becoming increasingly popular is a full dollar differential generic substitution plan. In a full dollar differential generic substitution plan, when a generic is available, the insurance company only reimburses pharmacies for the cost of the generic drug. This results in patients having to pay the full differential in cost between the brand and generic drug if they want the brand name product. This differential is often more than patients have to pay when there is a different copayment for brand name drugs than there is for generic drugs. For example, the 1994 Redbook average wholesale price (AWP) for a month supply of a brand name antihypertensive, 30 tablets of Tenormin^{R} 50mg, was about $25. The government maximum allowable cost for the generic version, 30 tablets of atenolol 50mg, during the same time period was about $5. This means that if a patient wanted the brand name product instead of the generic, under the full dollar differential generic substitution plan they would have to pay about $20 a month. In plans that use a different copayment for brand name drugs than they use for generic drugs, the difference typically is less than $10.

Managed care organizations especially favor the use of full dollar differential generic substitution plans. Seventy percent of all health maintenance organizations (HMOs) had them in place as of 1991 (Moss 1993). Since the numbers of HMOs and other managed care organizations are increasing, and since full dollar differential generic substitution plans are favored by managed care organizations, it is important to

examine how implementing this type of plan affects consumer purchase of generic prescription drugs. This also will allow conclusions to be drawn about how sensitive consumers are to the price of brand name prescription drugs.

A theoretical framework to help predict and explain consumers' purchasing behavior of generic prescription drugs is based on economic demand theory. Traditional economic demand theory is based on a relationship between the quantity of a product demanded and its price. Most products have a downward sloping demand curve, which means you will sell more of a product if you lower the price. For products that have substitutes, if you increase the price of the original product, the quantity of the substitute sold will increase and the quantity of the original product sold will decrease. In order for this theory to apply to the generic prescription drug market, two conditions must be met: 1) consumers must be sensitive to the price of prescription drugs (they will buy less if the price increases and they will buy more if the price decreases) and 2) generic prescription drugs must be considered substitutes for brand name prescription drugs. The literature review will discuss whether previous research supports these requirements.

What does economic supply and demand theory predict after implementing a full dollar differential generic substitution program? This type of substitution program raises the price of brand name drugs to the consumer, so if you assume consumers view generic drugs as substitutes for brand name prescription drugs, the theory predicts that implementing this type of program would result in more people choosing to purchase generic prescription drugs instead of the brand name. The proportion of prescription drugs dispensed generically should increase as the price differential between the brand name version and the generic version increases.

Economic demand theory provides one explanation for the potential impact of a full dollar differential generic substitution program. However, since many factors potentially influence consumer decisions about generic prescription drugs, it is useful to examine another theory. Risk-price theory was applied to the retail market for generic prescription drugs in a 1995 Ganther and Kreling study. This theory is based on a relationship between the perceived risk in purchasing a generic product and the price differential between the brand name product and the generic version. Risk-price theory will be discussed further in the literature review, but it was developed based on the finance theory that people are willing to accept some risk in return for a "reward" (Brigham and Gapenski 1994), and the economic theory that consumers are willing to pay to avoid a perceived risk (Evans and Viscusi 1993).

People would perceive risk in purchasing a generic prescription drug if they believed generics were less safe or effective than the brand name. The "reward" in the case of the prescription drug market would be the lower price of the generic drug. This theory says that people have a predetermined perception of the risk involved in purchasing a generic, and they will only purchase the generic if the price savings is enough of a "reward" to justify the perceived risk. This theory allows for the possibility that factors other than price affect the decision to purchase a generic prescription drug instead of the brand. Consumers' predetermined perception of risk can be based on many factors such as: previous experience with generic prescription drugs, pharmacist and physician recommendations regarding generic drug use, and therapeutic class of the prescription drug.

Risk-price theory predicts that consumers would require more price savings to purchase generic prescription drugs with higher perceived risks. As mentioned above, one factor that may influence perceived risk is the therapeutic class of the prescribed

medication. If the risk-price theory is valid, implementing a full dollar differential generic substitution program should increase the proportion of generics dispensed, more in therapeutic classes where generics are perceived as less risky than in therapeutic classes perceived as more risky. This theory also suggests that for drugs with a similar perceived risk, as the price differential between the brand and generic increases, more people should be willing to take the generic product.

Both risk theory and economic supply and demand theory predict that an increase in the price of brand name drugs (such as with implementing a full dollar differential generic substitution program) should increase generic prescription drug purchases and decrease brand name prescription drug purchases. The main purpose of this study is to determine what effect implementing a full dollar differential generic substitution program has on the overall proportion of prescription drugs dispensed with a generic product. An increase in the generic dispensing rate would indicate that consumers are sensitive to the price of brand name prescription drugs.

The second purpose of the study is to examine how well the proposed risk-price theory explains the impact of the change on consumer purchase of generic prescription drugs. This can be accomplished by examining the effect of the full dollar differential substitution program on the proportion of generics dispensed within different therapeutic classes. If the effect of implementing the full dollar differential generic substitution program is greater for therapeutic classes with higher perceived risk, risk-price theory is plausible. However, if the effect is the same for all therapeutic classes or greater for therapeutic classes with less risk, that would suggest that the risk theory may not fit the generic prescription drugs market. An important caveat is that while risk-price theory is proposed as a way to explain the generic prescription drug market, this study was not specifically designed to test the risk-price theory.

CHAPTER 2

LITERATURE REVIEW

Both traditional economic demand theory and risk-price theory offer explanations for the effect of implementing a full dollar differential generic substitution plan. The literature review will examine how well previous research supports applying these theories to the market for generic prescription drugs. In order to apply economic demand theory to the generic prescription drug market, consumers must be sensitive to the price of prescription drugs and generic prescription drugs must be considered substitutes for brand name drugs.

The first section of the literature review will examine previous research on consumer price sensitivity toward prescription drugs. The second section will discuss research concerning consumer attitudes towards generic prescription drugs. This will help determine whether generic prescription drugs are considered substitutes for brand name prescription drugs. The research in this section also will allow conclusions to be drawn about whether consumers perceive risk in purchasing generic prescription drugs.

In addition to the research about general consumer attitudes towards generics, research that directly measures perceived risk towards using generic prescription drugs will be examined. Since risk-price theory would only apply if consumers are willing to accept some perceived risk in purchasing a generic product in return for some amount of price savings, research concerning the hypothesized relationship between perceived risk and price savings also will be discussed. The final section of the literature review will summarize previous research on the impact of financial incentives designed to increase the use of generic prescription drugs.

Consumer Price Sensitivity Toward Prescription Drugs

One important factor in predicting how people will respond to financial incentives to purchase generic prescription drugs is consumer price sensitivity toward prescription drugs. If the demand for prescription drugs is price sensitive, then decreasing the price of prescription drugs should result in a greater quantity being sold. If consumers are not sensitive to prices, then the quantity demanded should be unaffected by a change in price. There have been several studies that measured consumer price sensitivity toward prescription drugs. In some studies, researchers have examined consumer price sensitivity towards prescription drugs by determining the impact of cost sharing on prescription drug usage. Others have specifically calculated the price elasticity of demand for prescription drugs, which is defined as the percentage change in quantity demanded divided by the percentage change in price (Nicholson 1994).

Two studies have directly calculated the price elasticity of consumers' demand for prescription drugs. The first of these was a time series regression analysis of English National Health Service prescription data (O'Brien 1989). In this study, researchers measured the monthly volume of prescriptions purchased from 1969 to 1986. During this time period there was considerable variation in the copayments that consumers paid and there were some groups that were exempt from charges throughout the entire period. This allowed the researchers to calculate the price elasticity of demand for prescription drugs, which was -0.33 over the entire time period. This means that for every 10 percent increase in price, there was a 3.3 percent decrease in the quantity sold. Price elasticities of demand that are greater than -1 are considered to be inelastic while price elasticities of demand less than -1 are elastic (Nicholson 1994). Thus, the price elasticity of -0.33 is relatively inelastic. This is not surprising, as the price

elasticity of demand for most health care products and services is somewhat inelastic. The data also showed that the price elasticity of demand for prescription drugs has become more elastic over time.

In the second study which measured the price elasticity of demand for prescription drugs, researchers used data from a national prescription drug service (Smith 1993). The prescription drug service had many different employer groups which had different copayments for prescription drugs, ranging from 1 to 8 dollars per prescription. A price elasticity of demand of -0.098 was calculated from these data. This also suggests that the demand for prescription drugs is relatively price inelastic. Both the Smith and O'Brien studies were limited by the small range of prices studied, and it is possible that if price elasticity of demand was measured over a larger range of prices a more elastic estimate would be obtained.

Several other studies have examined the impact of cost sharing on prescription drug usage. While these studies do not calculate the price elasticity of demand specifically, they do provide a measure of how sensitive consumers are to the price of prescription drugs. One such study was the RAND study, which was a study designed to measure the impact of cost sharing on consumer demand for health services (Leibowitz 1985). In this experiment, families in six cities were assigned randomly to health insurance plans with 0, 20, 50, or 95 percent coinsurance, although there was a maximum dollar expenditure after which there was no charge for services. The results showed that per capita prescription drug expenditures increased steadily as the percentage of cost sharing decreased, with expenditures in the free plan being about 60 percent higher than the plan with 95 percent coinsurance. This suggests that consumers are sensitive to the price of prescription drugs.

In another study, researchers used data from the South Carolina Medicaid program to examine the impact of cost sharing on prescription drug usage (Nelson et al. 1984). Researchers examined the effect of implementing a 50 cent copayment per prescription on prescription drug usage. In the study, the Tennessee Medicaid population was used as a control group, since they did not have a copayment during the study period. The results showed that the average drug utilization per person decreased 2.8 percent over the three years after the copayment was implemented, compared to a 17.8 percent increase in the control state. Since this study used only data from the Medicaid program, a small copayment may have had a larger effect than it would in a population with higher income, and therefore the results can not be generalized to other populations.

In a more recent study, researchers used data from a staff model HMO to measure the impact of prescription drug copayments on drug utilization (Harris et al. 1990). They found that implementing a $1.50 copayment resulted in a 10.7 percent decrease in prescription usage relative to the control group. Implementing an additional $1.50 copayment resulted in an additional 10.6 percent decrease in drug utilization. The results from this study again suggest that consumers are somewhat sensitive to the price of prescription drugs.

Overall, results from the studies examining whether consumer are sensitive to the price of prescription drugs show that consumers are at least somewhat sensitive to price. However technically, the price elasticity of demand for prescription drugs probably can be considered relatively inelastic. It is important that consumers are somewhat sensitive to the price of prescription drugs, since some price sensitivity is necessary in order for financial incentives to affect consumer purchase of prescription drugs. One limitation of all these studies except the RAND study, was that price

elasticity or price sensitivity was determined based on a small range of prices. It is likely that if price elasticity or sensitivity was measured over a wider range of prices, the demand for prescription drugs would be shown to be more responsive to price.

Consumer Attitudes Towards Generic Prescription Drugs

Consumer price sensitivity to the price of prescription drugs was only one of the necessary conditions for economic demand theory. This theory also assumes that generic prescription drugs are substitutes for brand name prescription drugs. Examining consumer attitudes towards generic prescription drugs is one way to determine the validity of this assumption. Some of the early research on consumer attitudes towards generic prescription drugs was conducted shortly after state laws permitting the substitution of generics were introduced in the early 1970s.

In a 1978 study; a sample of 105 consumers were surveyed to determine their attitudes toward the use of generic prescription drugs (Bearden and Mason 1978). The researchers found that 33 percent of respondents were against the prescribing of generic prescription drugs. Those respondents opposed to the prescribing of generic prescription drugs perceived more risk across risk dimensions such as quality, safety and efficacy than did respondents in favor of generic prescribing.

A 1980 survey of Florida households showed much more unfavorable attitudes towards generic prescription drugs (Lambert et al. 1980). These researchers were particularly interested in older consumers, so approximately half of the respondents were 65 or older. The study showed that 67 percent of respondents would refuse a generic substitute no matter what the price savings. Respondents who rejected generic

substitution perceived generic prescription drugs to be less safe and less effective than brand name drugs.

In a 1981 study, researchers surveyed 95 residences via telephone to determine their perceptions and awareness of generic prescription drugs (Carrol and Jang 1981). The researchers found that approximately 25 percent of respondents who were aware of generic prescription drugs felt generics were less safe and effective than brand name drugs. These results were similar to the earlier Bearden and Mason study. However, in the Carrol and Jang study, 41 percent of respondents were unaware of generic prescription drugs. Since generic substitution was allowed in most states by the early 1970s, this low level of awareness is surprising.

More recent research has reinforced some of the earlier results. In a 1989 study, 100 Chicago area consumers were interviewed to determine their beliefs about generic prescription drugs (Podulka et al. 1989). The researchers found that 20 percent of respondents believed generic prescription drugs to be of lower quality than brand name prescription drugs. This study under-represented older adults, since only 5 percent of respondents were 65 or older. This limits the generalizability of this study, as older adults tend to be more frequent users of prescription drugs.

In a 1991 study that did focus on older adults, researchers interviewed 287 people over the age of fifty to determine their attitudes toward generic prescription drugs (Wolfgang and Perri 1991). Respondents' mean attitude score towards generic prescription drugs was 11.5 on a scale of 3 to 15, with 15 representing an extremely favorable attitude toward generics. Only 8.3 percent of respondents felt generic prescription drugs were less safe than the brand name, and only 12.2 percent felt that generics were less effective than the brand name. These results show somewhat more favorable attitudes toward generic prescription drugs than previous studies. However,

17.4 percent of respondents still agreed or strongly agreed with the statement that they "never use generic substitutes when they have a prescription filled".

In addition to the studies measuring general attitudes towards generic prescription drugs, in a 1988 study, 389 college undergraduates were surveyed to measure their perceptions of the effectiveness and side effects for specific types of prescription drugs (Tootelian et al. 1988). For all types of medications studied, respondents perceived generic drugs to be somewhat less effective and have slightly more side effects than brand name drugs. This study was limited in its generalizability since it only surveyed college undergraduates, who were primarily less than 30 years old.

In a recent study, 373 consumers from a central Wisconsin town were surveyed via mail to determine their attitudes towards generics (Ganther and Kreling 1995). The results of the survey showed that between 25 and 35 percent of respondents viewed generics as less safe and effective than brand name prescription drugs. Although the study was limited to the population of one town, it did have a representative sample of ages and income levels. More importantly, the sample used for the survey is from the same population that is being used in the current study. This makes the conclusions from this survey particularly applicable to the present study.

In general, research examining consumer beliefs about the safety and efficacy of generic prescription drugs shows that while the majority of consumers believe generic products are equivalent to the brand name versions, typically around 20 to 30 percent of consumers believe generic prescription drugs are less safe or effective than the brand name. This suggests that although generic prescription drugs may be considered substitutes for brand name drugs, it can not be assumed that all consumers perceive generic prescription drugs to be equivalent to brand name drugs. This conclusion, along with the somewhat inelastic price elasticities of demand for the prescription drug

market, suggests that the economic demand model may not fully explain the market for generic prescription drugs.

Perceived Risk Associated With Generic Prescription Drugs and the Relationship Between Risk and Price Savings

Since the basic economic demand model may not completely explain the generic prescription drug market, a supplemental theory that includes other factors should be considered. A theory that may be applicable to this market is risk-price theory. The risk portion is based on consumer research models which have conceptualized perceived risk in terms of consumer perceptions of the consequences and uncertainty of buying a product (Dowling and Staelin 1994). Since the research discussed earlier shows that approximately 20 to 30 percent of consumers view generic prescription drugs as less safe or effective than the brand name, there appears to be some uncertainty, and therefore risk, associated with purchasing a generic prescription drug.

However, just because people perceive risk in the use of a generic prescription drug does not mean that they are unwilling to purchase it. The Capital Asset Pricing Model from finance theory suggests that people are willing to assume some degree of risk in return for some "reward" (Brigham and Gapenski 1994). In this case people would be willing to purchase a generic if the price savings (reward) was enough to compensate them for their perceived risk. While the finance theory is based on speculative risks, it is logical to extend it to other types of risks.

Conversely, economic risk theory says that most consumers are risk averse and therefore willing to pay to avoid a perceived risk (Evans and Viscusi 1993). This

means that a person's perceived risk associated with using a generic prescription drug would have to be high enough to justify paying more for the brand. If it was not, they would purchase the generic. Both economic and finance risk theories suggest that there should be a relationship between the perceived risk associated with using a generic prescription drug and the price savings necessary before the generic would be purchased instead of the brand.

For consumers that view generic prescription drugs as less effective than brand name drugs, one perceived consequence of using a generic product would be failure to treat the medical condition completely. Thus, consumers' perceived risk of using a generic prescription drug instead of the brand name may depend on the medical condition being treated, with higher risk associated with more serious medical conditions. Three studies have examined perceived risk across different medical conditions or therapeutic classes, and all have found risk to be dependent on the type of medication.

In a 1989 study, consumers were asked whether they would be comfortable taking the generic equivalent for a variety of different therapeutic classes of medication (Podulka et al. 1989). The percent of consumers willing to take the generic differed considerably across type of medication. It was greatest for pain medication (63 %) and antibiotics (60 %), and lowest for oral contraceptives (30 %) and heart medicine (34 %). In a 1991 survey, college undergraduates were asked to rate the risk in using a generic prescription drug instead of the brand name across different types of medications (Tootelian et al 1991). This study found that perceived risk was highest for depression medications and tranquilizers, and lowest for antihistamines and pain medications. This study did not use heart medication as one of the types of medications.

The most recent study to examine perceived risk across different types of medications was a mail survey of a sample from the same population which was used in the present study (Ganther and Krèling 1995). Consumers rated the risk of using a generic prescription medication instead of a brand name version to treat various medical conditions. The risk rating for the five medical conditions is provided in Table 2.1. Consumers' perceived risk was highest for using a generic prescription drug to treat a heart condition and lowest for cough. Perceived risk was significantly different across medical condition when tested via MANOVA ($p < .01$)

Table 2.1 Consumers' Risk Rating of Using a Generic Prescription Drug Across Medical Conditions

Medical Condition	Risk Rating Mean (s.d.)
Heart	6.03 (1.38)
High Blood Pressure	5.80 (1.36)
Strep Throat	5.29 (1.10)
Pain	5.13 (1.11)
Cough	5.06 (0.92)

Risk was measured on a scale of 1 to 9 where 1 = generic is less risky than bran
5 = generic is the same risk as brand, and 9 = generic is riskier than brand.

The results from all three of these studies suggest that consumers do perceive risk in using a generic prescription drug instead of a brand name drug, and that the risk varies across drugs used to treat different medical conditions. However, the fact that some consumers perceive risk in purchasing a generic prescription drug does not mean that they are unwilling to purchase generics. As discussed earlier, finance and economic

theory suggest there should be a relationship between the perceived risk in using a generic prescription drug and the price savings necessary before a generic prescription drug would be purchased instead of the brand.

There is very little research that actually examines this relationship between perceived risk and price savings. In one study, a researcher did investigate what effect the amount of price differential between the brand and generic had on the willingness of consumers to purchase generic prescription drugs (Nelson 1973). A sample of 1,250 consumers in a controlled national panel was surveyed via mail questionnaire. The consumers were asked about their willingness to purchase a generic drug at three different savings levels for each of two prices. The researcher concluded that consumers' acceptance of generic prescription drugs depended on the difference between the brand and generic price, but not on the absolute price of the brand name drug. He also concluded that some consumers may have perceived risk in the purchase of a generic, but as the savings increased the dollars saved may have been enough to overcome the risk. This supports the proposed relationship between risk and price.

A recent study that directly examined the relationship between risk and price savings was the 1995 Ganther and Kreling study. In this study, respondents were asked to check the amount of price savings necessary before they would purchase the generic prescription drug instead of the brand name to treat a specific medical condition. The five medical conditions used were the same ones that respondents assessed the perceived risk of using: heart condition, high blood pressure, strep throat, pain, and cough. The price savings options were: $2 or less, $3 to $5, $6 to $10, $11 to $15, more than $15, and "would not buy the generic".

The results showed a definite relationship between perceived risk and price savings. The price savings necessary before a generic would be purchased was highest for the

condition with the highest perceived risk (heart condition) and lowest for the condition with the lowest perceived risk (cough). Spearman correlations between perceived risk and price savings were significant ($p < .01$) for all five medical conditions. Although research in this area is too limited to draw a definite conclusion about the relationship between risk and price saving, these two studies support the hypothesized relationship.

There has been one study where the price savings and generic substitution rates across therapeutic class have been examined (Mott and Kreling 1996). The results showed that generic substitution rates did vary considerably across medical condition. Although this study did not measure risk perceptions, the generic substitution rates do offer some support for risk-price theory. Generic substitution rates were low in the cardiovascular category and high in the analgesic category, which is what the risk ratings from the 1995 Ganther and Kreling study would predict. The antibiotic category had a high generic substitution rate and it also had the largest price differential between the brand and generic. The only finding that was somewhat inconsistent between the two studies was the low generic substitution rate in the cough and cold therapeutic class. Since the cough class had a low risk rating in the Ganther and Kreling study, risk theory would predict a high generic substitution rate in this class. However, the price differential between brand and generic was not large for the cough and cold class, so this could be a possible explanation for the low substitution rate that would be consistent with risk-price theory.

Age is another factor which has been hypothesized to have an affect on consumer perceptions of generic prescription drugs. Previous research assessing the relationship between age and consumer perceptions of generic prescription drugs has shown mixed results. In one study researchers found that older respondents were more likely to reject a generic substitute (Lambert et al 1980). In another study, adults that were 50

years of age and older had overwhelmingly favorable attitudes toward generic prescription drugs (Wolfgang and Perri 1991). In a recent study, researchers found that age was not a significant predictor of consumer perceptions of risk associated with purchasing a generic prescription drugs (Ganther and Kreling 1995). Because of the mixed results, it is difficult to predict what affect age will have on perceptions of risk associated with generic prescription drugs and therefore, on generic dispensing.

Impact of Financial Incentives on the Purchase of Generic Prescription Drugs

In addition to examining consumer price sensitivity toward all prescription drugs, it also is useful to examine the price sensitivity toward generic prescription drugs specifically. Very few studies have examined consumer price sensitivity toward generic prescription drugs, and those that did examined the impact of financial incentives to use generic prescription drugs on the purchase of generics. In the RAND cost sharing study described earlier, the effect of cost sharing on the proportion of generics dispensed as well as the effect on the overall purchase of prescription drugs were examined (Leibowitz et al. 1985). Cost sharing had a significant impact on the purchase of prescription drugs, but it did not affect the proportion of drugs dispensed as the generic.

Since there was a wide range of cost sharing, from 0 to 95 percent, this study seems to suggest that financial incentives do not affect the purchase of generic prescription drugs. However, at the time of the study, the price differential between brand and generic drugs was much smaller than it is now. A 1980 prescription audit found that the average price difference between brand and generic drugs was $1.69 (DeNuzzo

1980). This small differential probably explains why the RAND study did not find that cost sharing affected the proportion of generic drug products dispensed.

Another study compared prescription drug use in one fee for service insurance plan with prescription drug use in seven prepaid health insurance plans (Weiner et al. 1991). Of the seven prepaid plans, three had full dollar differential generic substitution plans where consumers were required to pay the full price differential between the brand and generic if they wanted the brand. Two of the prepaid plans had a $2 differential copayment between brand and generic while the other two had no price differentials to the consumers. The fee for service plan had a $5 copayment for both brand name and generic prescription drugs.

In the fee for service plan, 14 percent of the prescription claims were for generic drugs, while in the prepaid plans, 17 to 42 percent of the prescription claims were for generic drugs. Among the prepaid plans, the $2 differential copayment appeared to increase the use of generic prescription drugs as significantly as the full dollar differential generic substitution plan. One significant limitation of this study is that since there were no data collected prior to having the consumer incentives to use generics, the differences in generic usage can not be attributed necessarily to the incentives. However, in spite of the limitations, this study is only study to date which compares generic drug usage in a fee for service plan to generic usage in plans with various incentives to use generics.

The previous section has provided a summary of the relevant literature. Clearly, there has been very little previous research that examined the effect of prescription insurance benefits on consumer purchase of generic prescription drugs. One reason for this is the difficulty of obtaining prescription records of people who underwent a change in prescription drug benefits both before and after the change was implemented.

Another reason has been the lack of a comparison group. If there is no comparison group, it is difficult to determine how much of any effect can be attributed to the change, and how much was related to other factors in the environment. It also may be difficult to separate the effect that the program has on prescribing from the effects it has on consumer purchasing behavior.

This study overcomes these difficulties by taking advantage of a natural experiment involving the implementation of a full dollar differential generic substitution program. Before the plan was implemented, patients could receive either brand or generic at no charge after a small deductible was met. After the implementation, if the patient wanted the brand name for a multi-source product, they were required to pay the full difference between the generic price and the brand name price. This natural experiment allows generic dispensing rates to be measured before and after the substitution plan was implemented.

There are several advantages that this study has over previous work. One is that the design of this natural experiment allows a baseline generic proportion to be determined for the study population. In addition, the change in benefits occurred at two different times, so there was a six month interval where one group of customers had the full dollar differential substitution plan and the other group did not. This, in effect, provided a control group for part of the time period. There was also the opportunity to measure the change in generic dispensing rates for a comparison group of non-study prescriptions. The physician generic prescribing rate before and after the change also was measured. This allowed the separation of the affects of the plan on substitution at the pharmacy, from affects on physician generic prescribing. Another advantage that this study has over previous work is that purchasing behavior can be studied over a

range of price differentials. Studies involving differential copayments between brand and generics may miss information because of the small fixed price difference.

Objectives

The main objective of this study is to measure how implementing a full dollar differential generic substitution plan affects the generic dispensing rate, which is defined as the proportion of prescriptions dispensed in the generic form. This will allow conclusions to be drawn about how price sensitive consumer demand for brand name pharmaceuticals is. There are several secondary objectives which will help determine whether risk-price theory is applicable to the market for generic prescription drugs. One objective is to examine how the generic substitution plan affects the proportion of generics dispensed in specific therapeutic classes. Another is to examine whether the amount of price differential between the brand name product and the generic version influences the generic prescribing rate after controlling for therapeutic class. The affect that age has on the generic dispensing rate also will be examined.

Hypotheses

H1: Implementing a full dollar differential generic substitution plan will increase the generic dispensing rate.

H2: During the six month period after the first plan implemented the change in benefits, but before the second plan did, the generic dispensing rate will be higher for the plan that implemented the change.

H3: The increase in the generic dispensing rate will be larger for the two study plans then it will be for the comparison group.

H4: Therapeutic class will be a significant predictor of generic dispensing even after controlling for the amount of price differential.

H5: Age will have a significant influence on generic dispensing.

CHAPTER 3

METHODS

This study took advantage of a natural experiment involving a change in prescription insurance benefits. The first section of this chapter provides some background concerning the change in benefits. The second section addresses data collection methods and then the third section discusses data preparation. The final sections describe data analysis and statistical analysis.

Background

Wausau, a central Wisconsin city with population of approximately 37,000, is the site of Wausau Insurance's company headquarters. Most of the major employers in the city use Wausau Insurance for their health benefits, including prescription drug benefits. Prior to July of 1992 Wausau Insurance administered their own prescription benefits and paid 100 percent of the usual and customary price for both brand and generic prescription drugs, after a deductible was met. The amount of the deductible depended on the employer group, but the majority of the deductibles were between $50 and $100. The plan was primarily an indemnity type plan, although some local pharmacies (including the pharmacies used in the study) had a special arrangement to bill Wausau Insurance directly for prescription claims. Some Wausau Insurance customers used the direct billing arrangement but others were unaware of, or chose not to use, the direct billing and sent in their own claims.

Beginning July 1, 1992 Wausau Insurance contracted with Diversified Pharmaceutical Services (DPS), a pharmaceutical benefits manager, to administer their prescription drug benefits. When this change occurred coverage was switched from

indemnity to service benefit, and a full dollar differential generic substitution plan was implemented. With this substitution plan, if a generic version of the drug was available and the drug was on DPS's maximum allowable cost (MAC) list, coverage was limited to the cost of the generic drug. Patients still could get the brand name drug product, but if there was a generic version available they were required to pay the full difference between the MAC cost of the generic and the cost of the brand. The deductible provision was maintained and for drugs with a generic available, only the cost of the generic was applied to the deductible. After the deductible was met persons accepting the generic had no out-of-pocket expense but persons requesting the brand name version of a substitutable drug had to pay the full cost differential between the brand and generic.

The switch to DPS also included the implementation of a thirty day supply limit and occurred on two different dates, with the switch date being determined by the customers' employer group. The first group (July plan) switched on July 1, 1992 and the second group (January plan) switched on January 1, 1993. The reimbursement to pharmacies was changed to 90 percent of Average Wholesaler Prices (AWP) + $2.00 dispensing fee for brand name prescriptions, and MAC + $2.00 dispensing fee for generic prescriptions.

Since state generic substitution laws can influence the generic dispensing rate, the next paragraph provides a description of the Wisconsin state law concerning the substitution of generic prescription drugs. In Wisconsin, state law requires that consumers be given the choice of purchasing the brand name product or the generic product for drug products that have an AB equivalence rating. This rating is determined by the Food and Drug Administration (FDA) and an AB rating means that the generic version can be substituted without contacting the physician if the patient

gives permission (unless the physician specifies do not substitute on the prescription order). For drug products for which an AB rated generic version is not available, the physician must be contacted and permission to substitute obtained. Because of this, prior to the change in insurance benefits consumers were not routinely offered non-AB rated generic versions. After the change, since DPS had non-AB rated generic products on their MAC list, consumers were offered non-AB rated products if they were on the DPS MAC list, but they were advised that the physician would have to be contacted.

Data Collection

There were three sources for the data used in the study. The main source of data was prescription records from two pharmacies in the Wausau area. The second source of data was the 1992 Medispan database. Medispan is a firm that provides drug prices and drug reference information databases and systems. The final source of data was from an audit of a sample of prescriptions.

Pharmacy Data:

The prescription records used in the study were obtained from the two Shopko Pharmacies in the Wausau area. Shopko is a large regional mass merchandiser chain with pharmacies in all of their stores. Approximately 25 to 30 percent of the prescriptions at these two stores were dispensed under the Wausau Insurance plan. There were other pharmacies in the area that dispensed prescriptions under the Wausau Insurance plan, but the two Shopko Pharmacies had a large share of the market. The researcher was employed at one of the subject pharmacies when the change in insurance

benefits occurred. This helped tremendously with obtaining the database of prescription records, preparing the database for analysis, and analyzing the database.

Records for prescriptions dispensed at the two stores between July 1, 1991 and December 31, 1993 were collected retrospectively. This time period included a full year of data before and after the change in benefits occurred. The first group changed insurance benefits on July 1, 1992 and the second group switched on January 1, 1993. During the intermediate six month interval, one group had the full dollar differential generic substitution plan and the other group had no special incentives to purchase the generic version. Figure 3.1 provides a time line of the above events. Both customer data elements and prescription data elements were obtained from the pharmacies and these data elements are listed in Table 3.1. The customer data elements were attached to the corresponding prescriptions, such that each prescription record also contained the customer information. Patient and physician name were deidentified in the data to protect confidentiality.

Figure 3.1 Time Line of Data Collection Period.

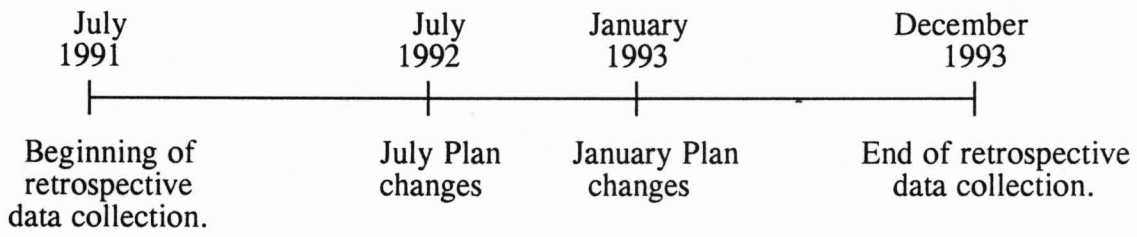


Table 3.1 Data Elements Collected From the Study Pharmacies

Data Elements	
Prescription	**Customer**
prescription number	ID code
fill date	date of birth
quantity	gender
drug name	zipcode
drug strength	
national drug code	
insurance code	
price to customer	

Medispan Data:

Some data elements that were necessary for the analysis were not available from the pharmacy so it was necessary to obtain some additional data elements from the 1992 Medispan database. These data elements are listed and defined in Table 3.2 and a more complete description of each data element is provided in Appendix A.

There were some modifications of the Medispan data. First, since the Medispan data were from 1992 and the prescription database included prescriptions from all of 1993, there were some drugs in the prescription database that were missing from the Medispan data. A separate file of the NDC numbers for these drugs was created and the missing information was obtained from the 1993 and 1994 Redbook, the 1995 AHFS and the knowledge of the researcher. The data from the missing drugs then were linked back with the original Medispan database. The second modification was to replace the hcfaffp data element containing the MAC price set by HCFA, with the DPS MAC price. This was done to obtain a more realistic estimate of the price of generic

version of drugs to customers in the Wausau Insurance plans. A more complete description of the modifications of the Medispan data is provided in Appendix B

Table 3.2 Names and Definitions of the Medispan Data Elements

Data Element	**Definition**
Route	The route of administration (e.g. oral, topical, injectible).
Generic	Identifies the drug as generic (Y), single source (N), original product for which a generic is now available (O), or a multi-source co-licensed product (M).
Brand Name	Identifies whether the drug name is a generic name (G), a trademarked name (T), or a branded generic name (B).
GPI	The generic product identifier number, which is the same for drugs that are the same strength, dosage form and drug product.
Manufacturer	The name of the manufaturer who makes the drug.
Product Name	The name of the drig.
Dosage Form	The dosage form of the drug (e.g. tablet, capsule, suspension).
Package Size	The package size the drug was dispensed from (based on NDC).
AWP Price	The average wholesaler price for the drug (based on package size).
AWP Unit Price	The AWP price per unit of the drug.
Wholesaler Cost	The wholesaler cost of the drug (based on package size)
HCFA FFP	The Health Care Financing Administration upper limit for payment (per unit).

Audit Data:

The final source of data was an audit of original prescriptions. This was done because one necessary data element, the physician generic prescribing rate, was not available from the stores' prescription databases or the Medispan database. To obtain this information, a random sample of prescriptions from both stores was audited to

determine whether the prescriptions were written for brand or generic drug products. The sampling frame for the audit was all new prescriptions filled by Wausau Insurance customers in the year before either group had switched and the year after both groups had switched. The six month period when one group had switched and the other had not was excluded from the audit.

The sample size for the audit was calculated using an estimate of the generic prescribing rate. The estimated generic prescribing rate was obtained by subtracting the pharmacist substitution rate (Mott 1995) from the proportion of prescriptions dispensed as the generic (Neff and Simpson 1992). Based on these estimates, a sample size of 1300 was determined to be necessary to obtain, with 95 percent confidence, a proportion within two percentage points of the actual proportion (see Appendix C for calculations). In order to oversample, a target sample size of 1600 was used, with 800 prescriptions selected from each store. The 800 prescriptions were split approximately equally between the pre and post-change time period.

A systematic random sample was used in order to obtain prescriptions written throughout the entire time period. The prescriptions were arrayed in order of fill date and for one store, 1 out of 8 pre-change and 1 out of 38 post-change prescriptions were selected. For the other store, 1 out of 11 pre-change and 1 out of 40 post-change prescriptions were selected. The pre-change and post-change sampling fractions were different because there were fewer pre-change prescriptions than post-change prescriptions in the database. There are several possible factors that contributed to this difference. 1) The prescription volume of the two pharmacies was increasing and thus there were more total prescriptions dispensed toward the end of the data collection period. 2) The number of customers with prescription insurance benefits from Wausau Insurance increased between the beginning and end of the data collection period. 3)

Because of the way in which the DPS prescriptions were identified, not all of the DPS prescriptions dispensed before the change were in the sampling frame (this will be discussed further in the database preparation section). 4) Since a month supply limit was implemented at the time of the change, people who had been getting one, several month supply prescription would now be getting several one month supply prescriptions. Although the sampling fractions were different for the pre and post-change periods, this difference should not have a significant affect on the results of the audit since the prescribing rate was measured as a proportion.

The final sample size was 799 for one store and 783 for the other store. The audit involved traveling to the two stores and examining the original prescription orders to determine whether the physician had written the prescription for a brand name or generic product. Although patient names were observed by the researcher during the audit, they were not recorded.

Database Preparation

Converting the database from the form in which it was received, to a database that could be analyzed required a substantial amount of computer programming. The details of the computer programming are described in the following section, but Figure 3.2 provides an overview of the process and the approximate number of prescriptions involved at each step. There are four main parts to the data programming. Part 1 involves linking the prescription data elements from the two pharmacies with the Medispan data elements. Part 2 involved dividing the database into two separate databases, the Wausau Insurance prescriptions and the non-Wausau Insurance prescriptions. In Part 3 the July plan and January Plan customers were identified.

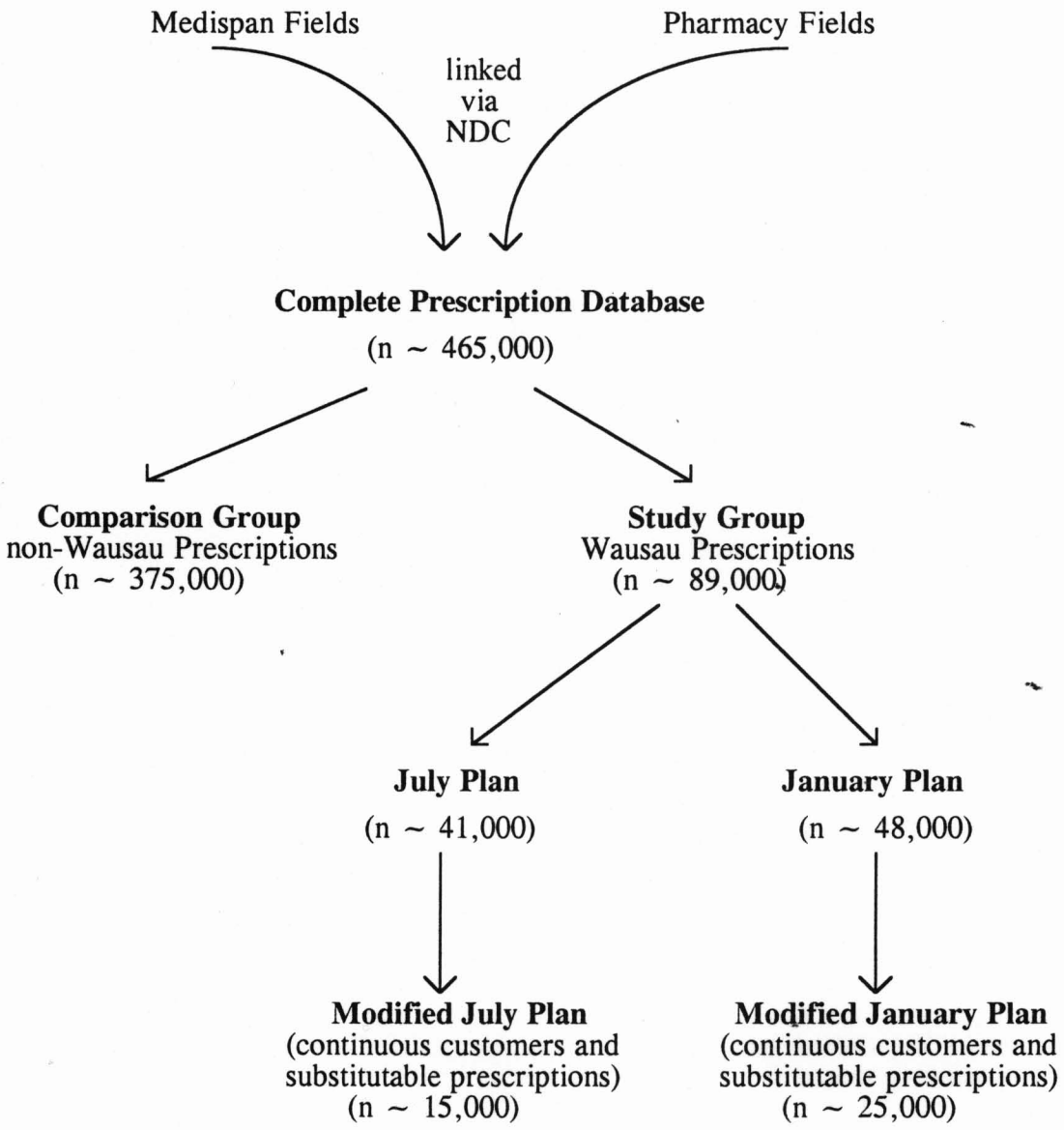
Finally, in Part 4 there was some further modification of the July and January plan prescriptions. While Figure 3.2 provides the logical flow to the database programming, the methods are described in the text in the order in which the analysis actually was done.

In order minimize the programming that needed to be done by Shopko, all prescription records from the two stores that were dispensed within the study time frame were sent from the Shopko general office via a datatype cartridge. The data were transferred from the cartridges to a personal computer database at the School of Pharmacy. FoxPro software, version 2.5 was used for the database programming. The first step in preparing the database for analysis was to separate out the prescriptions dispensed under the Wausau Insurance prescription plan.

Identification of Wausau Insurance Prescriptions:

The prescriptions dispensed after the change in prescription benefits were easy to identify because they had a DPS code in the third party data element. However, identifying the prescriptions dispensed before the change was more difficult because prior to the change, the prescription benefits were indemnity benefits. Shopko had a special arrangement with Wausau Insurance to bill them directly for these indemnity prescriptions, and the prescriptions billed this way could be identified by a WAU code in the third party data element. However many people either were unaware of, or chose not to take advantage of this service and their prescriptions were indistinguishable from cash prescriptions in the database.

Figure 3.2 Overview of Database Preparation



It was decided that the best way to separate out the Wausau Insurance prescriptions was to identify any customer that had at least one prescription dispensed with a DPS code in the third party data element, and then select all prescriptions dispensed to those customers during the entire study period. This resulted in a database of prescriptions dispensed to customers who had received at least one prescription under the DPS plan. One problem with this method was that it missed any customer who only had prescriptions dispensed to them before the change. This contributed toward the smaller number of pre-change prescriptions mentioned earlier. While this problem could not be corrected, it was not thought to be a large problem, since the customers of interest were those who had prescriptions dispensed to them both before and after the change in benefits.

Another problem with the database was that it contained some people who had switched to Wausau Insurance or from Wausau Insurance at some time during the study period. Since these people had different prescription benefits before they switched to or from Wausau Insurance, their prescriptions needed to be deleted from the database. To accomplish this, people with prescriptions having third party codes other than DPS, WAU or blank were identified. Prescription data for these people then were examined to determine when they switched to or from Wausau Insurance. If they had Wausau Insurance for all but approximately the last two months of the study time frame only those prescriptions dispensed under the other insurance were deleted. Since these people had undergone the change in insurance benefits and they had some post change prescriptions dispensed, their other prescriptions were retained. If the people had some other insurance for more than the last two months of the study period, all of their prescriptions were deleted from the database.

There was also a small number of people who had DPS insurance through someone else other than Wausau Insurance. To try to eliminate these people, all prescriptions with a DPS code dispensed prior to July 1, 1992 were identified. Due to the way prescription files were set up in the computer, if the insurance code was changed for a prescription number, any prescriptions filled under that number prior to the change also were assigned the new insurance code retroactively. Because of this, some Wausau Insurance customers had prescriptions showing up as DPS prescriptions prior to July 1, 1992 and therefore all customers with a DPS prescription prior to July 1, 1992 could not just be deleted from the database.

In order to try to identify correctly which of these people were Wausau Insurance customers, their prescription data were examined individually. Prescriptions for people that could be verified through audit information to be Wausau Insurance customers were left in the database. Prescriptions for people that could not be verified as Wausau Insurance customers were deleted. It is possible that prescriptions dispensed to some people who had non-Wausau Insurance DPS coverage which began after the switch remained in the database, but this was thought to be a very small number of people.

Creation of a Comparison Group:

Since the original dataset contained records of all the prescriptions dispensed at the two study pharmacies, it was possible to create a comparison group. The comparison group was composed of all prescriptions for non-Wausau Insurance customers. It contained prescriptions dispensed to customers with no insurance, other private third party insurance, and government provided coverage (Medicaid). While customers in the comparison group potentially could have undergone some changes in insurance

benefits during the study time frame, it was thought that a change affecting only a small percentage of the people would not have a large effect on the overall generic dispensing rates. To the best of the researcher's knowledge, there were no other major insurance plans in the area that had a change in the benefits for brand name drugs during the study period.

Linking Pharmacy Data elements with Medispan Data elements:

After creating the database of Wausau Insurance prescriptions, the next step in preparing the database for analysis was to link the data elements in the prescription database with the additional data elements contained in the 1992 Medispan database. The Medispan database had been modified previously, as described in the data collection section. To add these data elements to the prescription database, the files were linked by NDC number and where there was an NDC match, the new data elements were added.

Identifying July Plan and January Plan Members:

The next step in preparing the prescription database for analysis was to separate the people who had the benefit change begin on July 1, 1992 from those who had the benefit change begin on January 1, 1993. It originally was thought that anyone who had a prescription dispensed under a DPS code between July 1, 1992 and January 1, 1993 could be assumed to have had the change begin on July 1, 1992 and be assigned to the July plan. However, upon a close examination of the database, it was determined that because of the way the prescription files were set up in the computer, if

the insurance code was changed for a prescription number, any prescriptions filled under that number prior to the change also were retroactively assigned the new insurance code. This meant that prescriptions with a DPS code dispensed during that six month time period were not dispensed necessarily under the DPS insurance.

Based on this, the method used to assign people to a plan was to identify customer codes that had at least one prescription dispensed with a WAU or blank third party data element between August 1, 1992 and December 31, 1992 and assign these prescriptions to the January plan, meaning that they switched on January 1, 1993. Only the last five months of the six month overlap period was used because some people received their DPS cards late, or did not bring in their cards right away. This resulted in some people having blank or WAU third party data elements initially, even though they were in the plan that switched benefits on July 1, 1992. A program then was written to identify any customers who had at least one prescription assigned to the January plan, and assign all prescriptions dispensed to that customer to the January plan. All other prescriptions were assigned to the July plan.

It is believed that most of the prescriptions were assigned to the correct plan using this method, but if customers had prescriptions dispensed after August 1, 1992 without showing their new DPS cards, or if they had a prescription dispensed for a drug not covered under DPS, or if there was a computer problem at the time they had a prescription dispensed, their prescriptions may have been assigned incorrectly to the January plan. Their prescriptions could have been assigned incorrectly to the July plan if they had only refill prescriptions dispensed during the intermediate six month time period and all of these refill prescription numbers incorrectly were assigned a DPS third party code retroactively.

After indexing the database by customer code and drug name and examining the data elements fill date, customer code, drug name, plan, third party, quantity, price and prescription number it was determined that the plan of some customers had been identified incorrectly. It was decided to examine the customers individually to determine whether they were assigned to the correct plan. To do this, a new data element was created and all customers who had at least one prescription filled prior to January 1, 1993 were identified. These customers then were examined to determine if they had been assigned to the correct plan.

This determination was made by examining the third party codes for any new prescription numbers that were dispensed during the intermediate 6 month time period. If only refills were dispensed during that time period, then the determination was made by looking for changes in quantity dispensed or price paid. These data elements often signaled when the insurance change occurred, because the change also involved implementing a month supply restriction, and a change from usual and customary reimbursement to a usually lower service benefit reimbursement. Because of the large number of customers involved, only customers with more than five prescriptions were examined.

Final Modifications of the Database:

After the customers were assigned to the correct plan, the final steps of database preparation were to create an age data element from the birthdate data element, and to calculate a price differential between the brand and generic price for all generically substitutable prescriptions. To convert the birthdate to an age, the birthdate data

element was subtracted from the last day of the data collection period, 31 December 1993, and that number was divided by 365 to get an age, in years, for each customer.

To determine the price differential between the brand and generic price for all generically substitutable prescriptions, two data elements from the database were used. These were the AWP unit price and the HCFA FFP upper limit, which now contained the unit DPS MAC price. Since the ingredient cost reimbursement basis for the DPS plan was 90 percent of AWP for brands, 90 percent of the AWP unit price was used as the brand unit price. Then the DPS MAC unit price was subtracted from 90 percent of the AWP unit price to determine the unit price differential for each prescription. This differential was multiplied by the prescription quantity to give a total price differential for each generically substitutable prescription.

One additional step had to be performed for prescriptions that were dispensed generically. In this case, the price in the AWP unit price data element was for the generic product and the brand AWP unit price was needed. For these prescriptions the AWP unit price for the generic was replaced by the AWP unit price for the comparable brand name product. To do this, a file of unique GPI numbers for brand name drugs was created. This file contained two data elements, GPI and AWP unit price. This file then was linked back to the original database via GPI number, and the generic AWP unit prices in the original database were replaced by the brand name AWP unit prices. An average price differential was calculated for each therapeutic class. There were some prescriptions with a negative price differential and these were not included in the average. In most cases the negative price differential resulted from prescriptions that were dispensed with a branded generic. In these cases, 90 percent of the "brand" AWP was lower than the DPS MAC.

Data Analysis

Generic Dispensing Rates for Combined Study Plans and Comparison Group:

The first step in data analysis was to determine the overall generic dispensing rates before and after the change in insurance benefits. To do this, counts were made of the total number of prescriptions and total number of prescriptions for generic drugs dispensed during the pre-change period (7/1/91 to 6/31/92) and the post-change period (1/1/93 to 12/31/93). Generic prescriptions were identified in the Medispan database. The number of generic prescriptions was divided by the total number of prescriptions to obtain the generic dispensing rate for both time periods. Generic dispensing rates were determined for the combined study groups and the comparison group. These dispensing rates included both prescriptions written by the physician for a generic product and prescriptions written by the physician for the brand name product but substituted by the pharmacist with a generic product. An estimate of the proportion of prescriptions written by the physician for generic products was obtained from the audit described earlier.

Generic Dispensing Rates for July Plan and January Plan:

After obtaining the overall generic dispensing rates, the next step was to split the overall generic dispensing rates for the combined study groups into separate dispensing rates for both the July plan and the January plan. The change was implemented for the July plan on 7/1/92, while the change was implemented for the January plan on 1/1/93. Generic dispensing rates were obtained as described above for both plans in each of

three time periods: Time 1 (7/1/91 to 6/30/92), Time 2 (7/1/92 to 12/31/92), and Time 3 (1/1/93 to 12/31/93). During Time 2, the change had been implemented for the July plan but not for the January plan, so the January plan functioned as a control group. These rates also were compared to the comparison group.

Comparison of the July Plan and January Plan:

In order for the January plan to be a realistic control group, the customers in the July plan and the January plan needed to be similar in terms of age, average number of prescriptions, and their prescriptions needed to be from a similar mix of therapeutic classes. To compare the two plans, the unique customer codes from each plan were identified, and the average age of these customers was calculated. Then the total number of prescriptions dispensed to people in each plan during the entire study time period was divided by the number of customers in each plan to obtain an estimate of the average number of prescriptions per customer in each plan. Finally, the prescriptions were classified into fifteen different therapeutic classes, and the percent of prescriptions in each therapeutic class was calculated for both plans. The therapeutic classes are listed in Table 3.3.

All Prescriptions versus Substitutable Prescriptions:

There are actually two different denominators that can be used when calculating a generic dispensing rate. The generic dispensing rate can be determined by dividing the number of generic prescriptions by the total number of prescriptions, or by the number of substitutable prescriptions.

Table 3.3 Therapeutic Class Categorization

Cat. #	Therapeutic Class	AHFS* Number
1	Antihistamine	40000
2	Antiinfective	080000-084000
3	Autonomic	120000-129200
4	Blood formation & Coagulation	200000-204000
5	Cardivascular	240000-241600
6	Central Nervous System	280000-282800
7	Electrolytic, Caloric & Water Bal.	400000-404000
8	Antitussive, Expect. & Mucolytic	480000-482400
9	Eyes, Ears, Nose and Throat	520000-523600
10	Gasterointestinal	560000-564000
11	Hormones & Synthetic Subs.	680000-683608
12	Skin & Mucous Membrane	840000-848000
13	Smooth Muscle Relaxants	860000-861600
14	Vitamins	880000-882800
15	Miscellaneous Agents	

* American Hospital Formulary Service classification.

Although examining the generic dispensing rate for all prescriptions provided important information, it was confounded by the availability of substitutable prescriptions. If the mix of prescribed medications changed and there were either more or less substitutable drugs prescribed, it would affect the overall generic dispensing rate. This would confound the effect of the insurance benefit change.

In order to control for this, it was decided also to examine the generic dispensing rate for substitutable prescriptions. This rate was determined by dividing the number of generic prescriptions by the number of prescriptions that were for drug products with generic versions. These prescriptions were identified in the Medispan generic data element. The Medispan classification was used instead of the DPS MAC drugs because it was believed that pharmacists assumed that all substitutable drugs were on the DPS MAC list because the DPS MAC list included even some drugs that did not have an AB rated generic equivalent. An AB rated generic equivalent can be substituted with the patient's permission. A generic equivalent that is not AB rated can only be substituted with the approval of the prescriber.

Overall generic dispensing rates for substitutable prescriptions were determined for the combined plans in Time 1 and Time 3. They were also determined in Time 1, Time 2, and Time 3 for the July plan, January plan, and the comparison group in the same manner as described above for the overall generic dispensing rate.

All Customers versus Continuous Customers:

All customers identified as Wausau Insurance customers were included in the analyses described above, but not all customers in the dataset underwent the change in insurance benefits. Because not all pharmacies in the area processed DPS claims, some

customers started receiving their prescriptions from the two study pharmacies after the change in benefits. Since these customers did not receive prescriptions from the study pharmacies before the change, there were no data about their prescription purchasing behavior prior to the change in benefits. Also, because of the way in which customers were identified as a January plan or a July plan customer, all of the new customers were identified as July plan customers. This influenced the post-change generic dispensing rates for the July plan. In order to analyze only prescriptions that were dispensed to customers who received prescriptions before and after the change, any customer who had received at least one prescription prior to 1/1/93 was identified as a continuous customer. The analyses described above were then repeated for only the continuous customers.

Generic Dispensing Rates Across Therapeutic Classes:

After the generic dispensing rates for substitutable prescriptions were determined for the continuous customers, the next step was to examine the change in generic dispensing rates with certain therapeutic classes. The prescriptions had previously been classified into fifteen different therapeutic classes, and generic dispensing rates for substitutable prescriptions were determined for all but one of these classes during Time 1 and Time 3. The Blood Formation and Coagulation class was not analyzed because of the small number of substitutable prescriptions in it.

There also were some modifications made to several of the therapeutic classes. All thyroid prescriptions were deleted from the Hormone and Synthetic Substitute class because Synthroid[R] was identified in Medispan as a generically substitutable drug. This was skewing the results for the entire thyroid class since there is no AB rated generic

equivalent and it was not on the DPS MAC list. There were not enough non-Synthroid[R] prescriptions to justify analyzing the other thyroid prescriptions. All Lanoxin[R] and Procardia XL[R] prescriptions were removed from the Cardiovascular class for the same reason. Combined data from the January plan and the July plan were used because of the small sample size within some of the therapeutic classes. Time 2 substitution rates were not determined because the combined plan data was used. The analyses included only customers who had received prescriptions before and after the insurance benefit change.

Statistical Analysis:

Chi-square analyses were used to test the similarity of the two study plans and the comparison group in terms of customer age and therapeutic class mix of prescriptions. The significance of the increase in the physician generic prescribing rate was also tested via Chi-square analysis.

The hypotheses were tested via logistic regression. Logistic regression was used because the dependent variable, generic dispensing, was a dichotomous variable (either the prescription was dispensed with a generic product or it was not). The logistic regression analysis was done on a 25 percent random sample of the database in order to stay within the processing capabilities of a personal computer. Only the two study plans were analyzed in the regression analysis. The comparison group was not used in the analysis because of its large size. The independent variables used in the regression equation were plan, therapeutic class, age, and price differential. The independent categorical variables were coded using indicator coding, where antiinfectives were the reference category for therapeutic class and the July plan was the reference category for

the plan variable. When indicator coding is used, a separate variable is created for each category of the original variable. The effect of each variable is then compared to the effect of the reference category.

Separate equations were run for Time 1, Time 2, and Time 3 in order to test for the plan effects during each of those time periods. Because of this, and since only 25 percent of the prescriptions were used in the analysis, there were some therapeutic classes that were too small to include in the analysis. These were the vitamin, blood formation and coagulation, and miscellaneous therapeutic categories. The variables were entered into the regression equation using the backward stepwise method and the likelihood ratio test.

CHAPTER 4

RESULTS

This chapter reports the results of this study. The first section will present the physician generic prescribing rates determined from the audit of original prescriptions. The second section will compare customers in the January plan, the July plan, and the comparison group in terms of their age, average number of prescriptions and the mix of therapeutic classes of their prescriptions. The third section will report the overall generic dispensing rates for all prescriptions and for substitutable prescriptions before and after the change in insurance benefits. The fourth section will report the pre and post-change generic dispensing rates for each therapeutic class. The final section will present statistical analyses of the effect of the change in insurance benefits, therapeutic class, price differential, age, and time on generic dispensing rates.

Physician Generic Prescribing Rates

Table 4.1 reports the physician generic prescribing rates before and after the change in prescription drug insurance benefits. These rates were determined from the audit of original prescriptions described in the methods section. The percent generic column in Table 4.1 is the percent of prescriptions that were prescribed by the physician for a generic product. The results of the audit show an increase of 3.68 percentage points in the physician generic prescribing rate from the time period before to the time period after the change in insurance benefits. This increase was not statistically significant when tested via Chi-square analysis. The percent increase also was not significantly different for prescriptions from the two stores, although it was slightly higher in store

2. These findings suggest that the full amount of any increase in the generic dispensing rate can not be attributed to an increase in consumer purchase of generic prescription drugs, but should be adjusted to reflect changes in the generic prescribing rate.

Table 4.1 Physician Generic Prescribing Rates

	Store 1*		Store 2*		Both Stores**
	# Rxs	% Generic	# Rxs	% Generic	% Generic
Pre-change [1]	389	20.05	377	19.36	19.71
Post-change [2]	398	23.37	376	23.4	23.39

1. July 1, 1991 to June 30, 1992
2. January 1, 1993 to December 31, 1993
* The physician dispensing rates for the two store were not significantly different when tested via Chi-square analysis.
**The increase in physician generic dispensing rate was not significant when tested via Chi-square analysis.

Demographic Characteristics of the January Plan, July Plan, and Comparison Group

In order to compare the generic dispensing rates over time for the two study plans and the comparison group, it was necessary to examine their similarity in terms of the age of the customers and the average number of prescriptions per customer during the study period. The therapeutic class mix of the prescriptions in each group also was determined. The age and average number of prescriptions are listed in Table 4.2. The average ages of customers in the July and January plans, and the comparison group were similar. The percent of customers in each age group was not significantly different for the two study plans when tested via Chi-square analysis. However, the percent of customers in each age group was significantly different when the combined

study plans were compared to the comparison group ($p < 0.01$). This probably was because the percentage of customers in the over 60 age group was larger in the comparison group than it was in either of the two study groups. The small number of study plan customers in the over 60 age group results from the study groups being composed mostly of employees and their dependents. There were some retirees in the study groups, but it was still a much smaller proportion than the comparison group. All three groups had a large percentage of customers in the 0 to 20 age group. This may be explained by the location of the two study pharmacies near acute care clinics. Because of this, a large proportion of the prescriptions they dispense are acute care prescriptions for children.

Table 4.2 Age and Average Number of Prescriptions for Customers in the July Plan, January Plan, and Comparison Group

	July Plan*		January Plan*		Comparison**	
Age	No.	%	No.	%	No.	%
0-20	607	31.68	716	29.50	12422	31.59
21-40	597	31.16	766	31.56	12913	32.84
41-60	565	29.49	772	31.81	7922	20.15
>60	147	7.67	173	7.13	6061	15.42
Average Age	32.59		33.15		33.97	
Average # Rx [1]	15.84		20.02		9.50	

1. Average # of Rxs is average number of prescriptions per customer over the 2 1\2 year study time period.

* The percent of customers in each age category was not significantly different for customers in the July and January plans.

**The comparison group was significantly different from the combined study plans. Chi-square = 386.079 $p < 0.01$

Although the average age of all three groups was nearly the same, the average number of prescriptions per customer during the study was very different across the groups. The average number of prescriptions over the 2 1\2 year study period was over four prescriptions higher for customers in the January plan than it was for customers in the July plan. For customers in the comparison group it was considerably lower than either the July plan or the January plan. The presence of a one month supply quantity restriction would be one explanation for differences in the average number of prescriptions. This type of restriction would increase the average number of prescriptions per customer, since customers would have to obtain refills every month. The lower average number of prescriptions in the comparison group could be explained by this, since many of the customers in this group may not have had a quantity limit. However, this reasoning does not explain the lower average number of prescriptions occurring in the July plan compared to the January group. Since the July plan had the month supply limit imposed first, it would be expected that they would have a larger average number of prescriptions than the January plan.

The two study plans and the comparison group also were compared in terms of the therapeutic mix of prescriptions dispensed to customers in each group. The results are listed in Table 4.3. The prescriptions dispensed to customers in the July plan and the January plan had a significantly different therapeutic class mix when tested via Chi-square analysis ($p < 0.01$). The biggest difference was in the antiinfective class, where the July plan had 4.5 percent more antiinfectives than the January plan. Due to the data processing limitations of a personal computer, the therapeutic class mix could not be compared across the study groups and the comparison group. However, upon examination the comparison group appeared to have a somewhat different mix of prescriptions from the July plan or the January plan. The biggest difference between

the comparison group and the study plans was the larger percentage of cardiovascular and electrolytic agents in the comparison group. This can be explained by the larger percentage of customers in the over 60 age group in the comparison group. The comparison group had a lower percentage of antiinfectives than the study group did.

Table 4.3 Therapeutic Class Mix of Prescriptions Dispensed to Customers in the July Plan, January Plan, and Comparison Group.

	Percent of Total Prescriptions		
Therapeutic Class	July Plan*	January Plan*	Comparison Group
Antihistamine	2.06	2.68	1.70
Antiinfective	20.79	16.29	15.59
Autonomic	4.21	4.76	4.12
Blood formation & Coagulation	0.78	0.54	1.20
Cardivascular	15.65	16.90	18.09
Central Nervous System	19.55	21.74	19.58
Electrolytic, Caloric & Water Bal	3.92	5.20	6.42
Antitussive, Expect. & Mucolytic	2.06	1.76	1.51
Eyes, Ears, Nose and Throat	2.68	2.14	2.62
Gasterointestinal	2.67	3.16	2.78
Hormones & Synthetic Subs.	13.33	14.33	15.76
Skin & Mucous Membrane	4.51	4.11	3.38
Smooth Muscle Relaxants	0.65	0.99	0.76
Vitamins	1.99	1.19	1.02
Miscellaneous Agents	5.15	4.21	5.47
N =	40,783	48,595	374,178

* The July plan and the January plan had a significantly different therapeutic class mix. Chi-square = 670.603 , $p < 0.01$

Generic Dispensing Rates for All Prescriptions and Substitutable Prescriptions Before and After the Change in Insurance Benefits

In the following results section there are distinctions made between "all prescriptions" and "substitutable prescriptions". "All prescriptions" refers to using all prescriptions, both substitutable and non-substitutable, as the denominator for the generic dispensing rate. "Substitutable prescriptions" refers to using only prescriptions that could be substituted with a generic product as the denominator for the generic dispensing rate. There also is a distinction made between "all customers" and "continuous customers". "All customers" indicates the inclusion of all Wausau Insurance customers, some of which had only received prescriptions after the change. "Continuous customers" indicates the inclusion of only customers who had received prescriptions both before and after the change in insurance benefits.

Data analysis first was done to determine the generic dispensing rate for all prescriptions dispensed to all customers in either the Wausau Insurance July plan or January plan. The generic dispensing rate for all prescriptions is the percent of all prescriptions dispensed as a generic product. Table 4.4 compares the generic dispensing rate for the combined Wausau plans before and after the change in insurance benefits, to the generic dispensing rate of the comparison group during the same time frame. This was a gross measure of the impact of the change in insurance benefits. Time 1 is the one year period before the change and Time 3 is the one year period after both plans had undergone the change in benefits. The intermediate 6 month period was not included in this analysis because only some of the Wausau Insurance customers had undergone the change in insurance benefits. The generic dispensing rate for the combined Wausau Insurance plans increased 13.31 percentage points subsequent to the

change in insurance benefits. During these same time periods, the comparison group experienced an increase of 8.81 percentage points in their generic dispensing rate.

Table 4.4 Generic Dispensing Rates for the Combined Wausau Plans and the Comparison Group: All Prescriptions and All Customers

Generic Dispensing Rates Expressed as a Percent of Total Prescriptions

	Time 1 7/1/91 to 6/30/92		Time 3 1/1/93 to 12/31/93		Time 1-->3
	N*	%	N*	%	Increase**
Wausau Plans	13891	29.04	56716	42.34	13.31
Comparison Group	87279	31.63	188310	40.44	8.81

* N is the total number of prescriptions.

** Increase is the difference between the generic dispensing rates in the listed time periods.

The next step of the analysis was to take the information for the combined plans and split it into generic dispensing rates for each Wausau plan. Since the full dollar differential generic substitution plan was implemented for the July plan 6 months before the January plan, during the intermediate 6 months the January plan functions as a control group. The generic dispensing rates for each plan and the comparison group are reported in Table 4.5. The generic dispensing rate for the July plan increased slightly more from Time 1 to Time 2 than the January plan. It also increased much more than the January plan from Time 2 to Time 3, which is somewhat surprising. The generic dispensing rate for the comparison group increased slightly more from Time 1 to Time 2 than it did from Time 2 to Time 3, but in both cases the increase was

less than both of the Wausau plans. The total percent increase from Time 1 to Time 3 was the largest for the July plan, but was larger for both of the study groups than it was for the comparison group.

Table 4.5 Generic Dispensing Rates: All Prescriptions, All Customers

Generic Dispensing Rates Expressed as a Percent of Total Prescriptions

	Percent			Increase*		
	Time 1[1]	Time 2[2]	Time 3[3]	Time 1-->2	Time 2-->3	Time 1-->3
July Plan	29.50	36.75	44.55	7.25	7.80	15.05
January Plan	28.50	35.72	40.10	7.22	4.42	11.60
Comparison	31.63	37.03	40.44	5.40	3.41	8.81

1. July 1, 1991 to June 30, 1992
2. July 1, 1992 to december 31, 1992
3. January 1, 1993 to December 31, 1993

* Increase is the difference between the generic dispensing rates in the listed time periods.

Although the generic dispensing rate for all prescriptions provides important information, it is confounded by the percent of prescriptions that were available in the generic form. If the availability of generic products changes, either by the introduction of new patented therapies, or by drugs going off patent, this could change the generic dispensing rate for all prescriptions. This change could amplify or mask the effect of the change in insurance benefits. Also, the three groups could differ in terms of the mix of generically available drugs prescribed for them. In order to account for this, the next two tables report the generic dispensing rates for substitutable prescriptions. Table 4.6 lists generic dispensing rates for substitutable prescriptions before and after the change in insurance benefits, for all customers in the combined Wausau plans and

the comparison group. From the period before the change in benefits to the period after the change, the generic dispensing rate for the combined Wausau plans increased 7.4 percentage points more than the generic dispensing rate for the comparison group.

Table 4.6 Generic Dispensing Rates for the Combined Wausau Plans and the Comparison Group: Substitutable Prescriptions and All Customers

Generic Dispensing Rates Expressed as a Percent of Substitutable Prescriptions

	Time 1 7/01/91 to 6/30/92		Time 3 1/1/93 to 12/31/93		Time 1-->3
	N*	%	N*	%	Increase**
Wausau Plans	6605	60.09	29544	80.55	20.46
Comparison	44371	62.10	101324	75.15	13.05

* N is the total number of prescriptions.

** Increase is the difference between the generic dispensing rates in the listed time periods.

Table 4.7 Generic Dispensing Rates: Substitutable Prescriptions and All Customers and Substitutable Prescriptions

Generic Dispensing Rates Expressed as a Percent of Substitutable Prescriptions

	Percent			Increase*		[1]
	Time 1	Time 2	Time 3	Time 1-->2	Time 2-->3	Time 1-->3
July Plan	63.31	75.29	83.15	11.97	7.86	19.84
January Plan	57.99	67.36	77.90	9.37	10.54	19.91
Comparison	62.10	69.40	75.15	7.30	5.75	13.05

1 The difference in percent change between Table 4.6 and 4.7 for the Wausau plans is due to different denominators.

* Increase is the difference between the generic dispensing rates in the listed time periods.

Table 4.7 shows the same information as in Table 4.6, except that the generic dispensing rates for the Wausau plans are split into the two individual plans. As was the case with the generic dispensing rates for all prescriptions, the substitution rate increased less for the comparison group then it did for either of the two Wausau plans. This was true from Time 1 to Time 2, and Time 2 to Time 3. For the two Wausau plans, from Time 1 to Time 2 the July plan increased 2.6 percentage points more than the January plan. From Time 2 to Time 3 the January plan increased 2.68 percentage points more than the July plan.

After examining the data, it appeared that the July plan results for Time 3 were somewhat exaggerated. Because of the way in which customers were identified as a July plan or January plan member, all customers who had no prescriptions filled prior to Time 3 were classified as July plan members. This meant that while the customers classified as January plan members were all customers who had prescriptions dispensed to them before and after the change in insurance benefits, some July plan members only had prescriptions dispensed to them after the change in benefits. Since the purpose of the study was to examine the effect of the change in insurance benefits, it was decided that further analysis would include only those customers who had prescriptions dispensed to them before and after the change in insurance benefits (continuous customers).

Table 4.8 reports the generic dispensing rates for continuous customers and substitutable prescriptions. The generic dispensing rates from Time 1 and Time 2 are the same as reported in Table 4.7. The only rate that was changed was the substitution rate in Time 3 for July plan customers. This decreased by 2.81 percentage points from the rate reported for the July plan which included all customers. This indicates that the new customers had a higher generic dispensing rate than the continuous customers did.

Table 4.8 Generic Dispensing Rates: Substitutable Prescriptions and Continuous Customers

Generic Dispensing Rates Expressed as a Percent of Substitutable Prescriptions

	Percent			Increase*		
	Time 1	Time 2	Time 3	Time 1-->2	Time 2-->3	Time 1-->3
July Plan	63.31	75.29	80.34	11.97	5.05	17.03
January Plan	57.99	67.36	77.90	9.37	10.54	19.91
Comparison	62.10	69.40	75.15	7.30	5.75	13.05

* Increase is the difference between the generic dispensing rates in the listed time periods.

All of the previous results were reported for three time periods, pre-change, intermediate, and post-change. Although this provided important aggregate information, it also was important to examine monthly generic dispensing rates for both Wausau plans and the comparison group. This gave a better picture of the time trends in the generic dispensing rates. The time series data are reported in Table 4.9 and Figure 4.1. The monthly data show that generic dispensing rates increased over time for all three groups, but the effects of the change in insurance benefits are also apparent.

What is especially interesting in the monthly generic dispensing rate data, is the change between the months before and after the change was implemented. The impact of the change is shown in Table 4.10 where between June and July the generic dispensing rate for the July plan, which had the benefit change implemented, increased 9.18 percentage points. During this same time period there were negligible changes for the January plan and comparison group. Between December and January, when the January plan change was implemented, there was an increase of 7.44 percentage points

in the generic dispensing rate for the January plan, and an increase of less than 2 percentage points for the July plan and the comparison group.

Figure 4.1 shows a graph of the monthly generic dispensing rates. The pre-change rates were somewhat erratic for the two study plans, due to the smaller number of prescriptions, but the July plan rates appear slightly higher than the January plan or comparison group rates. There was a large increase in the generic dispensing rate for the July plan after the change was implemented on July 1, 1992 and for the next six months the July plan rates were higher than the January plan rates. There was however, a temporary decrease in the rate for the July plan in the second month post-change, which can not be explained. The rate did increase again in the third month post-change. On January 1, 1993 when the January plan had the change implemented, there was an increase in the January plan substitution rates. Thereafter, the July plan and the January plan have similar rates and their rates were both higher than the comparison group rates.

Figure 4.1 Monthly Generic Dispensing Rates: Substitutable Prescriptions and Continuous Customers

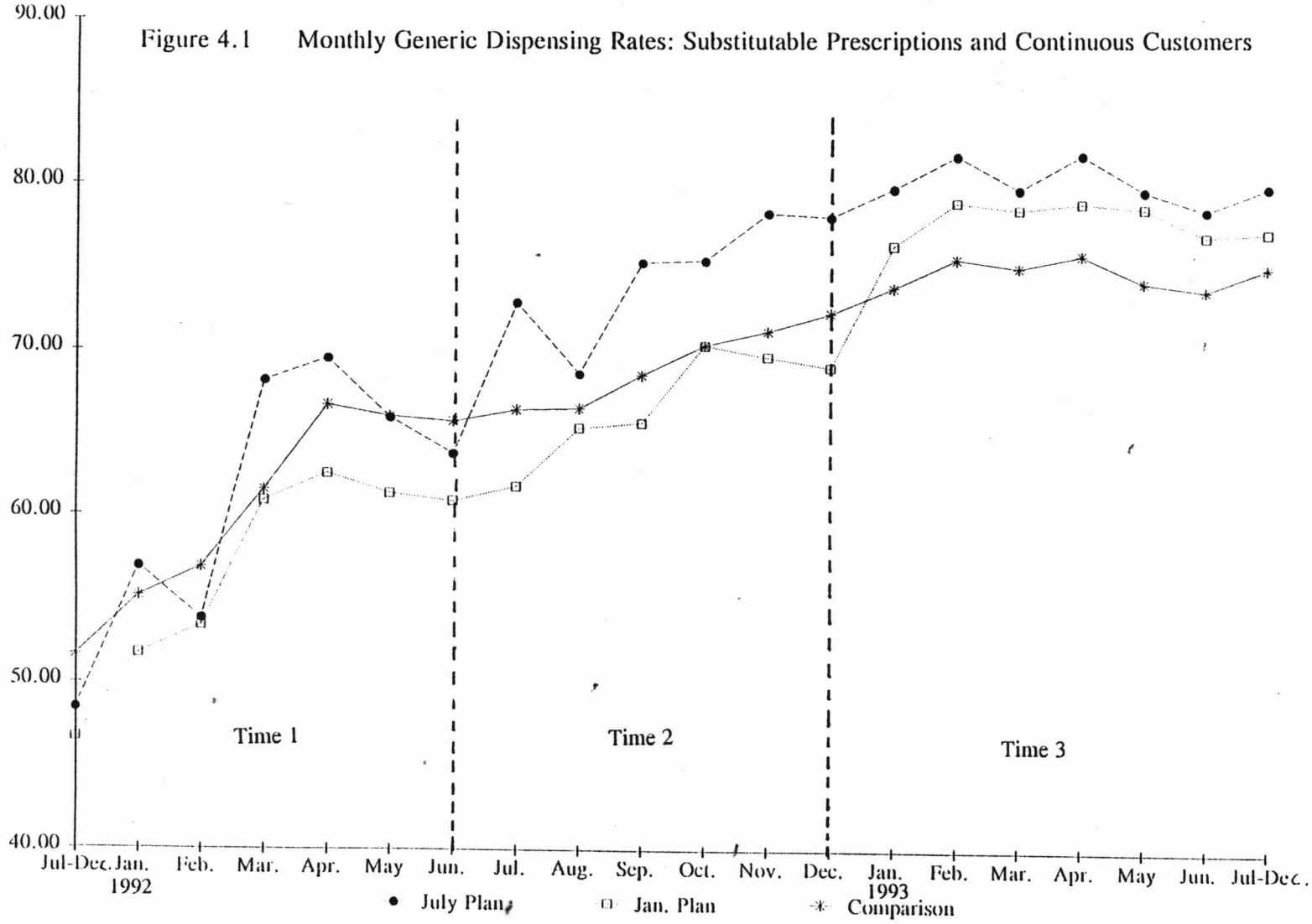


Table 4.9 Monthly Trends In Generic Dispensing Rates: Substitutable Prescriptions and Continuous Customers

	1991 Jul-Dec.	1992 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
July Plan	48.48	56.91	53.85	68.18	69.52	65.96	63.77	72.95	68.64	75.43
Jan. Plan	46.70	51.77	53.43	60.87	62.53	61.34	60.89	61.78	65.35	65.68
Comparison	51.66	55.16	56.86	61.53	66.70	66.03	65.73	66.45	66.55	68.57

	1992 Oct.	Nov.	Dec.	1993 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul-Dec.
July Plan	75.58	78.45	78.24	79.97	81.92	79.98	82.05	79.94	78.79	80.22
Jan. Plan	70.39	69.72	69.11	76.55	79.17	78.77	79.19	78.90	77.24	77.49
Comparison	70.40	71.28	72.42	74.00	75.77	75.27	76.06	74.43	73.96	75.36

Table 4.10 Increase In Generic Dispensing Rates One Month Post Insurance Change

Increase in Generic Dispensing Rates

	1992 Jun.-Jul.	1992-1993 Dec.-Jan.
July Plan	9.18%	1.73%
Jan. Plan	0.89%	7.44%
Comp.	0.72%	1.58%

Generic Dispensing Rates for Specific Therapeutic Classes

The pre and post-change generic dispensing rates for each therapeutic class are reported in Table 4.11 The generic dispensing rates are given only for Time 1 and Time 3. Time 2 is excluded because only one of the groups had switched during this time period. The dispensing rates are for substitutable prescriptions and for continuous customers in the combined Wausau Insurance plans. The comparison group was not used in this analysis. There were modifications made in some of the therapeutic classes to remove prescriptions that met the following criteria: 1) they did not have a an AB rated generic available and 2) they were not on the DPS MAC list. Table 4.11 shows large differences across therapeutic classes both in the pre-change substitution rates and in the percent change in the rates after the change in insurance benefits.

There was tremendous variability in the generic dispensing rates across therapeutic classes prior to the change in insurance benefits. The generic dispensing rates ranged from 13.49 percent to 89.43 percent. After the change in insurance benefits there was less variability in the generic dispensing rates, with rates ranging from 59.59 percent to 96.49 percent. The increase in generic dispensing rates from the pre-change period to the post-change period ranged from 1.33 percentage points to 49.60 percentage points.

The Antiinfective and Gasterointestinal classes both had high pre-change generic dispensing rates. Because of this, there were minimal increases in the generic dispensing rates after the change in insurance benefits. The lowest pre-change generic dispensing rates were in the antihistamine, cardiovascular, autonomic and antitussive classes, but all four of these classes experienced large gains after the change in insurance benefits. The antihistamine class before the change had an extremely low substitution rate of 13.49 percent. Even after the change in insurance benefits, it still

only had a generic dispensing rate of 63.09 percent. This may be due to the large number of non-AB rated generic drugs in this class. In most cases, customers would not have been offered non-AB rated generic drugs before the change. This would explain the low pre-change substitution rate. After the change, customers would have been offered the generic, but they were advised that they would have to wait while the pharmacist contacted the physician. This may have discouraged customers from accepting the generic version.

One class that had a low pre-change substitution rate and yet only experienced minimal gains after the change was the vitamin class. This may have been because the majority of prescriptions in this category were for prenatal vitamins. Consumers may have been reluctant to take a generic version while pregnant, possibly because they were trying to avoid any perceived risk to the baby (more risk averse). This class also had a low price differential, which may not have provided enough incentive to accept the generic version.

Table 4.12 shows the average amount of price differential between the brand name and generic versions for each therapeutic class. The average was calculated for all substitutable prescriptions with price differentials greater than zero. The lowest amounts of price differential were in the Electrolytic, Hormone, and Vitamin classes. The average price differentials were under $10.00 for all of these classes. The highest price differentials were in the Antiinfective, Cardiovascular, and Gasterointestinal classes. The price differentials for these classes were all over $20.00, with the Antiinfective class having the highest price differential ($29.36).

Table 4.11 Generic Dispensing Rates Across Therapeutic Class: Substitutable Prescriptions and Continuous Wausau Plan Customers

Generic Dispensing Rates Expressed as a Percent of Substitutable Prescriptions					
	Time 1		Time 3		
Therapeutic Class	Percent	No.[1]	Percent	No.[1]	Increase
Antihistamines	13.49	126	63.09	298	49.60
Antiinfectives	89.43	1419	96.49	5129	7.06
Autonomics	40.68	322	78.62	945	37.94
Cardivascular Drugs[2]	46.16	860	90.13	2311	43.97
Central Nervous System Agents[3]	66.12	1470	90.80	5269	24.68
Electrolytic, Caloric & Water Bal.	63.52	603	85.78	2067	22.26
Antitussives, Expect. & Mucolytics	39.17	120	81.29	727	42.12
Eyes, Ears, Nose and Throat Drugs	51.88	133	66.85	362	14.97
Gasterointestinal Agents	82.28	79	84.24	184	1.96
Hormones & Synthetic Subs.[4]	76.73	245	82.43	1104	5.70
Skin & Mucous Membrane Drugs	66.87	166	73.31	577	6.44
Smooth Muscle Relaxants	64.71	102	82.59	201	17.88
Vitamins	58.26	115	59.59	584	1.33
Miscellaneous Agents	62.80	164	75.90	614	13.10

1. Total number of substitutable prescriptions in each category.
2. After removing Lanoxin and Procardia XL prescriptions.
3. After removing stimulent prescriptions (e.g. Methylphenidate)
4. After removing thyroid prescriptions.

Table 4.12 The Average Price Differential Between the Brand Name and Generic Versions Across Therapeutic Classes

Therapeutic Class	Average Price Differential ($)*
Antihistamines	16.29
Antiinfectives	29.36
Autonomics	11.50
Cardivascular Drugs	24.23
Central Nervous System Agents	17.38
Electrolytic, Caloric & Water Bal.	7.55
Antitussives, Expect. & Mucolytics	10.08
Eyes, Ears, Nose and Throat Drugs	18.33
Gasterointestinal Agents	22.33
Hormones & Synthetic Subs.	5.75
Skin & Mucous Membrane Drugs	19.93
Smooth Muscle Relaxants	14.99
Vitamins	5.55

* The amount of price differential between the brand name version and the generic version. Only substitutable prescriptions were included in the analysis.

Logistic Regression Results: The Influence of Plan, Therapeutic Class, Age, and Price Differential on Generic Dispensing

A separate logistic regression analysis was done for each time period. The results for Time 1 (pre-change) are shown in Table 4.13. Before the change in insurance benefits occurred, generic dispensing rates for the July plan and the January plan were not significantly different. Therapeutic class of the prescription had a significant influence on generic dispensing ($p < .01$). However, age of the consumer and the price differential between the brand name product and the generic version did not significantly influence generic dispensing. Because of the way in which categorical data is coded in logistic regression, the coefficient and odds ratio are not reported for the overall therapeutic category, but only for individual therapeutic classes. Table 4.13 reports both the significance of the Wald statistic and the significance of the log-likelihood ratio difference if a term is removed from the model. In cases where the statistics disagree, the likelihood ratio test is considered to be a better test for statistical significance than the Wald test (Hosmer and Lemeshow, 1989).

The odds ratios reported in Table 4.13 compare the generic dispensing rate of each therapeutic class to the antiinfective class. For example, a prescription in the cardiovascular class is only 29 percent as likely to be dispensed with a generic version as a prescription from the antiinfective class is. For plan, the odds ratio compares the January plan to the July plan. For age, which was a continuous variable, the odds ratio of 1.0012 means that for every 1 year increase in age, generic dispensing of a prescription is 1.0012 times more likely. For price differential, which was also a continuous variable, the odds ratio of 1.0026 means that for every 1 dollar increase in the price differential, generic dispensing of a prescription is 1.0026 times as likely.

Table 4.13 The Influence of Plan, Therapeutic Class, Age and Price Differential On Generic Dispensing Prior to the Change In Insurance Benefits

Variable	Coefficient	S.E.	Odds[1]	Sig.*
Constant	0.8926	0.3334		
Plan	0.1005	0.1654	1.1058	0.5434
Age	0.0012	0.0057	1.0012	0.8306
Pricedif.	0.0026	0.0034	1.0026	0.5414
Therclass				0.0000
Antihistamines	-3.3232	1.0801	0.0360	0.0021
Autonomics	-1.5670	0.3981	0.2087	0.0001
Cardiovasculars	-1.2376	0.3441	0.2901	0.0003
CNS Agents	-0.6075	0.3049	0.5447	0.0463
Electrolytics	-0.2608	0.3766	0.7705	0.4887
Antitussives	-1.5072	0.5871	0.2215	0.0103
EENT	1.3732	1.0734	3.9481	0.2008
Gasterointestina	-0.1372	0.8838	0.8718	0.8766
Hormones	-0.6027	0.9646	0.5473	0.5321
Skin Agents	1.1668	1.0851	3.2117	0.2822
Muscle Relax.	-1.1052	1.4409	0.3312	0.4431

N = 699

Agreement between observed and predicted probabilities = 62.95%

1. For therclass variables the odds are relative to Antiinfectives, for plan the odds are relative to the July plan.

* Significance is based on the Wald Statistic.

Model if Term Removed

Term Removed	Log Likelihood	-2 Log LR	Significance
Plan	-443.987	0.369	0.5435
Age	-443.825	0.369	0.8306
Pricedif	-443.992	0.379	0.5382
Therclass	-472.950	58.296	0.0000

Table 4.14 reports the logistic regression results for Time 2, the six month period after the July plan had changed insurance benefits but before the January plan had changed benefits. The main difference between Time 1 and Time 2, is that in the logistic regression equation analysis for Time 2, plan has a significant influence on generic dispensing ($p < .01$). Customers in the January plan are 0.4294 times as likely to have prescriptions dispensed with a generic product as customers in the July plan are. During this time therapeutic class was still a significant influence on plan ($p < .01$) and age was not. Price differential was a significant influence on plan, but only at the $p < .10$ significance level.

The results of the logistic regression equation for the time period after both plans had changed insurance benefits are reported in Table 4.15 . During this time period, plan no longer had an influence on generic dispensing. Therapeutic class was still a significant variable influencing generic dispensing ($p < .01$), but age was not. Price differential during this time period was significant at the $p < .01$ level. The odds ratio reported for price differential means that a 1 dollar increase in price differential makes generic dispensing 1.0322 times as likely.

Table 4.14 The Influence of Plan, Therapeutic Class, Age, and Price Differential On Generic Dispensing During Time 2[1]

Variable	Coefficient	S.E.	Odds[2]	Sig.*
Constant	2.5109	0.3552		0.0000
Plan	-0.8453	0.1752	0.4294	0.0000
Age	0.0045	0.0051	1.0045	0.3769
Pricedif.	0.0086	0.0052	1.0087	0.0992
Therclass				0.0000
Antihistamines	-3.7027	0.6300	0.0247	0.0000
Autonomics	-1.9379	0.3648	0.1440	0.0000
Cardiovasculars	-1.3209	0.3787	0.2669	0.0005
CNS Agents	-1.1466	0.3188	0.3177	0.0003
Electrolytics	-0.4933	0.4177	0.6106	0.2377
Antitussives	-2.3683	0.4777	0.0936	0.0000
EENT	0.0678	0.7973	1.0701	0.9323
Gasterointestina	-2.1644	0.8386	0.1148	0.0099
Hormones	3.8096	8.9895	45.133	0.6717
Skin Agents	0.3882	1.0834	1.4744	0.7201
Muscle Relax.	-0.1190	1.0959	0.8878	0.9135

N = 1024

Agreement between observed and predicted probabilities = 79.88%

1. Time 2 is the period after the insurance change was implemented for the July plan, but before the change was implemented for the January plan (7/1/92 to 12/31/92)
2. For therclass variables the odds are relative to Antiinfectives, for plan the odds are relative to the July plan.

* Significance is based on the Wald Statistic.

Model if Term Removed

Term Removed	Log Likelihood	-2 Log LR	Significance
Plan	-506.126	24.853	0.0000
Age	-494.090	0.782	0.3766
Pricedif	-495.190	2.980	0.0843
Therclass	-540.396	93.392	0.0000

Table 4.15 The Influence of Plan, Therapeutic Class, Age, and Price Differential on Generic Dispensing After the Change In Insurance Benefits

Variable	Coefficient	S.E.	Odds[1]	Sig.*
Constant	1.7635	0.2787		0.0000
Plan	-0.2662	0.1628	0.7663	0.1019
Age	0.0033	0.0050	1.0033	0.5148
Pricedif.	0.0317	0.0074	1.0322	0.0000
Therclass				0.0002
Antihistamines	-0.9110	0.5068	0.4021	0.0722
Autonomics	0.1547	0.3505	1.1673	0.6589
Cardiovasculars	0.3502	0.3342	1.4193	0.2947
CNS Agents	-0.1727	0.2397	0.8414	0.4712
Electrolytics	1.1839	0.3813	3.2672	0.0019
Antitussives	0.1940	0.4773	1.2142	0.6843
EENT	1.5845	1.0299	4.8771	0.1239
Gasterointestina	-1.0302	0.6976	0.3569	0.1397
Hormones	0.7325	1.0637	2.080	0.4910
Skin Agents	-1.0046	0.4560	0.3662	0.0276
Muscle Relax.	3.9543	7.0237	52.159	0.5734

N = 2106

Agreement between observed and predicted probabilities = 69.24%

1. For therclass variables the odds are relative to Antiinfectives, for plan the odds are relative to the July plan.

* Significance is based on the Wald Statistic.

Model if Term Removed

Term Removed	Log Likelihood	-2 Log LR	Significance
Plan	-611.867	2.729	0.0985
Age	-610.715	0.424	0.5148
Pricedif	-622.937	24.869	0.0000
Therclass	-631.086	41.167	0.0000

CHAPTER 5
DISCUSSION

This chapter will provide a discussion of five main topics. The first section will discuss the physician generic prescribing rate. The next section will discuss the use of the comparison group, and the use of the January plan as a control group. The third section will discuss change in generic prescribing rates and compare and contrast the results when all prescriptions were used, with the results when only substitutable prescriptions were used. The fourth section will discuss how well the results support the proposed theoretical framework. Finally, the limitations of the study will be discussed.

Changes In the Physician Generic Prescribing Rate

As reported in the results, the physician generic prescribing rate increased from the period before the insurance change to the period after the insurance change. This meant that only part of the increase in the generic dispensing rate was due to an increase in consumer purchase of generics. There are several possible reasons for the increase in physician generic prescribing rates. One reason is that as more generics became available, physicians may have become more aware of generics and started prescribing them more often. Another reason could have been a change in physician behavior in response to the increasing pressure to slow the growth of health care costs. During the study time period there was considerable political discussion of health care reform and the need to contain health care costs. A final reason is the effect of the change in prescription drug insurance benefits. Wausau is not a large city, and the

insurance change affected a large percent of the local population. For some of the drugs on DPS's MAC list, after the change in insurance benefits pharmacists would have to call the physician to get permission to substitute the generic for these drugs. Physicians who were contacted frequently (e.g. acute care clinic physicians) may have started prescribing the generic version more often, in order to eliminate the need to contact them. What ever the reason for the increase, it is important to account for changes in physician generic prescribing rates when examining changes in generic dispensing rates.

Although there was an increase in the physician generic prescribing rate, the increase was very small compared to the increase in generic dispensing during the same time period. One reason for this may have been the influence of pharmaceutical advertising on physicians. Pharmaceutical manufacturers heavily promote their brand name products to physicians. Physicians are constantly seeing reminders to prescribe a certain brand in journal advertisements and on promotional merchandise (e.g. pens and pads of paper with the names of brand name products on them). They also receive periodic visits from pharmaceutical manufacturer representatives who are promoting the brand name products of their company. All of this promotion of brand name products encourages physicians to prescribe brand name products. In addition, the names of brand name products are often shorter and easier to remember than the generic name. These influences probably kept the increase in the generic prescribing rate to a minimum.

Use of a Comparison Group and the January Plan as a Control Group

In addition to examining the generic dispensing rate for customers who underwent a change in their prescription drug insurance, this study also determined generic dispensing rates for a comparison group. This comparison group contained prescriptions from all of the customers at the study pharmacies who did not have Wausau Insurance. This comparison group contained customers with no insurance, other private non-Wausau third party insurance, and state Medicaid coverage. This group could not be used as a control group because potentially, customers in this group also could have undergone some type of change in insurance benefits that affected their purchase of generic prescription drugs. However, it does make a reasonable comparison group because it reflects changes that were occurring in the environment throughout the study time period. Also, based on the researcher's knowledge of insurance plans in the area, there were no other major plans in the area that implemented a full dollar differential generic substitution plan during the study time period. However, a few plans did implement either a differential copayment for generics, or switch from copayments to coinsurance during the study time frame and this could have influenced consumer purchase of generics. Because of this, the increase in generic dispensing rates for the comparison group was probably higher than it would have been for a control group which had no changes in insurance benefits.

Although it was not reasonable to use the non-Wausau prescriptions as a control group, one Wausau plan could be used as a control group for the other Wausau plan. This was because one Wausau plan had the change in benefits implemented six months before the other group. However, the plan that switched last could only function as a control group if both plans were similar in terms of the age of the customers, and the

mix of therapeutic classes of the prescriptions. Fortunately, the July plan and the January plan were very similar in terms of the age of the customers in each plan. The average age was almost identical for both plans. The mix of therapeutic classes also was similar for both plans, although there were some small differences. After these therapeutic class differences were controlled for in the statistical analysis, the two plans did not differ significantly in their pre-change generic dispensing rates. This suggests that it was appropriate to use the plan that switched last as a control group.

Changes in Generic Dispensing Rates

Two conclusions about generic dispensing rates were apparent from the results of this study. First, there was an upward trend in generic dispensing rates over the study time period. This was true for both of the study groups and the comparison group. The other main conclusion was that the implementation of a full dollar differential generic substitution plan does significantly increase the generic dispensing rate. These conclusions held both when the generic dispensing rates were determined for all prescriptions and when they were determined for only substitutable prescriptions. However, there were some definite differences depending on whether all prescriptions or only substitutable prescriptions were used in the analysis.

First of all, the pre-change generic dispensing rates were ranked differently when different denominators were used in the analysis. When all prescriptions were used, the comparison group had the highest pre-change generic dispensing rate and the January plan had the lowest rate. When only substitutable prescriptions were used, the January plan still had the lowest rate, but the July plan now had the highest rate. For the six month period after the July plan had the change implemented, the July plan had

a larger increase in the generic dispensing rate than either the January plan or the control group. This was true both when all prescriptions were used and when only substitutable prescriptions were used. The percent increase was larger when only substitutable prescriptions were analyzed, but this is not surprising, since the denominator decreased.

The biggest difference between using only substitutable prescriptions and using all prescriptions occurred after the January plan had the change implemented. It was expected that the January plan would have the largest increase from Time 2 to Time 3 since this was when they had the change implemented. Since the July plan had the change implemented six months earlier, it was thought that from Time 2 to Time 3, they would have an increase that was similar to, or slightly higher than the comparison group. This occurred when only substitutable prescriptions were used in the analysis. However, when all prescriptions were used in the analysis, there were some surprising results. The July plan had a much larger increase from Time 2 to Time 3 than the January plan did. The increase for the January plan was only slightly greater than for the comparison group.

The magnitude of the changes was also dependent on the denominator. The increase in the July plan substitution rate from Time 2 to Time 3 was virtually the same when substitutable prescriptions were used as it was when all prescriptions were used. However, for the January plan, the increase was about 6 percentage points larger when only substitutable prescriptions were used then it was when all prescriptions were used. This appears to show a large increase in the proportion of non-substitutable prescriptions dispensed to customers in the January plan from Time 2 to Time 3. It is unclear, given the similarity of the two plans, why this occurred for the January plan and not the July plan.

The denominator used in the analysis was also a factor when examining the total increase from the pre-change to the post-change time periods. When using all prescriptions as the denominator, the July plan increase was about 3 percentage points larger than the January plan, and about 6 percentage points larger than the comparison group. When only substitutable prescriptions were used in the analysis, the July plan and the January plan had virtually identical rates of increase. The comparison group decrease was about six percentage points smaller than the two study groups. Because the generic dispensing rate for all prescriptions was confounded by the proportion of prescriptions that were available in a generic version, the most accurate estimate of the effect of the change in insurance benefits is obtained when only substitutable prescriptions are included in the analysis.

The other decision that needed to be made during the analysis was whether to include all Wausau Insurance customers' prescriptions in the analysis, or only include prescriptions from customers who received prescriptions before and after the change. As a result of the method in which customers were identified in the database as a July plan or January plan customer, including all customers in the analysis only affected the July plan. Including all customers in the analysis exaggerated the amount of increase in the generic dispensing rate for the July plan. It appeared that customers who only received prescriptions after the change had a higher generic dispensing rate than customers who had received prescriptions at the study pharmacies before and after the change in benefits.

There are two possible reasons why customers might have had no prescriptions dispensed at the study pharmacies prior to the change. One reason is that they were getting their prescriptions from another pharmacy. The other possibility is that they had not needed any prescriptions in the period prior to the change. If this was the case,

they might have been more willing to take a generic version for a new prescription than would a customer who already had been getting the brand name product and would now have to switch to a generic version. Because the primary objective of this study was to measure the effect of the change in insurance benefits, the most accurate assessment of this effect was from the analysis that used only customers who received prescriptions before and after the change.

Since substitutable prescriptions and continuous customers provided the best estimate of the effect of the insurance change, the monthly substitution rates were determined only for this subset. Analyzing the monthly substitution rates provided some important information that was not obtained from the aggregate pre-change and post -change substitution rates. There was a substantial increase for both plans in the month following the implementation of the insurance change. However, the monthly substitution rates for about the first year of the study time period are very erratic for the July plan. The July plan did have a slightly smaller sample size than the January plan, which may explain the fluctuations partially.

Since the July plan substitution rate was fluctuating so much in the time period prior to the insurance change, it is hard to conclude that the entire increase in the month immediately following the change is in fact due to the change. This is supported by the large drop in the second month post-change substitution rate. Probably a more realistic estimate of the effect of the insurance change would be to average the one month post-change increase with the second month post-change decrease. It is much easier to conclude that the full amount of the one month post-change increase for the January plan was due to the insurance change. The January plan monthly substitution rates were much more stable in the period prior to the change than the July plan rates were.

Results and the Proposed Theoretical Framework

Both risk-price theory and economic demand theory predict that an increase in the price of a good relative to its substitute would result in more people choosing to purchase the substitute instead of the original good. Since implementing a full dollar differential generic substitution plan increases the price of the brand name product relative to the generic, implementing this type of plan should result in an increased generic dispensing rate. This is what the results of this study showed. There was a large increase in the generic dispensing rate after the full dollar differential substitution rate was implemented. This also indicates that consumers are sensitive to the price of brand name prescription drugs.

The logistic regression results also support the conclusion that the change in benefits had an effect. There was not a significant difference between the July plan and the January plan before the change was implemented. Then, after the change was implemented for the July plan, there was a significant difference in the generic dispensing rates for the two plans. Finally, after the change also was implemented for the January plan, there again was no significant difference in generic dispensing rates for the two plans. This clearly shows the effect of the full dollar differential generic substitution plan.

Economic demand theory also predicts that the magnitude of the price differential between the brand name product and the generic version would affect consumers' decisions to purchase the generic. This theory predicts that the larger the price differential, the more people that would purchase the generic version. This prediction also was supported by the logistic regression results. Price differential was not a significant predictor of generic dispensing before the change occurred. This is not

surprising since before the change people may not have been aware of the difference, or even if they were aware of the difference they may not have cared since they did not have to pay the difference directly. After the change had been implemented for one plan, price difference was significant at the $p < .10$ level but not at the $p < .05$ level. Since the change had affected less than half of the people during this time period this result makes sense. After the change was implemented for both plans, price differential became significant at the $p < .05$ level. This supports the economic theory prediction that the magnitude of the price differential is a predictor of the generic dispensing rate.

The other theory, risk-price theory, proposed that consumer perceive risk in purchasing the generic version of a prescription drug, but that they may be willing to purchase the generic version anyway, if the amount of price differential between the brand and generic is enough to compensate them for their perceived risk. This theory also predicts that implementing a full dollar differential generic substitution plan would increase the generic dispensing rate. Before the substitution plan was implemented, there was no price savings to compensate consumers for their perceived risk and therefore, only customers who perceived little or no risk in using the generic version would purchase the generic. After the change, since customers would have to pay more for the brand name, the price differential might be enough to convince even customers who perceived risk in using the generic version to purchase it. This theory also predicts that as the amount of price differential increases, more people would be persuaded to purchase the generic. The results of this study support this theory also.

The main advantage of risk-price theory is that it offers an explanation for differences in generic dispensing rates across different therapeutic classes. This theory predicts that peoples' perceived risk could vary depending on the therapeutic class of

the prescription drug. Economic demand theory would predict that price differential would be a factor, but not that therapeutic class would be a factor. Logistic regression results showed that therapeutic class was a predictor of generic dispensing during all three time periods and this offers support for risk-price theory. The only explanation that basic economic theory would have for the differences in generic dispensing rates across therapeutic class would be that there were differences in price differential across therapeutic class. There were differences in price differential across therapeutic classes, but therapeutic class was significant even after controlling for these price differentials. This indicates that risk-price theory may provide important insights about the market for generic prescription drugs.

There is one additional factor that may have moderated the increase in generic dispensing rates in different therapeutic classes. This is the promotion of brand name drugs by the pharmaceutical manufacturers. It is possible that brand name products in certain therapeutic classes may have been more heavily promoted than brand name products in other classes. There are two main ways that this promotion could have influenced the results. First, it may have influenced physician prescribing. This could have influenced generic prescribing in some therapeutic classes more than others. It may also have had differential effects on the mix of substitutable and non-substitutable products prescribed in different therapeutic classes. This could have influenced the results that included all prescriptions. Second, direct to consumer advertising could have influenced consumer purchase of prescription drugs. If consumers were familiar with the brand name product because of direct to consumer advertising, then it may have made them more reluctant to accept the generic version. It is not known which therapeutic classes would have been most influenced by the promotion of brand name products.

Limitations

There were several limitations of this study. First the study was restricted to a small geographic area and thus the results are not generalizable to other populations. The small geographic region was used because it was the region where the change in insurance benefits occurred. However, prescription records were obtained from only two pharmacies in this geographic region. It is possible that the results would have been different had prescription records been obtained for all customers who underwent the change in benefits. The two pharmacies were chosen because the researcher had worked for the chain that owned the pharmacies, and thus was able to obtain the prescription records. While only using prescriptions from two pharmacies limited generalizablity, the fact that the researcher had worked at one of the pharmacies helped immensely in the analysis of the data and provided valuable insights.

The other limitations of the study all resulted from problems with obtaining and analyzing the data. One of these limitations was that only the generic dispensing rate, and not the generic substitution rate could be determined. This was because there was no way to determine from the pharmacy computer data elements whether or not the prescription was written by the physician for a brand or generic product. Thus, prescriptions identified as generic in the computer system could have either been prescribed by the physician for a generic product, or prescribed by the physician for a brand name product and then substituted by the pharmacist with a generic version. An audit of a sample of prescriptions was done to determine an approximate physician generic prescribing rate to compensate for this. However, it was not possible to audit all of the prescriptions. Since the purpose of the study was to determine how the

change in insurance benefits affected consumer purchase of generic, the best analysis would have been the generic substitution rate, not the generic dispensing rate.

Another limitation arose from difficulties in identifying customers who underwent the change in prescription drug benefits and capturing other consumer variables. Prior to the insurance change, many of the customers with Wausau Insurance were indistinguishable from cash customers in the pharmacy database. Because of this, only customers who received prescriptions under Wausau Insurance after the change could be identified. Prescriptions dispensed to these customers prior to the change could be identified, but prescriptions dispensed to customers who only received prescriptions before the change could not be identified. This resulted in a smaller sample size of prescriptions in the time period prior to the change. Other consumer information, in particular social and economic status variables, were not available. Because of this, the income effect on consumer purchase behavior could not be accounted for.

There were also some difficulties in identifying whether customers belonged to the July plan or the January plan, since they were not identified as such in the database. Because of the way in which the computer system was set up at the pharmacy, for some data elements when a change was made in the information, the computer retroactively updated that data element for all of the previous dispensings of that prescription number. This resulted in a need to examine each customer individually to determine whether they belonged to the January plan or the July plan. While this should have resulted in the majority of customers being assigned to the correct plan, there was the possibility that some human error occurred.

Another limitation was in determining the price differential between the brand name product and the generic version. The difficulties in doing this are described in the methods section, and based on these difficulties the price differentials determined may

not be completely accurate. Finally, since the database used in the study was very large, and since there was a great deal of computer programming necessary to analyze the database, there is always the possibility that one or more computer programming errors may have occurred. However, a lot of effort was expended to do accurate computer programming and to track and correct any errors that occurred, and it is believed that any programming errors were minor and did not affect the results of the study.

CHAPTER 6
CONCLUSIONS

The primary purpose of this study was to examine how implementing a full dollar differential generic substitution plan affected the generic dispensing rate. The results of the study show that implementing this type of generic substitution plan does increase the generic dispensing rate. This suggests that consumers are sensitive to the price of brand name prescription drugs. The customers who underwent the change in insurance benefits experienced approximately a 20 percentage point increase in the generic dispensing rate for substitutable prescriptions. However, the entire amount of this increase can not be attributed to the change since the comparison group had approximately a 13 percentage point increase in the generic dispensing rate for substitutable prescriptions over the same time period. A conservative estimate of the effect of the change in insurance benefits is 7 percentage points, which is the difference between the study plans and the comparison group. This estimate is probably conservative, since incentives to purchase generic prescription drugs potentially could have been implemented for customers in the comparison group and this was not captured in the study. While 7 percentage points may not seem like a large increase, even that amount of increase in the generic dispensing rate for substitutable prescriptions will result in significant savings, because of the large price differential between brand and generic drugs.

The other purpose of this study was to examine how well economic theory and risk-price theory fit the market for generic prescription drugs. Both theories correctly predicted that implementing a full dollar differential generic substitution plan would increase the generic dispensing rate. The main difference between the two theories is

in their explanation of difference in generic dispensing rates across therapeutic classes. Economic demand theory predicts that any difference in generic dispensing rates across therapeutic classes should be explained by differences in the price differential between the brand name and generic products. In this study, there were differences in generic dispensing rates across therapeutic classes even after controlling for price differential.

Risk-price theory predicts that people will purchase the generic if the price savings is enough to overcome their perceived risk. In this theory, price differential is a factor but it is not the only factor. A small price differential would be enough to convince people to purchase the generic version if they perceived little risk in the purchase. However, if they perceived a large amount of risk in purchasing a generic prescription drug, then they would require a large price savings before they would purchase the generic version. Because consumers will have differing levels of perceived risk, this theory predicts that there would be differences in dispensing rate across therapeutic classes even after controlling for price differential.

The results of this study are consistent with what risk-price theory would predict, since there were significant differences in therapeutic class even after controlling for price differential. However, this study does not offer proof of the risk-price theory since there was no measure of consumers perceived risk. Ideally, to test this theory you would need to determine consumers' perceptions of risk a priori, and then examine their purchasing behavior. It was difficult to determine whether generic dispensing rates were lower in high risk therapeutic classes, since there was no measure of perceived risk across therapeutic class for the consumers used in the study. The results were somewhat consistent with predictions based on perceived risk measures from other studies. In summary, the results of this study offer some support for risk-price theory, but much more research is needed. It is important to note that the main purpose of this

study was to measure the impact of implementing a full dollar differential generic substitution plan. In this paper, risk-price theory was proposed as a way to predict the impact of this type of substitution plan, but this study was not designed specifically to test the validity of risk-price theory.

Implications

The results of this research have important implications for various parties. Certainly the results of this research have direct implications for insurers and employers. One implication is that the surface impact of insurance benefit changes may be masked or exaggerated by other changes in the environment. For example, although the generic dispensing rate increased approximately 20 percentage points for the two groups that experienced the benefit change, it would be inappropriate to conclude that the increase was entirely due to the benefit change, since the comparison group experienced approximately a 13 percentage point increase in their generic dispensing rate. Another implication for insurers and employers is that the impact of the policy was not consistent across therapeutic classes. This means that the effect of a benefit change may be very different for populations with a different therapeutic class mix of prescriptions.

There are also implications for pharmaceutical manufacturers. For manufacturers, if risk-price theory is correct it could influence pricing decisions. For example, manufacturers of generic prescription drugs may want to price generic products in a perceived high risk therapeutic category, such as cardiovascular drugs, so that the price differential between the brand name product and the generic version is large. In contrast, they probably would want to price generic products in a low perceived risk

class so that there is only a small price differential. In a low perceived risk class, people would not need as much incentive to take a generic product. Another implication for pharmaceutical manufacturers relates to promotion of prescription drug products. Brand name manufacturers would want to convince consumers that their products were less risky than generic products. Increasing consumer awareness of the brand name could make consumers less inclined to take the generic. They also could try to influence the risk perceptions of health care providers.

This research also suggests that health care providers could moderate the effects of insurance benefit changes. They could do this by influencing consumer decisions about whether to take the brand name or generic product. Previous research suggests that physician and pharmacist opinions about generic prescription drugs can influence consumer decisions (Ganther and Kreling 1995). This could increase generic dispensing if the health care provider expressed positive opinions about generic products. It also could decrease generic dispensing if the provider disapproved of generic products. In addition, prescribers could circumvent the insurance benefit change by prescribing more products that do not have a generic version available.

Finally, although this research did not measure the impact of the change on consumer health outcomes or satisfaction, this type of insurance benefit change could affect both of these outcomes. If consumers took the generic version reluctantly, their compliance might be affected adversely. If they were unhappy with the change in benefits, they might become dissatisfied with the insurance and complain to their employee benefit managers. When the change occurred, the researcher observed that many consumers complained vehemently about the change in benefits, and this could have resulted in employers changing insurance plans. In addition, consumers could ask prescribers to prescribe drugs that were not available in a generic version.

Future Research

As mentioned above, although this study offers support for risk-price theory, it was not designed specifically to test this theory. More research is necessary to fully test risk-price theory. Future studies should measure consumers' perceptions of risk associated with purchasing generic prescription drugs and then examine generic prescription drug purchasing behavior in the same group of consumers. In order to fully understand consumers' perceptions of the risk in purchasing a generic prescription drugs, more research also needs to be done to determine what factors affect perceptions of risk and whether perceptions of risk are static, or dynamic and easily influenced.

In this study, the effect of implementing a full dollar differential generic substitution plan on generic dispensing rates was examined for a small population. Future research is necessary to examine the effects of this, and other types of generic substitution plans, on consumer purchase of generic prescription drugs. Since this type of insurance change often affects only a localized population, it would be difficult to design a study that would be generalizable to the entire United States population. Because of this, it is important to repeat this type of study in many different geographic regions. Since experimental control is hard to achieve in studies of this nature, it is important to take advantage of natural experiments that occur in the environment. More research also needs to be done in the general area of measuring the impact of insurance benefit design on consumer behavior. In this study, the impact of a very specific type of change in insurance benefits on consumer purchasing behavior was measured. Clearly, there are many different outcomes and many changes in health insurance benefits that could be examined.

The results of this study can help employers, insurers, health care providers, pharmaceutical manufacturers and consumers to better understand the potential effects of a change in prescription drug insurance benefits. Based on the results of this study, the design of insurance benefits can have a significant impact on consumer decisions. It is hoped that this, and future studies in the area, will help employers and insurers make educated decisions about the design of insurance benefits so as to achieve optimal care for the patient, while maintaining efficient allocation of scarce resources.

BIBLIOGRAPHY

Anonymous. (1992). "Business Barometer" *Drug Topics*, Feb.17, 16-19.

Anonymous. (1995). "Business Barometer" *Drug Topics*, 139(22), 31

Bearden, W.O. and J.B. Mason. (1978). "Consumer-Perceived risk and attitudes toward generically prescribed drugs." *Journal of Applied Psychology*, 63(6), 741-746.

Brigham, E. and Gapenski, L. (1994). Financial Management- Theory and Practice. (7th ed.) Fort Worth: Dryden Press.

Carroll, N.V. and R. Jang. (1981). "Consumer Awareness of Generic Drugs" *Contemporary Pharmacy Practice*, 4(3), 155-159.

Churchhill, G.A. (1987). Marketing Research Methodological Foundations. (5th ed.) Orlando Fl: Dryden Press.

DeNuzzo, R.V. (1980). "24th Annual Prescription Survey, Albany College of Pharmacy" *Medical Marketing and Media*, 15(April), 17-36.

Dowling, G. and R. Staelin. (1993). "A Model of Perceived Risk and Intended Risk-handling Activity." *Journal of Consumer Research*, 21(1), 145-153.

Evans, W.N. and W.K. Viscusi. (1993). "Income Effects and the Value of Health" *Journal of Human Resources*, 28(3), 497-518.

Ganther, J.M. and Kreling, D.H. (1995). Consumer Perceptions of Generic Prescription Drugs: An Investigation of the Relationship Between Perceived Risk and Price Savings. Unpublished Manuscript, University of Wisconsin.

Harris, B.L., A. Stergachis, and L.D. Ried. (1990). "The Effect of Drug Co-Payments on Utilization and Cost of Pharmaceuticals in a Health Maintenance Organization" *Medical Care*, 28(10), 907-917.

Hosmer, D.W. and S. Lemeshow. (1989) Applied Logistic Regression (1st edition), New York: John Wiley & Sons.

Lambert, Z.V., P.L. Doering, E. Goldstein, et al. (1980). "Predispositions Toward Generic Drug Acceptance" *Journal of Consumer Research*, 7, 14-22.

Leibowitz, A., W.G. Manning, and J.P. Newhouse. (1985). "The Demand for Prescription Drugs as a Function of Cost-Sharing" *Soc Sci Med*, 21(10), 1063-1069.

Moss, K. (1993). "Seizing the Moment :The Managed Care Movement Spurring Growth of Generics" *Drug Topics*, 137(supp 2), 24s-25s.

Mott, D.A. (1995) "The Influence of Patient Out-of-Pocket Expenditures on Physician Prescribing" Unpublished Doctoral Dissertation, University of Wisconsin.

Mott, D.A. and Kreling, D.H. (1996). The Influence of Therapeutic Category and Insurance Type on Generic Substitution of Drug Products. *Journal of Research in Pharmaceutical Economics*, (in press)

Neff, A.M. and T.J. Simpson. (1992). "Drug Substutution Rate Advances: Market Measures" *Drug Topics*, Feb. 17, 16-19.

Nelson, A. (1973). The Saliency of Price In the Acceptance of the Pharmacist Substituting Chemically Equivalent Drugs on a Prescription. Unpublished Doctoral Dissertation, University of Iowa.

Nelson, A.A., Jr., C.E. Reeder, and W.M. Dickson. (1984). "The Effect of a Medicaid Drug Copayment Program on the Utilization and Cost of Prescription Services" *Medical Care*, 22(8), 724-736.

Nicholson, W. (1994). Intermediate Microeconomics and its Application. (6th ed.) Orlando: Dryden Press. 126-127.

O'Brien, B. (1989). "The Effect of Patient Charges on the Utilization of Prescription Medicines" *Journal of Health Economics*, 8, 109-132.

Podulka, M., K. Krautkramer, D. Amerson, et al. (1989). "Consumers' Attitudes Toward Generic Drugs" *Journal of Pharmaceutical Marketing and Management*, 4(1), 93-104.

Smith, D.G. (1993). "The Effects of Copayments and Generic Substitution on the Use and Costs of Prescription Drugs" *Inquiry*, 30, 189-198.

Tootelian, D.H., R.M. Gaedeke, and J. Schlacter. (1988). "Branded Versus Generic Prescription Drugs: Perceptions of Risk, Efficacy, Safety, and Value" *Journal of Health Care Marketing*, 8(3), 26-29.

Vaczek, D. (1995). "Plans Squeeze Generic Profitability" *American Druggest*, Sept., 40-45.

Weiner, J.P., A. Lyles, D.M. Steinwachs, et al. (1991). "Impact of Managed Care On Prescription Drug Use" *Health Affairs*, 10(1), 140-154.

Wolfgang, A.P. and M. Perri III. (1991). "Older adults and generic drugs:An analysis of attitudes and intentions." *Journal of Pharmaceutical Marketing and Management*, 5(3), 97-106.

APPENDIX A

Description of Medispan Data elements

DATA ELEMENT CODE: T018 DATE LAST CHANGE: 4-1-89

MNEMONIC: HCFA-FFP-LIMIT RECORD POSITION: 18-26

LENGTH/TYPE: 9/N REPETITIONS: 5

DATA ELEMENT NAME: HCFA FFP LIMIT UNIT PRICE

PICTURE: 9(4)V9(5)

DATA ELEMENT DESCRIPTION:

This field identifies the Health Care Financing Administration (HCFA) Federal Financial Participation (FFP) Limit Price per unit. Data is entered directly as supplied by the Health Care Financing Administration.

HCFA has developed a list of multiple-source drugs with upper price limits for each specific strength and dosage form in its *Medicaid Manual*. The manual establishes ceiling prices for each set of therapeutically equivalent products, according to the formula in the Medicaid final regulation, published on July 31, 1987, by HCFA's parent organization, the Department of Health and Human Services (HHS). The rule's aggregate reimbursement ceiling is set at 150% of the lowest published price for therapeutically equivalent multiple-source drugs. HCFA will update the list of covered drugs periodically.

Individual states may use this list or set their own limits. To receive federal funding, the individual states must provide separate and distinct findings (supported by any documented, acceptable method of sampling, imputation and statistical analysis) to determine that, in the aggregate, Medicaid expenditures for multiple-source drugs are in accordance with the established upper limits.

In the event a HCFA FFP Limit Price is discontinued for particular items, the T1 Record will still exist, and the current price will be zero. The price, that previously applied, would then be found in the first oldest HCFA FFP Limit Price field.

NOTE: Effective October 29, 1987, the Federal Maximum Allowable Cost (MAC) program was discontinued and replaced by the HCFA FFP program. For records with previous effective dates prior to October 29, 1987, the former MAC unit prices and effective dates are reflected. As changes to the HCFA FFP Limit are encountered, current and previous prices will shift to further oldest fields until eventually current and previous price records will contain only HCFA FFP Limit Prices.

DATA ELEMENT CODE: R018 DATE LAST CHANGE: 4-1-89

MNEMONIC: AWP-PACK-PRICE RECORD POSITION: 18-23

LENGTH/TYPE: 6/N REPETITIONS: 6

DATA ELEMENT NAME: AWP PACKAGE PRICE

PICTURE: 9(4)V9(2)

DATA ELEMENT DESCRIPTION:

This code indicates the AWP or SWP. The AWP is provided by wholesalers; the SWP is provided by manufacturers.

DATA ELEMENT CODE: A089

DATE LAST CHANGE: 11-1-89

MNEMONIC: GEN-CD

RECORD POSITION: 89

LENGTH/TYPE: 1/A

REPETITIONS: 1

DATA ELEMENT NAME: GENERIC CODE

PICTURE: X

DATA ELEMENT DESCRIPTION:

A code identifying products as either original standard product or a generic copy of the standard product. Valid codes are:

N = Single-source product available from one manufacturer. The product is not generic, nor is it available as a generic.

M = Multi-source products that are co-licensed and not considered generic, nor available as a generic.

O = Original product or products which are considered the industry standard and generics now available.

Y = A product available from more than one source and considered generic. Often this is a copy of an original product valued as the standard.

Examples:

Condition	N	M	O	Y
Single-Source	Zantac 150 mg	-	-	-
Multi-source/ Co-licensing	-	Trandate 100 mg Normodyne 100 mg	-	-
Original with Generics	-	-	Valium 5 mg	Diazepam 5 mg
Former Co-Licensing with Generics	-	-	Septra DS Bactrim DS	SMZ/TMP DS Sulfamethoxazole/DS Trimethoprim

screening, drug allergy monitoring). As an example, Group 37-xx DIURETICS includes the following classes:

37-00	DIURETICS
37-10	Carbonic Anhydrase Inhibitors
37-20	Loop Diuretics
37-30	Mercurial Diuretics
37-40	Osmotic Diuretics
37-50	Potassium Sparing Diuretics
37-60	Thiazides
37-99	Combination Diuretics

Note: The number "99" is used throughout the classification coding system to denote combination products.

Subclass. The six-digit Drug Subclass is used only in situations where further distinction within a specific Drug Class is relevant, as illustrated in the following examples:

27-10-00	INSULIN
27-10-10	Mixed Insulin
27-10-20	Beef Insulin
27-10-30	Pork Insulin
27-10-40	Human Insulin

Drug Name & Drug Extension:

The basic drug moiety is designated by the first eight digits of the GPI, whereas the specific drug salt is designated by the first ten digits. This is illustrated as follows:

42-xx-xx-xx-xx	DECONGESTANTS
42-10-xx-xx-xx	Sympathomimetics
42-10-10-xx-xx	Systemic Decongestants
42-10-10-20-xx	Pseudoephedrine
42-10-10-20-10	Pseudoephedrine HCl
42-10-10-20-20	Pseudoephedrine Sulfate
42-10-20-xx-xx	Topical Decongestants
42-10-20-10-xx	Ephedrine
42-10-20-10-10	Ephedrine HCl
42-10-20-10-20	Ephedrine Sulfate

Combination Products. Selected multiple-ingredient drug products are included in the system. For these products, the fourth subfield contains two digits representing the number of active ingredients in the product. The

DATA ELEMENT CODE: A024 DATE LAST CHANGE: 4-1-89

MNEMONIC: LABELER-CD RECORD POSITION: 24-28

LENGTH/TYPE: 5/N REPETITIONS: 1

DATA ELEMENT NAME: NDC LABELER CODE

PICTURE: 9(5)

DATA ELEMENT DESCRIPTION:

The Labeler code links the proper manufacturer name to its product. Most Labeler codes are derived from the Labeler code segment of the NDC. However, in some cases, the Labeler code differs from this segment so the accurate manufacturer name can be associated with the product.

NDC LABELER

PRODUCT	NDC NUMBER	CODE	MANUF
E.E.S. 400 mg	00074-2589-13	00074	Abbott
Rondec	00074-5726-13	99996	Ross
Aminosyn 1%	00074-1108-05	99987	Abbott Hosp

The Labeler code "00074" for E.E.S. tablets corresponds to the labeler portion of the NDC. However, for Rondec and Aminosyn, the Labeler code used to assign the proper manufacturer name is not the same as the labeler portion of their respective NDC numbers.

For the purpose of showing correct manufacturer names, a small number of companies require the use of "pseudo" labeler codes for their products. A list of all Labeler codes used is available upon request, either alphabetically or numerically.

DATA ELEMENT CODE: G017 DATE LAST CHANGE: 10-1-89

MNEMONIC: GPI RECORD POSITION: 17-30

LENGTH/TYPE: 14/C REPETITIONS: 1

DATA ELEMENT NAME: GENERIC PRODUCT IDENTIFIER

PICTURE: X(14)

DATA ELEMENT DESCRIPTION:

The Generic Product Identifier (GPI) denotes pharmaceutically equivalent drug products. Products having the same 14-digit GPI are identical with respect to active ingredient(s), dosage form, route of administration and strength or concentration. The GPI does not consider the presence of inactive ingredients. Each unique GPI corresponds to the descriptive GPI generic name given in field G036 (eg. Acetaminophen w/ Codeine Tab 300-30 MG).

Note: Products identified as being "pharmaceutical equivalents" are not necessarily bioequivalent or therapeutically equivalent. Brand interchange or product substitution among products must consider possible differences in bioequivalence and legal restrictions concerning product substitution.

The FDA has designated the following groups of products as having significant potential for bioequivalence differences: controlled-release products, enteric coated oral dosage forms, products in aerosol-nebulizer delivery systems, injectable suspensions, and suppositories or enemas for systemic use. These products are generally considered not to be therapeutically equivalent unless specific bioequivalence data is provided.

Partial GPI Codes

Only products identified with identical fourteen-character codes are pharmaceutically-equivalent products. The G records in MDDB provide complete codes for the most commonly used single entity and combination drug products. The inclusion of a partial GPI refers to a general description of the product based on the Medi-Span Therapeutic Classification System. (See Appendix E. For example, multivitamin products are identified only by their therapeutic class name as illustrated below:

GPI Code	GPI Generic Name
78-12-00-00-00-03-00	*B-Complex w/C Tab***
78-34-00-00-00-01-00	*Multiple Vitamins w/ Fluoride Cap***
78-51-00-00-00-01-00	*Prenatal Vitamins Cap***

DATA ELEMENT CODE: A090 DATE LAST CHANGE: 4-1-89

MNEMONIC: BRAND-NAME-CD RECORD POSITION: 90

LENGTH/TYPE: 1/A REPITITIONS: 1

DATA ELEMENT NAME: BRAND NAME CODE

PICTURE: X

DATA ELEMENT DESCRIPTION:

This code indicates if the product is named generically or not in both the Product Description Abbreviation (J057) and Product Name and Product Name Extension (E017 and E042 respectively). Valid codes are:

G = Generic Name
T = Trademarked Name
B = Branded Generic Name
b = Does not apply

EXAMPLES:

Trademarked Name	Branded Generic Name	Generic Name
Amoxil		Amoxcillin
Phenergan VC	Promethazine VC	Promethazine w/ Phenylephrine
Darvon Cmpd 65	Propoxyphene Cmpd 65	Propoxyphene w/ ASA-Caffeine
Dimetapp	Bromatapp	Brompheniramine w/Phenylpropanolamine
Septra	Sulfatrim DS	SMZ/TMP
		Sulfamethoxazole/ Trimethoprim
Cortaid		Hydrocortisone

Note: In this context, the definition of a "Branded Generic Name" is a name accepted as an industry standard for a specific formulation that is used by more than one manufacturer/distributor.

Medi-Span's Generic Product Identifier categorizes drug products by a hierarchial therapeutic classification scheme that can be utilized for computerized therapeutic drug monitoring applications (eg., drug-interaction, allergy screening). It is also useful for market research and reporting applications. The unique therapeutic orientation of this classification system provides greater utility than conventional pharmacological approaches to drug classification. This coding system is based on subfields contained in the GPI structure. Drug product records containing the GPI may be readily manipulated to categorize drug products at various levels of specificity as required for any specific purpose.

Code Structure

The fourteen-digit GPI consists of seven subfields, providing increasingly more specific information characterizing drug products. These subfields are structured and identified as illustrated below:

GPI-Code-Subfield	Size	Representation	Example
12-xx-xx-xx-xx-xx-xx	2	Drug Group	DECONGESTANTS
12-34-xx-xx-xx-xx-xx	4	Drug Class	Sympathomimetics
12-34-56-xx-xx-xx-xx	6	Drug Subclass	Systemic Decongestants
12-34-56-78-xx-xx-xx	8	Drug Name	Pseudoephedrine
12-34-56-78-90-xx-xx	10	Drug Name Extension	Hydrochloride
12-34-56-78-90-12-xx	12	Dosage Form	Tab
12-34-56-78-90-12-34	14	Strength	60 MG

The first ten digits of the GPI identify the product by the Medi-Span Therapeutic Drug Product Classification System. For a complete listing of the drug groups, classes, and subclasses of the Therapeutic Classification System, see Appendix E. These records of the therapeutic classification system are available separately.

Subfields

Drug Group. This classification provides a broad general drug group commonly used to characterize drug products. These ninety-nine groups include the drug classes most frequently used in general market research and in processing third party prescriptions. Examples of group designations include:

01 PENICILLINS
25 CONTRACEPTIVES
27 ANTIDIABETIC
36 ANTIHYPERTENSIVE
86 OPHTHALMIC

Drug Class. The four digit Drug Class identifies specific therapeutic drug classes. The level of specificity provided by this field is designed to accommodate more detailed market research needs and to serve as the structural base for most therapeutic drug monitoring applications (eg. drug-to-drug interactions

DATA ELEMENT CODE: A072 DATE LAST CHANGE: 4-1-89

MNEMONIC: ROUTE-ADMIN RECORD POSITION: 72-73

LENGTH/TYPE: 2/A REPETITIONS: 1

DATA ELEMENT NAME: ROUTE ADMINISTRATION CODE

PICTURE: X(2)

DATA ELEMENT DESCRIPTION:

A code indicating how the medication, in the defined dosage form, is administered to the patient. Valid codes are:

BU = Buccal
EX = External
IJ = Injection (not specified)
  IM = Intramuscular
  IT = Intrathecal
  IV = Intravenous
  SC = Subcutaneous
IN = Inhalation
IR = Irrigation
IU = Intrauterine
MT = Mouth/throat
NA = Nasal
OP = Ophthalmic
OR = Oral
OT = Otic
RE = Rectal
SL = Sublingual
TD = Transdermal
UR = Urethral
VA = Vaginal
VI = In vitro

CO = Combination of the above
XX = Does not apply

DATA ELEMENT CODE: A044 DATE LAST CHANGE: 4-1-89

MNEMONIC: THERA-CLASS RECORD POSITION: 44-49

LENGTH/TYPE: 6/N REPETITIONS: 1

DATA ELEMENT NAME: AHFSCC THERAPEUTIC CLASS CODE

PICTURE: 9(6)

DATA ELEMENT DESCRIPTION:

Medi-Span is licensed by the American Society of Hospital Pharmacists to use the American Hospital Formulary Service Classification Compilation (AHFSCC) number. This is recorded as a six-digit number (no dashes). For current values for this code, see Appendix A.

specific combination of ingredients is designated by the numeric code in the fifth subfield. For example:

43-99-xx-xx-xx	COUGH/COLD COMBINATIONS
43-99-10-xx-xx	Decongestant Analgesics
43-99-10-02-10	Phenylephrine w/ Acetaminophen
43-99-10-02-20	Phenylpropanolamine w/ Acetaminophen
43-99-10-02-22	Phenylpropanolamine w/ Aspirin
43-99-10-02-30	Pseudoephedrine w/ Acetaminophen
43-99-10-03-20	Phenylpropanolamine w/ APAP & Caffeine
43-99-10-03-22	Phenylpropanolamine w/ ASA & APAP

Dosage Form & Strength. GPI positions 11 and 12 contain a two-digit code identifying the pharmaceutical dosage form of the product. (A listing of these codes and what they represent are included in Data Element L040.) Various strengths of products are differentiated by the two digits in positions 13 and 14. The features of these fields are illustrated as follows:

37-20-00-30-00	FUROSEMIDE
37-20-00-30-00-03-05	Furosemide Tab 20 MG
37-20-00-30-00-03-10	Furosemide Tab 40 MG
37-20-00-30-00-03-15	Furosemide Tab 80 MG
37-20-00-30-00-20-05	Furosemide Inj 10 MG/ML
37-20-00-30-00-20-50	Furosemide Oral Soln 10 MG/ML

Where strengths are not specified, positions 13 and 14 of the GPI may be "00".

90-55-00-75-00-29-00	Hydrocortisone Powder
90-55-00-75-10-29-00	Hydrocortisone Acetate Powder

The drug group, drug class, subclass, and basic drug moiety and/or drug salt name information is available on magnetic tape. Refer to Appendix F for a partial listing of this and to Appendix I for the data elements of this tape. This tape is available with your initial tape load and upon request. Call Medi-Span's Customer Service Department periodically to obtain this file.

APPENDIX B

Modification of the Medispan Data elements

There were some modifications of the Medispan data. First of all, since the Medispan data were from 1992 and the prescription database included prescriptions from all of 1993, there were some drugs in the prescription database that were missing from the Medispan data. A separate file of the ndcs for these drugs was created and the missing information was obtained from several sources. The AWP prices and package size were found in the 1993 and 1994 Redbook, and the therapeutic class was obtained from the AHFS 1995 addition. The generic product identifier (gpi) for new generics was obtained by searching for the brand name product in the database, but the gpi for new brand name products could not be obtained. Information such as DEA class, route of administration, dosage form, generic code, and brandname code were completed using the knowledge of the researcher and the list of codes from the Medispan book. The data from the missing drugs then were linked back with the original Medispan database.

The second modification was to replace the hcfaffp data element containing the MAC price set by HCFA, with the DPS MAC price. This was done to obtain a more realistic estimate of the price of the generic to customers in the Wausau Insurance plans. A July 1994 DPS MAC list was obtained from a local pharmacy, and the HCFA MACs in the Medispan database were replaced by the DPS MACs. Drugs that were on the HCFA MAC list, but not on the DPS MAC list were not given a MAC price. The new Medispan database containing the missing Ndcs and the DPS MACs was then relinked to the prescription database. The drugs that were on the DPS MAC list that were not on the HCFA MAC list still needed to have a DPS MAC price entered into the database. The gpis for the majority of these drugs were obtained by searching the database for the relevant drug names. All drugs with these gpis were then assigned the correct MAC for that gpi..

APPENDIX C

Sample Size Calculations for the Audit of Prescriptions

Absolute precision formula for estimating a proportion (Churchill 1987):

$N = Z^2 \, p(1-p) / H^2$

where:

N= sample size
p= estimate of physician generic prescribing rate = 15.2%*
Z= desired confidence level ~ 2 for 95% confidence level
H = absolute precision desired in proportion = .02

$N = 2^2/(.02)^2 \{.152 (1 - .152)\}$

N = 1289 ~ 1300

---

* Estimate of physician generic prescribing rate = estimate of generic substitution rate minus estimate of pharmacist substitution rate

Estimate of generic substitution rate = 32% (Anon 1992-extrapolation of 1990 rate)
Estimate of pharmacist substitution rate = 16.8% (Mott 1995)

Estimate of physician generic prescribing rate = 32% - 16.8% = 15.2%