EVALUATING THE IMPACT OF COST, PERCEIVED BENEFIT AND PERCEIVED VALUE ON PRESCRIPTION DRUG PURCHASING BEHAVIOR

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EVALUATING THE IMPACT OF COST, PERCEIVED BENEFIT AND PERCEIVED VALUE ON PRESCRIPTION DRUG PURCHASING BEHAVIOR

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EVALUATING THE IMPACT OF COST, PERCEIVED BENEFIT AND PERCEIVED VALUE ON PRESCRIPTION DRUG PURCHASING BEHAVIOR

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VITA

Mahesh Fuldeore, son of Jagannath Fuldeore and Shakuntala Fuldeore, was born on August 12, 1975, in Nasik, MS, India. He graduated with a Bachelors of Pharmacy degree from the College of Pharmacy in Nasik in 1997 and with a Master of Business Administration degree from the University of Pune, India in 1999. He served as a Management trainee at Panacea Biotec, from April 1999 to July 2000. In August 2000, he entered the Ph.D. program at Auburn University, AL, in the department of Pharmacy Care Systems, and also received a Masters of Science degree in Health Outcomes Research in 2003.

DISSERTATION ABSTRACT

EVALUATING THE IMPACT OF COST, PERCEIVED BENEFIT AND PERCEIVED VALUE ON PRESCRIPTION DRUG PURCHASING BEHAVIOR

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Many third party payers have implemented increased cost-sharing as a cost containment strategy. Previous studies suggest that this may reduce health care costs by reducing prescription drug expenditures. However, such strategies may increase total healthcare costs through increased non-adherence to treatment regimens. It is important to understand the factors influence patients' decisions to purchase medications in order to formulate effective cost containment strategies that minimize the negative impact on medication compliance.

According to consumer behavior theory, one's response to increased cost is based on the perceived benefit of and perceived value derived from the product. previous work aimed at analyzing the impact of cost sharing has not analyzed the role of perceived benefit and perceived value in the decision making process.

The purpose of this study was to 1) evaluate the relationship among cost, perceived benefit, perceived value and quantity of medication purchased, and 2) identify the major predictors of quantity of medication purchased.

Patients new to statin therapy were identified from the prescription database of a national retail chain. The quantity of medications purchased during the first 12 months of statin therapy was measured in terms of the Medication Possession Ratio (MPR). Information not obtained from retail chain database was collected through patient surveys. A total of 181 patients were included in the final analysis.

Structural equation modeling (SEM) demonstrated relationships among cost, perceived benefit, perceived value and MPR. Except for the direct relationship between perceived benefit and quantity of medications purchased, all the hypotheses were statistically significant. As expected, perceived value and MPR were positively impacted by perceived benefit and negatively impact by the cost paid by the patient. Perceived value had a positive impact on MPR. A CHAID (Chi-square automatic interaction detection) analysis identified five variables; cost, perceived benefit, perceived barrier, perceived value and perceived importance of taking medications as the most significant predictors of MPR.

This study demonstrated that the individual’s response to higher cost sharing is not uniform across the population and it mainly influenced by individuals’ perception of perceived benefit and perceived value of the treatment. Results also emphasized that the patient population can be segmented in different segments, based on which variable is most critical to their decision making. Decision makers can identify such individuals and formulate customized compliance improvement strategies.

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CHAPTER 1

INTRODUCTION

This study proposes to investigate the effect of cost on patients' prescription drug purchasing behavior. In particular, the study will focus on evaluating the impact of cost sharing on the quantity of medication purchased by new users of HMG-CoA reductase inhibitors.

Health Care Expenditures and Cost Sharing

In 2001, prescription drug expenditures in the US exceeded $140 billion, of which $ 66.6 billion was paid by private insurers. By 2005, prescription drug expenditures are expected to reach $228 billion, accounting for 10-11% of total US health care expenditure. Driven by such increased expenditures, many third party payers have implemented a range of cost containment strategies. Some payers increased co-payments, some switched to a multi-tiered co-payment system, and some did both. One of the most popular and successful containment strategies has been the multi-tier formulary, with differential co- payments for brand and generic drugs (CMS, 2001). This strategy has been cited as one of the major reasons behind the recent decline in the growth of prescription drug expenditures, which decreased from 19.7 percent of the total in 1999 to 16.4

total in 1999 to 16.4 percent in 2000 and to 15.7 percent in 2001(CMS, 2001). Early evaluations of such changes in benefit design, combined with increased co-payments, suggests that increased cost sharing is indeed helping control growing prescription drug expenditures. Increased cost sharing helps bring costs down in various ways: by reducing the number of prescriptions consumed, by increasing the use of generic products and by discontinuing or reducing the consumption of prescribed medication.

Advocates of cost sharing suggest that cost savings are achieved by reducing the number of prescriptions consumed or by increasing use of generic products, while critics suggest that it leads to an increase in the total healthcare cost through increased non-compliance with treatment regimens, i.e. patients decide to stop taking their medication or reduced the frequency of prescription refills (Billups, Malone, & Carter, 2000; Dor & Encinosa, 2003; Huskamp et al., 2003). This could have serious consequences for patients on long term chronic treatment.

There is a growing body of evidence to show the effect of cost-sharing on the quantity of medications purchased, particularly in chronic disease conditions requiring long term treatment regimens. In a survey of 10,927 Medicare beneficiaries from eight states, a significant number of respondents reported that they sometimes did not refill prescriptions due to cost. Approximately 22% said that they did not refill prescriptions or skipped doses in order to save money (Safran et al., 2002). In a retrospective analysis of drug utilization, Dor & Encinosa (2003) found a decrease of about 10% in the number of fully compliant individuals in a diabetic population when their co-payment increased from $6 to $10. These authors further estimated that this increased co-payment would increase annual drug savings by $ 177 million, simply due to the decrease in compliance. However, they also estimated that it may cost an additional $433.5 million annually to treat the complications that arise as a result of the increased non-compliance. In other words, drug cost sharing may be associated with reduced drug use, but it is accompanied by increased medical costs. Such findings raise important questions: what is the optimum level of cost sharing, what kind of population is most affected by the increased cost and what are the reasons behind a patient's decisions to reduce consumption of essential medications. These questions need to be examined from a third party perspective serving patients with chronic disease conditions. Their vulnerability to cost sharing may increase due to their long term dependence on chronic medications.

One such chronic condition is hyperlipidemia. In 2001, an estimated 104 million Americans suffered from hyperlipidemia (cholesterol levels of over 200 mg/dl), putting them at increased risk of heart disease. Heart disease is rated the number one cause of death in the United States, accounting for more than 725,000 deaths, 30% of the total, in 1999 alone. In 2004, the estimated direct and indirect costs of heart disease are expected to be $238 billion. It is also estimated that a 10% decrease in total cholesterol levels may result in 30% reduction in the incidences of coronary heart disease (AHA, 2004). According to the *Third Report* of the Expert Panel on Detection, Evaluation, and Treatment of High Cholesterol in Adults, only half of the individuals who are prescribed lipid lowering medications continue to take the medication after six months of treatment. Lack of adherence to this treatment regimen may be a big problem, as it takes 6-12 months before the benefits of treatment become apparent (NIH, 2002). Such a low level of adherence with the treatment regimen raises questions about cost sharing policies directed towards anti-hyperlipidemic users. Cholesterol lowering medications is also a therapeutic segment that puts a considerable burden on the third party payer, costing an estimated $ 18.3 billion for the year 2004 alone. Hence, it is important for a policy maker to identify patients who are vulnerable to cost sharing strategies.

The ideal situation from a payer's perspective would be one in which the patient switches to a lower tier drug without reducing consumption of the prescribed medication. Such action would ensure that cost savings are achieved without affecting the quantity of essential medications purchased by a patient. In order to formulate an effective strategy that would reduce the impact of cost-sharing on adherence to treatment, it is important to know how and to what extent these factors influence patients' decisions.

The Rationale behind Cost Sharing

The rationale behind the use of cost sharing is that insurance shields patients from paying the full cost of their medication, thereby increasing overutilization and the unnecessary use of prescription drugs. Insurance coverage makes demand for medical care less price elastic by reducing the financial burden on the consumer. With this decreased financial burden, the consumer becomes less price sensitive and may purchase medication in a quantity larger than the quantity they would have purchased without insurance (Folland, Goodman, & Stano, 1997a). Cost-sharing reduces the potential for overutilization by placing financial responsibilities on the consumer. With increased cost sharing, patients are expected to become more sensitive towards drug cost and reduce the consumption of medicines that are least valued by them. This rationale is based on economic models of consumer behavior, which assume the consumer is a rational individual who will select a bundle of goods that maximizes utility at fixed financial resources (Ekelund & Tollison, 1996; Nicholson, 1998). Based on the same rationale, the patient's decision on what products to give up and to what degree, when faced with higher costs is expected to be based on the value that they are receiving from the product purchase. According to consumer behavior theory, the quantity of goods demanded is a function of utility/benefit and the price of the product, and individuals will select a combination of products that provides maximum value per dollar spent. At a fixed price, the quantity of goods purchased will increase based on the perceived utility/benefit of the product, and at a fixed utility/benefit, the quantity of product purchased will increase as the price of the product decreases (Ekelund & Tollison, 1996; Folland, Goodman, & Stano, 1997b; Nicholson, 1998). The consumer is at an equilibrium point when the marginal utility per dollar spent on a product is equal to the marginal utility per dollar spent on other goods, and this is also the point at which the consumer maximizes the utility. A change in this equilibrium will result in a decrease in value for the consumer and will lead to a change in the quantity of product purchased until equilibrium is regained.

The same reasoning can be extended to explain the purchasing decisions involved in the refill of chronic medications. In a chronic disease condition like hyperlipidemia or hypertension, the patient is required to purchase a prescription at regular intervals. A patient's decision to refill a prescription will be based on the perceived value of the transaction, i.e. the ratio of benefit of the medication to money spent to acquire those medications. At an aggregate level, cost is expected to have a negative impact on the quantity demanded, but at an individual level the actual impact may be determined by individual patients' perceived benefits of those medications. If perceived benefits are lower than the co-payment, then the patient may reduce their consumption and if they are higher than the co-payment, there may not be any effect on the quantity purchased.

Perceived Value and the Patient's Role in Prescription Drug Purchasing Decisions

Perceived value is often used to operationalize the concept of utility maximization. Customer perceived value is basically a consumer overall assessment of the utility or worthiness of an exchange, based on what is to be received and what is to be given (Zeithmal, 1988). Anderson et.al (1993) defines value as the difference or tradeoff between perceived worth and price paid. The higher the ratio of benefit to cost, the higher the value surplus gained by a consumer. The role of perceived value has been studied for various products and services (Anderson, Jain, & Chintagunta, 1993; Dodds, Monroe, & Grewal, 1991; Grewal, Monroe, & Krishnan, 1998; Zeithmal, 1988), but there have been no studies published that evaluate its role in prescription drug purchasing decisions. The role of perceived value is based on the basic concept that a consumer is a rational individual who makes rational decisions based on the evaluation of available alternatives. It assumes that the consumer has sufficient information and knowledge to choose the best alternative. It is this assumption that might have lead to the lack of such studies in the prescription drug market, as decisions are not taken by patients themselves but by their physicians. This assumption might be true during the product selection process, during which the physician will evaluate different alternatives based on the diagnosis and prescribe the one that he thinks best for a patient. However, the situation is little different for long term treatment, which usually involves repeat purchases of prescribed medications. Patients may not have significant control on the product selection process, but they can definitely control the repeat purchasing of the products.

Factors Influencing Patients' Product Purchasing Decision

Evidence from the economic literature suggests that perceived benefit and cost are the two major determinants of product purchasing decisions. However, these are not the only variables that influence the quantity of medications purchased. In the social, behavior health science and marketing literature, other variables have also been shown to impact prescription drug purchasing behavior. It is important to analyze the role of these variables in purchasing behavior to gain a complete understanding of patients' behavior. Measuring these variables will also provide a control for confounding factors.

Social behavioral and health science studies predominantly look at the quantity of medications purchased as a part of the medication compliance issue. Compliance is a complex process that can be broadly described as the outcome of a combination of intentional and unintentional acts (Hussar, 1985). The patient's decision to not purchase medication in a prescribed quantity can be categorized as an intentional act of non-compliance. Intentional noncompliance is illustrated by the patient who makes a purposeful and thoughtful decision to discontinue or reduce their medication use.

According to models developed in the social and behavioral sciences, such decisions are based on patients' own health beliefs and personal circumstances (Donovan, 1995). Health science studies predominantly focus on identifying determinants of medication discontinuation. The important factors studied by this domain of literature include: complexity of dosage regimen, age, gender, race, income, health status and presence co-morbidities (Avorn et al., 1998; Benner et al., 2002; Jackevicius, Mamdani, & Tu, 2002; Sung et al., 1998).

In addition, studies published in the marketing literature have consistently demonstrated the significant impact of media advertising and perception of brand quality on the medications purchased (Calfee, Winston, & Stempski, 2002; Rosenthal, Berndt, Donohue, Epstein, & Frank, 2003).

To counter the effect of double digit increases in prescription drug costs, more and more health plans are adopting cost-sharing strategies. Previous work aimed at analyzing the impact of cost sharing on chronic medication utilization was limited in many ways. Firstly, the impact of cost was analyzed without taking perceived value into consideration. There are separate studies that demonstrate the effect of increased cost and perceived benefit on prescription drug purchasing behavior, but no published study has yet measured them. Secondly, the majority of studies were performed either prior to or following the introduction of the new benefit designs, making it difficult to distinguish if the outcomes obtained are a result of increased cost or changes in plan structures. Finally some studies used claims data alone to analyze the cost impact, which limited the ability of the researchers to incorporate factors related to patients' beliefs and perceptions.

Purpose

The purpose of this study is to: 1) evaluate the relationships between perceived value, perceived benefit, cost, and quantity of medication purchased in prescription drug purchasing behavior; 2) identify the factors influencing the quantity of medication purchased , based on factors suggested by a search of different bodies of literature, including economics, social behavior, health science and marketing; and 3) evaluate the relationships between the variables identified and their impact on the quantity of medications purchased.

Research Questions

1) What are the relationships between quantity of medications purchased, measured in terms of MPR, perceived treatment value, perceived treatment benefits and cost of medication to the patient?

2) What are the determinants of quantity of medication purchased by a patient, measured in terms of MPR, and how are they related to each other?

Disease Condition Studied

To control for the number of confounding effects of different disease conditions and therapeutic classes, this study will be limited to one disease condition and one therapeutic class: hyperlipidemia and HMG-CoA reductase inhibitors (statins). This disease and class of medication was selected for the following reasons.

1) Hyperlipidemia is an asymptomatic condition for which patients do not realize the effect of the treatment immediately, and patients will remain on statin treatment for a long period of time.
2) Discontinuation of these medications may lead to serious economic and clinical consequences.
3) Most of the statins are close substitutes and have similar regimens. Such homogeneity in treatment regimens will decrease the variation due to differences in the complexity of treatment regimen.

Hypotheses and Research questions

Research question 1

What are the relationships between quantity of medications purchased, measured in terms of MPR, perceived treatment value, perceived treatment benefits and cost of medication to the patient?

Research objectives:

a) Develop a model illustrating relationships among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost

b) Test the direct relationships between perceived benefit, cost, perceived value and quantity of medications purchased as illustrated in the model.

Following hypotheses were developed to achieve above research objectives

Hypotheses:

1 $H_{01:}$ Developed model illustrating relationship among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost does fit the data.

$H_{a1:}$ Developed model illustrating relationship among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost does not fit the data.

2 $H_{02:}$ There is no relationship between perceived treatment value and quantity of medications purchased.

$H_{a2:}$ There is a relationship between perceived treatment value and quantity of medications purchased.

3 $H_{03:}$ There is no relationship between perceived benefit of statin Treatment and perceived treatment value.

$H_{a3:}$ There is a relationship between perceived benefit of statin Treatment and perceived treatment value.

4 $H_{04:}$ There no relationship between cost and perceived treatment value.

$H_{a4:}$ There is a relationship between cost and perceived treatment value.

5 $H_{05:}$ There is no relationship between perceived benefit of statin treatment and quantity of medications purchased.

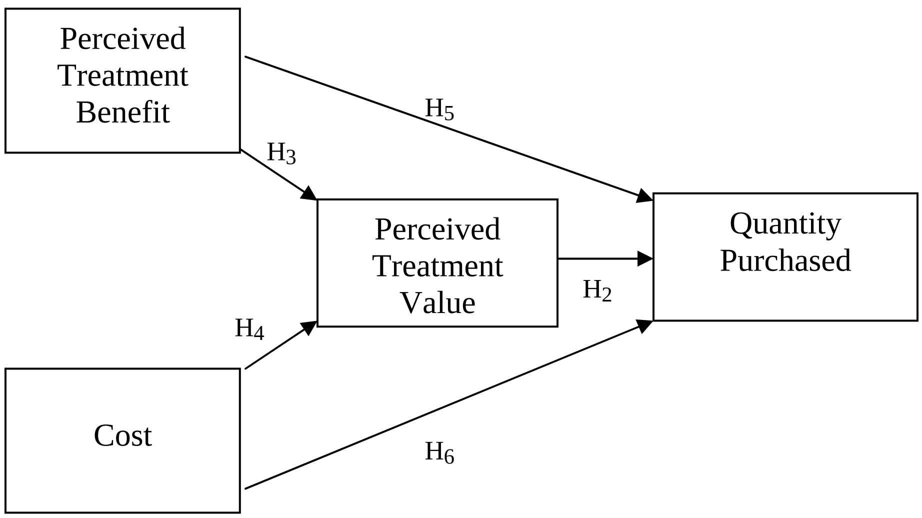
$H_{a5:}$ There a relationship between perceived benefit of statin treatment and quantity of medications purchased.

6 $H_{06:}$ There is no relationship between cost and quantity of medications purchased.

$H_{a6:}$ There is a relationship between cost and quantity of medications purchased.

Following proposed model (as shown in Figure1) was developed to test Hypothesis 1 and direct relationships among two variables were analyzed to test hypotheses 2 to 6.

Figure 1: Proposed model representing relationships among perceived benefit, cost, perceived value and quantity of medications purchased.



Research question 2:

The second research question is: What are the determinants of quantity of medication purchased by a patient, measured in terms of MPR, and how are they related to each other?

Research objectives:

a) Identify the direct correlation among dependent and independent variables

b) Identify the strongest predictors of quantity of medications purchased.

Hypotheses:

$H_{07:}$ Perceived treatment value, perceived treatment benefit, cost, demographic variables (age, gender, race, income and marital status) and personal circumstances (hospitalization, disease severity, co-morbidities, number of medications, satisfaction with the provider) and perceived health beliefs (perceived susceptibility, perceived severity and perceived barriers) do not explain the variance observed in quantity of medications purchased measured in terms of MPR

H_{a7} : Perceived treatment value, perceived treatment benefit, cost, demographic variables (age, gender, race, income and marital status) and personal circumstances (hospitalization, disease severity , co-morbidities , number of medications, satisfaction with the provider) and perceived health beliefs (perceived susceptibility, perceived severity and perceived barriers) explain the variance observed in quantity of medications purchased, measured in terms of MPR.

Operational Definitions

Variable	Definition
Age	Age of the respondent (years)
Brand quality	Perception of brand quality on a 7 point scale (1=very low….7=very high)
Co-morbidity: Depression	Presence of depression (1=yes, 2=no)
Co-morbidity: Diabetes	Presence of diabetes (1=yes, 2=no)
Co-morbidity: Hypertension	Presence of hypertension (1=yes, 2=no)
Cost	Consumer co-pay per prescription plus dispensing fee
Direct-to-consumer advertising	Number of time consumer remembers seeing the products advertised in any media in the past 3 months
Disease severity	Presence of CHD/CAD/history of heart attack/stroke (1=yes, 2=no)
Working status	Number of hours worked, per week.
Frequency of dose	Number of statin doses per day, calculated by quantity dispensed/days supply
Sex	Sex of the respondent (0=male, 1=female)
Household income	Yearly income on a 9 point scale (1= <10,000….9= >$80,000)
Involvement in the decision	If patient asked for a specific brand of medication (1=yes, 2=no)
Number of other medications	Number of medications per month consumed by the patient, calculated by number of medications/months

Variable	Definition
Overall health	Overall health perceived by consumer on a 5 point scale (1=very bad….5=very good)
Perceived barriers	Perceived barriers to taking medication measured on a 7 point perceived barrier scale (1=low….7=high)
Perceived benefit	Perceived benefit of the treatment measured on a 7 point perceived benefit scale (1=low….7=high)
Perceived severity	Perceived barriers to taking medication measured on a 7 point perceived severity scale (1=low….7=high)
Perceived susceptibility	Perceived barriers to taking medication measured on a 7 point perceived susceptibility scale (1=low….7=high)
Perceived value	Perceived value of the cholesterol medication measured on a 7 point perceived value scale (1=low….7=high)
Pharmacist relationship	Satisfaction with pharmacist services on a 7 point scale (1=not at all satisfied….7=very satisfied)
Physician Relationship	Satisfaction with physician advice on a 7 point scale (1=not at all satisfied….7=very satisfied)
Prescription drug expenditure	Monthly expenditure on a 6 point scale (1= <$100.…6= >$500)
Price awareness	Perception of actual price of the product on a 6 point scale (1= <$1….6= >$5.01)
Quantity purchased	In terms of the Medical Possession Ratio (MPR), days supply received/days supply prescribed
Race	Race of the respondent (1=white, 2=nonwhite)
Refill reminders	Receiving refill reminders (1=yes, 2=no)
Social support	Someone to help at home (1=yes, 2=no)

Significance

Results of the study:

1) will help decision makers identify patients at–risk of discontinuing medications due to higher cost sharing.

2) will help develop the compliance improvement strategies customized to group of individuals with distinct characteristics.

3) will provide better information about patients' responses to higher costs, which could be used to improve patients' satisfaction with cost containment strategies.

4) will help formulate cost containment strategies that would optimize the balance between restricting inappropriate use and underutilization.

CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of this research is to evaluate the effect of cost, perceived treatment benefit and perceived value on the quantity of statins purchased. A model will be developed to illustrate the relationship between these variables. This section is divided into two main parts, the theoretical framework used to develop a model and a review of the pertinent literature. The review of literature is divided into three main sections. The first section evaluates the research on the cost impact on drug utilization. The second section evaluates the research on the studies determining predictors of medication non-compliance, discontinuation, or non-persistency with the lipid lowering medication. The final section will present the research on the other variables that potentially affect the quantity purchased that were not covered by the first two sections.

Theoretical Framework

Theory of consumer behavior and demand: Overview of basic concepts

Consumer behavior theory focuses on explaining an individual's consumption choices when faced with limited financial resources. In this section, the basic concepts of consumer theory, namely utility, the indifference curve, and consumer equilibrium, and their application to prescription drug purchasing will be reviewed.

Utility:

Utility is defined as “the amount of satisfaction derived from consuming any given quantity of a good or services” (Ekelund & Tollison, 1996). Utility is often defined as a combination of two goods; a good of interest and all other goods. Under given financial constrains, the consumer will always try to maximize the utility deriving from the consumption of those goods. More desirable situations offer more utility than less desirable situations. If a person prefers situation A to situation B, then that person assigns more utility to situation A than situation B.

Total utility obtained after the consumption of two goods can be represented as

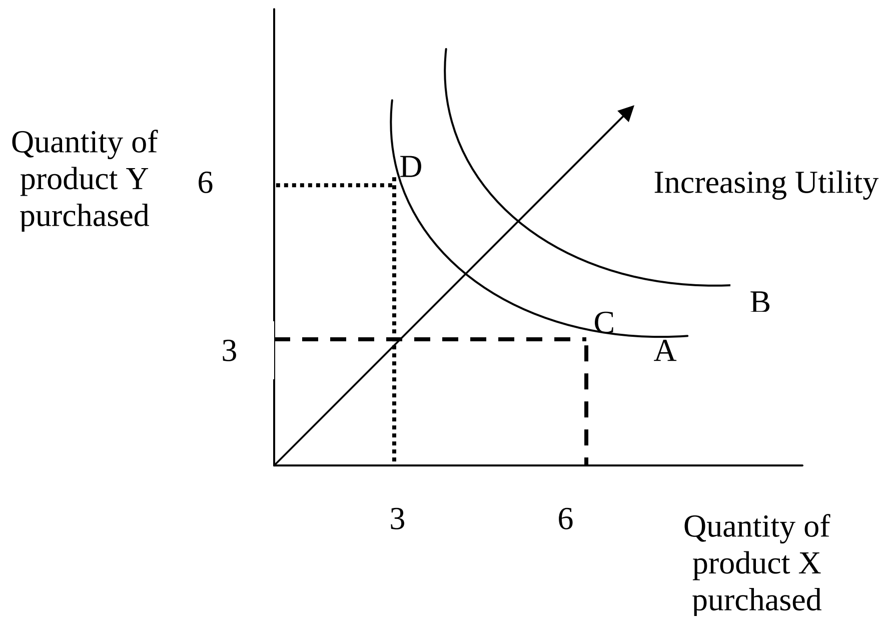
$$\text{Total utility} = U(X_1, X_2)$$

Total utility is the utility derived from the consumption of both goods ($X_1 \ldots X_2$), while marginal utility is the utility derived from the consumption of an additional unit of a good. Consumers are expected to experience increased satiation with increased consumption of goods, so the utility function will exhibit diminishing marginal utility. Put simply, the satisfaction gained by consumption of an additional unit of any good will decrease with the increase in the total quantity consumed. The satisfaction gained by the consumption of the first slice of pizza will be more than for the second or third slice, as hunger or need of consumption decrease with the increase in the number of slices consumed.

Indifference Curve:

An indifference curve shows all the combinations of two goods that yield the same level of satisfaction/utility for an individual. Consumers will be indifferent to a combination of goods presented on an indifference curve. This assumes that the consumer knows all the preferences and can order goods according to their preferences, and that every consumer wants a higher level of utility; i.e. more is better.

Figure 2. Indifference curve between products X and Y



On curve A, point C represents the consumption of 3 units of Y and 6 units of X. Point D represents the consumption of 6 units of Y and 3 units of X. Both of these points represent the same levels of utility. At all the points on this curve, the consumer is indifferent to different combinations of goods X and Y. Indifference curve B will provide more utility to the consumer than indifference curve A. On curve B, the consumer will be able to buy both goods, X and Y, in more quantity than they could on curve A. The slope of the curve represents the marginal rate of substitution. It indicates how much of Y a consumer will give up for one more unit of X. A decreasing slope in the curve from left to right indicates decreasing marginal rate of substitution along the slope. In simple terms, the quantity of Y that consumer will give up for an additional unit of X will also decrease as he/she consumes more of X. The decrease in the amount of Y for additional amounts of X will depend on the marginal utility. At a particular point, if the marginal utility of Y is higher than the marginal utility of X, the consumer will give up less of Y to gain an additional unit of X (Nicholson, 1998).

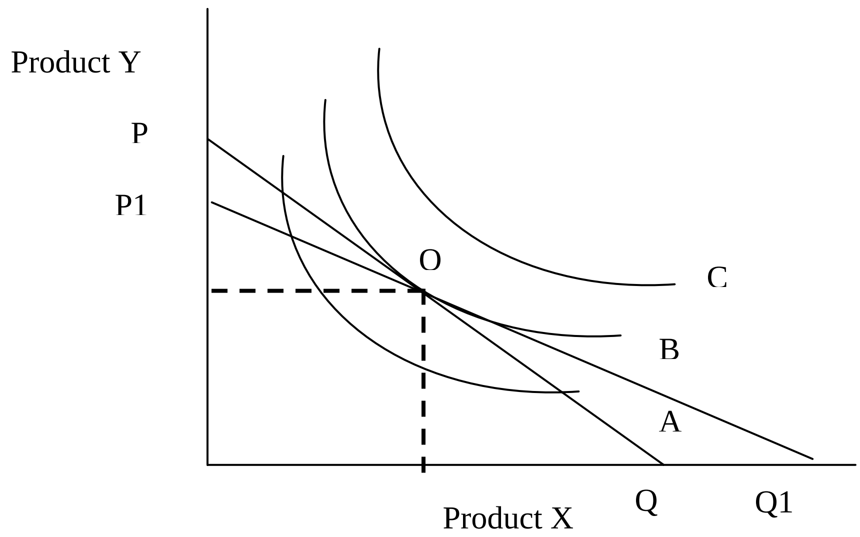
To summarize, the number of units that consumers will buy will depend on the amount of utility they derive from those goods, although the utility per unit decreases with an increase in the quantity purchased.

Consumer equilibrium and utility maximization:

This assumes that every individual is constrained by a limited budget and that under a financial constraint consumers will behave in such a way as to achieve maximum possible utility. The choice of an indifference curve, i.e. the combination of goods that one can buy, is decided by a budget constraint (line P-Q). As shown in the figure 3 , a rational individual will choose utility curve B. He/she will not choose A as it will not maximize his/her utility and could not choose C because there is no budget available with which to achieve that level of utility.

In Figure 3, the budget line P-Q shows all the combinations of X and Y that can be purchased with the same budget. The quantity of X or Y that one can buy would depend on the prices of X and Y. If the price of X decreases, the slope of budget line will become flatter, as will line P1-Q1, and the consumer will be able to buy more of product X than product Y.

Figure 3: The consumer equilibrium between product X and Y



Consumer equilibrium:

Consumer equilibrium is achieved when consumers exhibit no tendency to change. This is the situation in which the consumer chooses a quantity of goods in order to maximize utility under a given budget constraint. At this point, indicated in Figure 3 by O, the per-dollar marginal utility obtained from the last unit of product X purchased is equal to the marginal utility obtained from product Y.

At point O, the slope of indifference curve B (MU_X/MU_Y) is equal to the slope of the budget constraint line P-Q (P_X/P_Y).

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

Where,

MU_X = Marginal utility of product X

MU_Y = Marginal utility of product Y

P_X = Price of product X

P_Y = Price of product Y

Any changes in this equilibrium will change the quantity of product purchased. An increase in the price of product Y will reduce the ratio of marginal utility of Y to price. To be able to maximize the utility at a given budget constraint, the consumer will buy less of Y and more of X until the marginal utility per dollar of product X equals the marginal utility per dollar of product Y. In short, an increase in the price of product Y will decrease the demand for Y and increase the demand for product X, and vice versa. his also suggests that the quantity purchased is dependent on the utility that the consumer derives from either of the products.

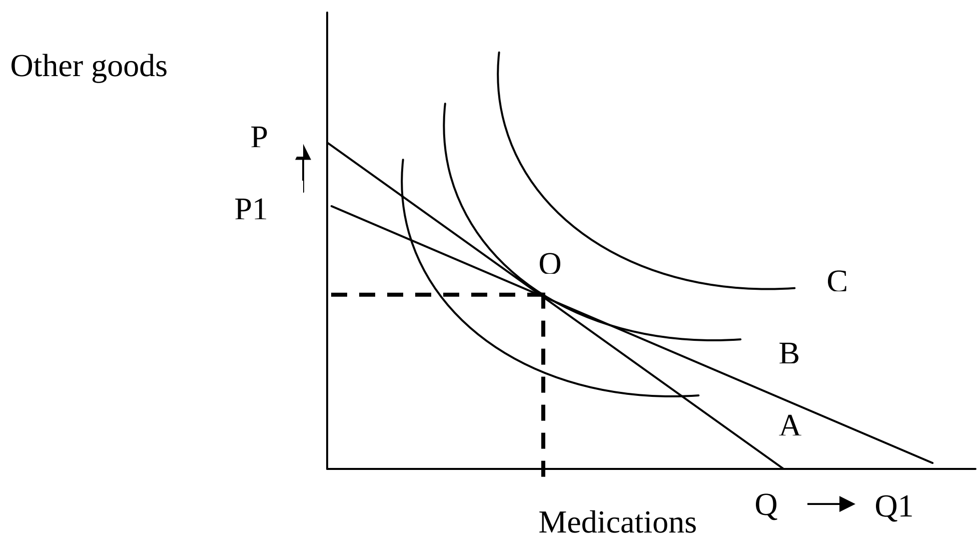
Application to prescription drug purchasing behavior

This theory of utility maximization and consumer equilibrium can be extended to explain the medication purchasing behavior of individuals on chronic medications. In a chronic disease condition like hyperlipidemia or hypertension, after the diagnosis of the disease the patient is required to purchase (refill) a prescription at regular intervals. Decisions to refill or not will be based on the expected utility deriving from those medications and the price that they have to pay to receive those medications. Patients with higher perceived utility and a lower co-payment are expected to purchase more medications than patients with lower perceived utility and a higher co-payment.

As seen earlier, at the equilibrium point consumers are getting maximum value for their money and any changes in price or utility will lead to changes in the quantity of product purchased. Increasing the price of the product disturbs this equilibrium, so the consumer is getting suboptimal value for their money. The consumer regains this equilibrium by reducing the quantity of product purchased. However, prescription drug purchases put patients in a unique situation; in this case both price and quantity to be purchased are given to them. The payer decides on the amount by setting the co-payment and the physician determines the quantity to be purchased. However, the patient is a rational individual and had it been left to him to decide how much to purchase, he would have purchased the quantity at which he maximizes utility. A patient may not control the quantity per prescription, but can control the quantity purchased over time by controlling the number of prescriptions filled. Differences between prescribed quantity and patients' estimation of quantity, based on their perception of utility and cost, may lead to non- compliance. The higher the ratio of utility to cost, the higher the probability that a patient will purchase the medication in the prescribed quantity.

Once patients receive their prescription, they perform their own cost and benefit analysis based on their perception of utility and the price they are paying. Depending on the outcome of this analysis, the quantity demanded would increase or decrease. In the hypothetical example illustrated in Figure 4, two products (medications and other goods) are compared. Increasing the price of the medication will result in a decrease in the quantity of medications purchased from Q1- Q and an increase in the quantity of other goods purchase from P1-P. This change in quantity purchased in response to a change in price will depend on the utility that patient is receiving from the medication.

Figure 4: Consumer equilibrium and indifference curve between prescription drug medications and other goods.

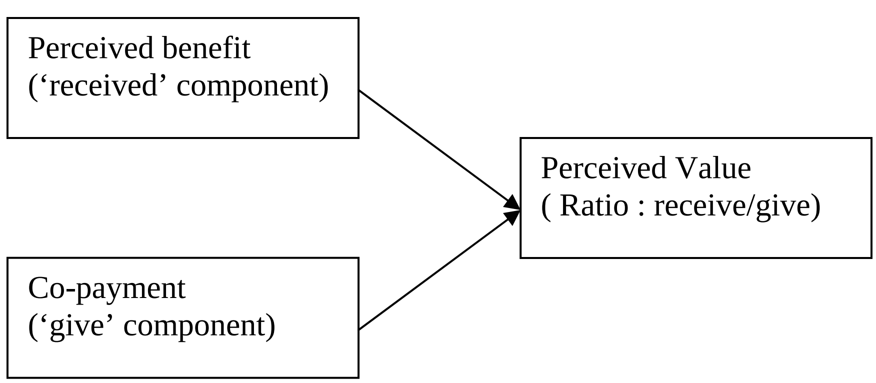


Perceived value

Perceived value encompasses the consumer's evaluation of perceived utility and price in a product purchasing decision. An assessment of the definitions of perceived value available in the marketing literature reveals certain commonalities among them (Anderson et al., 1993; Grewal et al., 1998; Zeithmal, 1988). Zeithmal (1988) operationalized perceived value as the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given. Monroe's (1991) definition is similar to that of Zeithmal's, defining perceived value as a cognitive tradeoff between perceived quality and sacrifice. Anderson et al. (1993) define perceived value as the difference or tradeoff between perceived worth and price paid, and actual value gained from the transaction is 'value surplus' or 'incentive to purchase'. Whatever the definition is, one important aspect common to all these definitions is the trade-off between two basic components: what is received (the benefits), and what is given (the cost). These components are similar to the concepts explained earlier under consumer behavior theory. The 'perceived utility' is represented by the 'received' component and 'price' is presented by the component 'give'. Consumers seek to maximize the ratio of 'received' to 'give' for given financial resources.

In prescription drug purchasing behavior, specifically refill decisions, perceived value can be conceptualized as the patients' overall assessment of worth of a prescription drug medication regimen based on what is to be received, i.e. the perceived benefits of treatment and what is to be given, i.e. the co-payment that must be made in order to receive those medications.

Figure 5: Relationship between perceived benefit, cost and perceived value.

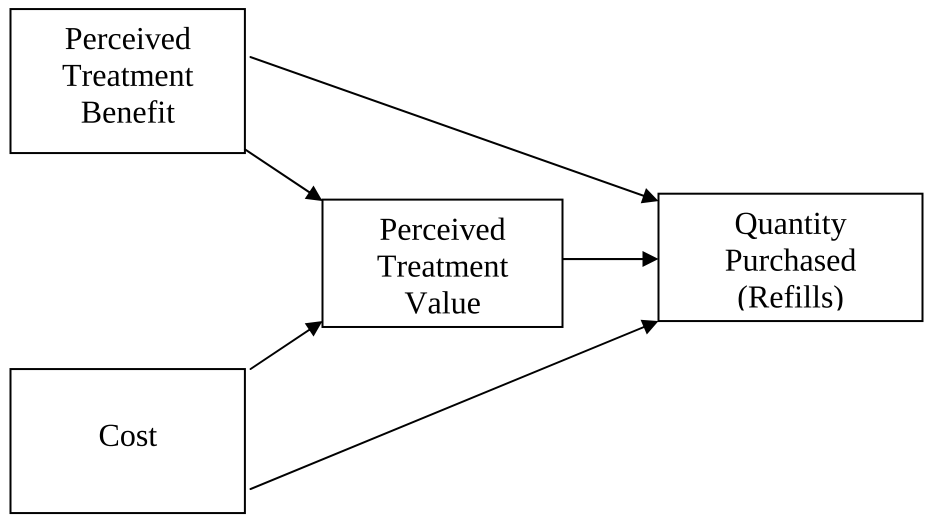


Relationship between perceived value and purchasing decisions:

The roles of perceived value, perceived benefit and cost have been tested in purchasing decisions for various products and services. Dodds et al., (1991) evaluated the effect of perceived product quality, product price and perceived value on willingness to buy two types of products, a calculator and a stereo headset. He found a positive relationship between the perceived value and consumers' willingness to buy those products. A consistent relationship was also observed between perceived value and willingness to buy when similar constructs where tested in the purchase of a bicycle (Grewal et al., 1998). The relationship between perceived value and willingness to buy was as high as r=0.7 for the calculator, r=0.8 for the stereo headset player and r=0.54 for the bicycle.

Though this concept has been not tested specifically for decisions to purchase prescription medication, a similar concept of tradeoff between benefit and cost is found in the health behavior literature for the constructs of the health belief model. Two constructs, perceived benefit and perceived cost, have been consistently found to be related to health behaviors, including medication purchasing (Fincham & Wertheimer, 1985a, 1985b; Harrison, Mullen, & Green, 1992; Janz & Becker, 1984; Nagia, 2002). Horne and Weinman (1998) assessed the role of perceived benefit, perceived cost and the difference between perceived benefit and perceived cost, for patients' adherence to a medication regimen. Among all the variables included in the study the difference score was the strongest predictor, accounting for 19% of the variance in a self reported adherence with treatment regimen. However, no published study has examined it using the patients' evaluation of perceived benefit and cost as one construct in prescription drug purchasing behavior.

Figure 6: The conceptual model proposing relationships among benefit, cost, value and quantity purchased



Effect of cost on prescription drug utilization :

As a part of Rand's Health Insurance experiment, researchers designed a randomized controlled trial to measure the effect of cost sharing on consumer demand for prescription drugs (Leibowitz, Manning, & Newhouse, 1985). Participants were randomly assigned to insurance plans with varied levels of co-insurance and its impact on the per capita prescription drug use was analyzed for a sample of 3860 individuals. Results of the study provide strong evidence that increased cost sharing decreases prescription drug utilization. Drug utilization decreased as percentage of coinsurance increased. A plan with 25% coinsurance had 8 % lower utilization than a free plan, while a plan with 50% coinsurance had 33% lower utilization than the free plan.

Retrospective analysis of prescription drug usage in Medicare beneficiaries produced similar results. Poisal & Chulis (2000) conducted a descriptive study to explore the relationship between prescription drug coverage and prescription drug utilization by analyzing data from the 1996 Medicare Current Beneficiary Survey (MCBS). Results of the study indicated that on average, Medicare beneficiaries used one fourth more prescriptions than enrollees with no prescription drug coverage. Similarly, enrollees with drug coverage spent 65 % more on prescription drugs than enrollees with no drug coverage. Results were significant across all age, gender and race groups. Younger (age less than 44), non-white and poor people were affected more by a lack of prescription drug coverage than other enrollees.

A considerable body of literature suggests that individuals respond to even a small change in co-payments. Harris, Stergachis, & Ried (1990) analyzed the impact of varied levels of co-payments on use and cost of prescription drugs in a staff model of HMO. A pre/post with control design was used to analyze the impact of $1.50, $3.00 and greater than $3 in a population with no previous out-of pocket expenses. The introduction of progressively higher levels of co-payment led to significant reductions in drug utilization at each additional level: 10.7 % at $1.5, an additional 10.6 % at $3.00 and an additional 12.0% at greater than $3. The effect of increasing the co-payment was larger for drugs classified as discretionary medications than for drugs classified as essential medications. The $1.50 co-payment had no significant impact on the use of essential drugs, but the $3.00 co-payment reduced their use by almost 13%.

Lexchin & Grootendorst (2003) reviewed the literature on cost-sharing and medication use across different groups in different countries. They analyzed more than

54 papers published in the area to reveal the price elasticity of prescription drug demand. Whenever price elasticity was not reported, they estimated it by calculating the percentage change in the use of prescription drugs with 1% change in cost sharing. Most of the studies were of elderly, low income populations from the US, UK or Canada. Findings of the study suggested that price elasticity, i.e. patients' response to cost sharing: a) increases with an increase of cost sharing b) increases with a decrease in prescription drug coverage, and c) decreases with an increase in income. Observed price elasticity was as low as -0.1 in younger individuals with current employment and as high as -0.34 to -0.40 in elderly individuals with low income

In the past few years, a considerable volume of literature has been published on the effect of co-payment levels on prescription drug utilization in a multi-tier benefit design. Joyce, Escarce, Solomon, & Goldman (2002) analyzed the impact of benefit packages such as 1-tier, 2-tier and 3-tier on generic as well as brand name drug utilization. Researchers analyzed two years of claims data for 420,786 beneficiaries aged 18 through 64 years. In a 1 tier plan, doubling the co-payment from $5 to $10 resulted in an approximately 22% decrease in the average annual drug expenditure. In a 2-tier plan, doubling the co-payments from $5 for generic and $10 for brand name drugs to $10 for generic and $20 for brand names reduced annual drug spending by 33%. In a 3-tier plan, doubling the co-payment from a structure of $5/10/15 to $10/20/30 resulted in a 34.5% decrease in annual prescription drug spending. Conversion of a 2-tier plan to a 3-tier plan by adding $30 co-payment for non-preferred brand resulted in 4 % reduction in expenditure. Addition of the third tier not only reduced overall health spending, but also resulted in an increase in use of generic drugs and a decrease in brand name drugs.

A similar study was conducted in commercially insured enrollees of a preferred provider organization. Motheral & Fairman (2001) used a quasi experimental pre-post design with a comparison group to study the effect of a 3-tier prescription co-pay system on prescription drug utilization. Change in utilization was observed in a plan that moved from a 2-tier co-pay structure, with $7 for generic and $12 for brand name drugs, to a 3-tier co-pay structure, with $8 for generics, $15 for preferred brands and $25 for non-preferred brands. The comparison group maintained a 2-tier structure, with $7 for generics and $12 for all brand names, for the study period. Analysis of utilization suggests that the intervention group experienced a significantly slower increase (15%) in the total number of prescription claims than the comparison group (22%). However, it was not clear if the reduction in prescriptions filled was a result of the conversion from 2-tier to 3-tier or a result of the increase in co-payment and out-of pocket expenses for consumers. Increases in cost sharing not only affected the number of prescription filled, but also compliance with the medication regimen. Many patients either discontinued medications or skipped doses in order to save money.

Dor & Encinosa (2003) studied the impact of increases in co-insurance and co-payments on compliance with anti-diabetic drugs. Patients were classified as ‘Fully noncompliant’ if they failed to refill another prescription in the first 90 days of the initial prescription, and ‘Fully compliant’ if they refilled all their prescriptions in the first 90 days of initial prescription. Data was analyzed by using logistic regression after controlling for chronic conditions, previous refills and demographic characteristics. In a coinsurance group, increase of coinsurance from 20 % to 75 % resulted in a 27% increase in the share of fully noncompliant individuals and 11% decrease in the share of fully compliant individuals. Similarly, an increase in co-payment from $6 to $10 resulted in a 13% increase in fully noncompliant individuals and a 10.6 % decrease in the fully complaint individuals. The authors further estimate that the increase in non-compliance as a result of increasing the co-payment from $6 to $10 would increase annual drug savings by $ 177 million, but also estimated that it may cost an additional $433.5 million annually to treat the diabetic complications that arise as a result of patients' increased non-compliance with their treatment regimen. Increased cost sharing also had a significant impact on the discontinuation of medication and formulary drug utilization, especially in a multi-tier system where a patient has financial incentives to select a lower tier drug.

In a recent study, Huskamp et al. (2003) studied the effect of increased co-payment for preferred drugs on prescription drug utilization in three therapeutic classes of chronic medications: ACE inhibitors, proton-pump inhibitors and statins. Utilization in two employer groups' health plans that implemented formulary changes were compared with the utilization in control groups. Plan One implemented drastic changes, moving from a 1-tier to a 3-tier formulary structure, and increasing co-payments for drugs in all tiers. This plan moved from a $7 generic and brand benefit design to a $8 generic - $15 preferred brand - $30 non-preferred brand benefit design. Plan Two implemented comparatively less drastic changes by moving from a 2-tier to 3-tier formulary, increasing only the co-payment for the 3rd tier of drugs. This plan moved from a $6 generic - $12 brand benefit design to a $6 generic - $12 preferred brand - $24 non-preferred brand benefit design. A summary of the results of this study is presented below in Table 1.

Table 1: Comparison of different benefit designs on drug utilization of the 3rd tier drug.

	Continued use of tier-3 drug			Switched to lower tier drug			Discontinued use of drugs		
	Exp %	Control %	Sig. $p<0.05$	Exp %	Control %	Sig $p<0.05$	Exp %	Control %	Sig. $p<0.05$
Plan One									
ACE-Inhibitors	42.3	89.4	Yes	41.6	4.2	Yes	16.2	6.4	Yes
Proton-pump inhibitors	32.9	79.6	Yes	35.1	1.5	Yes	32	18.9	Yes
Statins	29.2	72.1	Yes	49.4	17.3	Yes	21.3	10.6	Yes
Plan Two									
ACE-Inhibitors	50.6	69.4	Yes	41	14.9	Yes	8.3	15.8	Yes
Proton-pump inhibitors	64.7	78.7	Yes	17.6	2.1	Yes	17.6	19.1	NO
Statins	42.4	88	Yes	48.5	8	Yes	9.1	4	NO

From Huskamp et al. (2003).

As shown in Table1, changing the benefit design had a significant impact on both the number of enrollees that discontinued therapy and the number of enrollees that switched to lower tier drugs. Though this effect was strong in all therapeutic segments, the extent to which it influenced individuals depended on the nature of their disease. Patients on statins seem to be more sensitive to changes in co-payment than the patients on ACE-inhibitors, but less sensitive than patients on proton-pump inhibitors.

Evidence suggests that patients' response to the same level of cost sharing varies across different therapeutic classes (Huskamp et al., 2003). When faced with a higher co-pay, only 42% of patients continued taking that brand of statin medication. Most of the patients, about 49 %, switched to a lower tier brand and about 9% discontinued their medication altogether. In the case of patients taking proton-pump inhibitors, about 64% continued taking that brand of medication. Half of the remaining patients switched to other brands while the other half completely discontinued their medication. Researchers did not study the possible reasons behind such responses, but it could be hypothesized that such variations might have occurred due to differences in the perceived disease severity or perceived benefit of the treatment.

In several surveys, the higher cost of prescriptions was identified as one of the major causes of patients' decisions to either stop taking medications or to skip doses in order to save money. In a survey of 10,927 Medicare beneficiaries from eight states (Safran et al., 2002), approximately 22% said that they did not refill a prescription because it was too expensive or they skipped doses in order to save money. The numbers were higher for respondents with no prescription drug coverage, of whom 35% either skipped doses or did not fill prescriptions. The effect of drug coverage on skipping doses or not filling prescriptions was significant across all income groups, although this effect was more prominent in poor seniors, who were 3 times more likely to not fill their prescription and 2.1 times more likely to skip doses than their more affluent counterparts. A consistent response was observed in respondents with chronic disease conditions such as diabetes, chronic heart disease and hypertension: of seniors with three or more chronic conditions and without prescription drug coverage, one in three reported not refilling prescriptions because of cost.

Steinman, Sands, & Covinsky (2001) attempted to identify the elderly populations who were at risk of decreasing their own medication use because of lack of prescription drug coverage. Patients were asked if they took less medication than prescribed because of cost and a multivariate analysis was used to identify the risk factors. Surveyed individuals were divided into two groups: individuals with full drug coverage and individuals with no drug coverage. About 8% of surveyed individuals from the no coverage group and about 2% of surveyed individuals from the full coverage group reported that they restricted their medication use because of cost. The prevalence of medication restriction was about 13% for patients with out-of -pocket expenses of $100 or more. Among individuals with no prescription drug coverage, out-of pocket cost, ethnicity and income were the major predictors of medication restriction.

A survey of 1,010 individuals conducted by Harris Interactive found that 15% said they lowered their own dose to make their prescription last longer and 18% said they refilled prescriptions less often than required. Numbers were even higher for individuals on long term therapy; 21% said they lowered drug use and 25% said they did not refill prescriptions to save money (Taylor, 2002).

Over all, increased cost sharing had an impact on almost every aspect of prescription drug utilization, leading to decreases in the cost of prescriptions for health plans, decreases in the number of prescriptions utilized by individuals, decreases in the quantity of prescribed medications, increases in the discontinuation of prescribed medication and increases in formulary drug utilization. However, the extent of the impact on utilization is primarily dependent on individual patient characteristics (age, gender, race, and income), disease condition, length of therapy, employment status, total out-of-pocket expenses, presence of drug coverage, and the level of cost sharing (Lexchin & Grootendorst, 2003).

It would also be safe to assume that differences in prescription drug utilization as a result of changes in cost sharing are primarily driven by patients rather than physicians, who generally are not aware of the cost of the medication they prescribe. Ernst et al. (2000) surveyed 205 physicians to determine their familiarity with the cost of prescription medications. Physicians were given price ranges in multiples of $10 and asked to identify the price range of 50 commonly prescribed medications to uninsured patients. Only 22.9 % of the physicians came close to identifying the correct cost. The prices of branded medications were underestimated by 89% of the respondents, while the prices of the generic medications were overestimated by 90% of the respondents.

Consumer behavior theory states that the perceived benefit of a product is as important as the cost of the product in the product purchasing decision. The final outcome of the higher cost will dependent on the ratio of perceived benefit to cost of the medication. However, most of the studies analyzing the cost impact on prescription drug utilization seemed to focus only on the first aspect, cost, ignoring the role of perceived utility in the final outcome.

Factors Affecting Prescription Drug Behavior in Patients Taking Lipid Lowering Medications

Based on this review of the literature on consumer behavior theory and the effect of cost on prescription drug utilization, it has been hypothesized that perceived treatment value, perceived treatment benefit, and cost all affect the quantity of medication purchased. The objective of this section is to review past research to identify other variables that might also affect the quantity of medication purchased. A major focus will be on the evaluation of previously published studies aimed at examining determinants of discontinuations, compliance, or persistency of lipid lowering medication. Although these dependent variables were defined differently in the reported studies, the underlying variable measured was the quantity of medication purchased, and factors influencing these dependent variables can directly or indirectly affect quantity purchased. The important variables will identified and, based on their strengths of their relationships, decisions will be taken on which variables should be included in the final study.

In a retrospective study of an elderly and poor population covered by Medicaid and the PAAD (Pharmaceutical Assistance to the Aged and Disabled) program, Benner et al., (2002) studied patients who started on statin therapy during the observation period and followed them for up to 5 years. Patients with less than 80% MPR were categorized as subjects with suboptimal persistence. Study analysis found 79% persistency level in the first 3 months of treatment, 56% in the next 3 months and 42% in patients with more than 120 months of the treatment. Predictors of lower-persistency were identified using multiple regression models. Factors found to be associated with the lower persistency were non-white race, lower income, older age, high number of prescription medications (>11), occurrence of coronary heart disease after the therapy, and depression. Factors associated with higher persistency were the presence of co-morbidity like diabetes and hypertension, history of stroke and severity of coronary heart condition. Factors like the number of general practitioner visits and gender were not statistically significant. As this sample did not have to contribute a co-payment to receive their prescriptions, the effects of co-payment or the cost of prescription were not analyzed, although a lower rate of persistency was observed in the population group with lower income. Another interesting observation was that patients starting statin therapy between 1996 and 1998 were 25% less likely to stop or discontinue their medications. The authors attributed this increase in persistency to published clinical trails, but it was also the time when direct-to-consumer advertising became more prevalent and the observed higher persistency could have been a result of increased patient awareness or continuous reminders through the advertising. Because this study was limited to patients with low incomes aged 65 and more, most of whom were women, generalizabiltiy is limited. Furthermore, the study did not evaluate the role of cost and perceptions of treatment benefit, disease severity and barriers.

Another study by Avorn et al. (1998) examined predictors of persistency with lipid-lowering medications in a population similar to the one used by Benner et al. (2002). However, Avorn et al. followed patients for only one year and compared discontinuation rates across different lipid lowering medications. Patients were categorized into two groups, those with more than 80% MPR and those with less than 80% MPR. Predictors were identified and analyzed using a multiple regression model.

Study results found that 64 % of prescribed statin medications were purchased in the first year of the treatment, significantly higher than that of other cholesterol reducing medications (36%). Factors identified with the higher quantity of medication purchased were consistent with the Benner et al. (2002) study. Persistency was higher in patients with cardiovascular co-morbidities, long term users, patients taking less than 16 medications in the previous year, and patients with relatively higher incomes. Patients in medication programs were only 58% as likely to continue to take their medications as patients in the PAAD program. These differences were attributed to the income difference between the two groups; patients in the Medicaid program had lower incomes than the patients in the PAAD program. Variables such as race, socioeconomic status, cost, disease severity, and perceived health benefits were excluded from the study.

A study by Sung et al. (1998) analyzed medication compliance with lipid lowering medications in 772 patients enrolled in a Health Maintenance Organization. The proportion of males and females were evenly distributed in the sample, which had a mean age of about 60 years. Data were obtained from pharmacy claims data and a cross sectional survey. Compliance with the treatment regimen was categorized into two groups based on whether patients bought more than 90% of prescribed medications or not. Predictors were grouped into four clusters: 1) patient characteristics, 2) complexity of drug regimen, 3) health status, and 4) patients/provider relationships. Relationships between compliance and determinants were evaluated by logistic regression. Clusters were entered into the regression model sequentially, with patient characters being first, followed in turn by complexity of drug regimen, health status and patient/provider relationship. The following variables were included in each cluster

1) Patient characteristics: age, gender, race, marital status, employment, education, alcohol consumption and previous compliance. Only two variables, gender and previous consumption, were statistically significant.

2) Health status: quality of health (measured by sf-36), hospitalization for cardiovascular disease, number of physician visits, health status (chronic disease score), and newness to treatment. None of the factors except chronic disease score, which was negatively associated with compliance, were statistically significant.

3) Complexity of drug regimen: type of medication, number of antihyperlipidemic medication doses per day and number of chronic medications per day. Dose frequency of antihyperlipidemic drugs was negatively correlated with compliance.

4) Patient-provider relationship: satisfaction with physician advice and satisfaction with pharmacy services. Neither of the factors had a significant impact on the compliance.

This study was one of the most comprehensive studies to include different domains of variables. However, the results might have been different had, it been limited only to new patients (Benner et al., 2002). The length of therapy is generally found to be strongly associated with compliance, and the lack of control on duration of therapy might have influenced study results. Furthermore, inclusion of the variable 'previous compliance' as one of the independent variables, which is likely to be highly correlated with future compliance, may have contributed to making other variables statistically not significant. Results would have been different had this variable been omitted from the study or added in the later stages of regression. Like the studies described previously, variables such as cost and perceived health beliefs were excluded from the study.

Simon, Levis, & Judith (1996) surveyed 138 community pharmacists to analyze the discontinuation rate with all kinds of lipid lowering medications in the Australian health system. These pharmacists enrolled 610 patients who initiated lipid therapy and followed them for one year. Pharmacists were asked to maintain pharmacy dispensing records for each enrolled patient. Pharmacists reported reasons behind discontinuation based on any discussion they had with the patient. Patients were classified as 'Discontinuations' when they were four week overdue in collecting their prescription. Of 610 surveyed patients, 60% discontinued their medication in the first 12 months of treatment and half of those discontinuations occurred in the first three months. About 32% of the discontinuations were patient initiated because they were unconvinced about their need for the medication, 32% discontinued because of poor efficacy of medications, 7% discontinued because of adverse effects, and 2% discontinued because of financial reasons. Patients were also divided into two categories: complier if they refilled the prescription within 3 days, and non-complier if they refilled prescriptions after three days. Being older, in this case over 65, and the presence of cardiovascular medications were significantly associated with lower compliance.

This study also provided some information about the reasons behind discontinuation and did not focus solely on the patient characteristics. However, this study suffered from several limitations. Reasons behind discontinuation were not patient reported but were based on the pharmacists' perceptions and discussions with patients. It excluded various important variables like the complexity of the regimen, patients' health beliefs and the presence of cardiovascular co-morbidities. Validity of collected data was dependant on how accurately each pharmacist kept the log of refill data. It was also based on the assumption that patients will come back to the same pharmacy to get their prescriptions refilled.

Adherence to the statin therapy among elderly patients with and without acute coronary syndromes (ACS) was studied by Jackevicius et al. (2002). Patients with a minimum age of 66 years and receiving statin prescription for the first time were enrolled in the study. These patients were followed up for two years after their first statin prescription. Adherence was defined as statins being dispensed at least once every three months since initial prescription. The difference between the two groups and the role of confounding variables was analyzed using the Cox Proportional Hazard Model. The independent variables were: age, gender, number of medications, presence of co-morbidities, number of physician visits in the prior year. About 40 % of patients with ACS obtained prescriptions for statin, while this figure dropped significantly to 25 .4% in patients without ACS or coronary artery disease. Other factors found to be associated with non-adherence were age, gender (female), and presence of diabetes, presence of hypertension, number of prescriptions and number of physician visits.

Yang, Jick, & Testa (2003) evaluated the impact of co-morbidities and patients characteristics on the discontinuation of statin therapy. The researchers compared discontinuation across different therapeutic segments in a population with an average

age of 60 and distributed evenly distributed by gender. Results were consistent with previous studies. The relationships between discontinuation rate and a range of patient characteristics were analyzed by logistic regression. Patients were categorized as 'Discontinued' when they did not refill a prescription within 3 months of the expected refill date. Cardiovascular co-morbidities, number of cardiovascular medications, fewer number of non-cardiovascular medications, and more physician visits were associated with the higher medication usage. According to this study, 31% discontinue statin medication in the first year of treatment. Discontinuation was defined as 3 months past the refill date.

Catalan & LeLorier (2000) in their study analyzed the role of variables such as age, number of doses, chronic disease score, previous diagnosis of coronary artery disease and presence of diabetes, in predicting long term persistence on statin therapy in a subsidized population. Persistence was defined as the number of days from the date of the start of therapy to the first failure to continue refill medication with the permissible gap between two refills. About 983 new users of statin, predominantly females (70%) between the ages of 45 and 64, were followed for almost 5 years. Only 13% of the subjects persisted with the therapy. Chronic disease score and pre-existing cardiac condition were positively associated with higher persistency levels, but no relationship was observed with the other independent variables.

Kiortsis, Giral, Bruckert, & Turpin (2000) interviewed 193 hyperlipidemic patients, who were prescribed with at least one lipid lowering drug, in an out-patient clinic. The compliance rate was analyzed by asking patients how many pills they had missed during the previous month. Patients were divided into three groups: 1) high compliance (took all medications), 2) an intermediate compliance (missed less than 6% pills), and 3) low compliance (missed more than 6% pills). The only demographic information collected was age, which was found to be positively correlated with compliance. Instead of reporting the presence of co-morbidities, the researchers measured cholesterol levels, glucose and blood pressure. Except for systolic blood pressure, no significant association was found among other clinical indicators and levels of compliance. The only other variables found to have a significant effect were the number of other medications (negative impact) and provider relationship (measured as perceived time spent by physician to describe coronary artery disease). One of the major drawbacks of the study was that the classification of patients as complaint or non-complaint was based solely on the number of pills they missed in the previous month, which is likely to be influenced by the type of medication the patient is taking, patient recall, whether it is a new or old patient, and the number of pills that patients were asked to take. None of these factors were controlled for by the researcher. Additionally, measurement of the number of pills in a single month may not reflect the actual level of compliance.

Summary

Various studies have been performed to identify the predictors of lipid lowering drug utilization. Utilization was measured in terms of discontinuation of medications, adherence to treatment or persistence with the statin treatment. The majority of studies defined their dependent variable as the ratio of the quantity of medications that patient purchased to the quantity of medications that they were suppose to purchase. A ratio of <80% is the threshold commonly used to categorize an individual as non-complaint. Some studies used a delay in refilling prescriptions of about 3-4 months as a measure of medication discontinuation, while some studies used extent of persistency as a dependant variable. Though objectives of each study were different, predictors identified in these studies can be used as predictors of quantity of medications purchased (White et al., 2002)

Variables

A review of the literature suggests that patients are more likely to purchase statins than non-statin medications. The problem of persistency is still prevalent, with only 60-70% of patients purchasing their medications in the prescribed quantity in the first year of treatment. Most of the studies adopted multivariate models to analyze the impact of different factors, but no two studies included the same factors in their analysis. A summary of the results for the important factors used in the studies is presented below.

Age:

Age had a negative impact on the quantity of medication purchased in the older populations, and a positive impact in the relatively younger populations. Patients aged below 50 and over 70 are less likely to purchase medications in the required quantity than patients aged between 50 and70. The reason for such behavior varies. Younger patients might not have enough time to take medications or may not feel the need to do so, while older patients may have ability do so because of poor physical health or increased number of co-morbidities.

Gender:

The association between gender and quantity purchased was not consistent. This variable was insignificant in cases where the studied population was predominantly female. However, female gender was found to be negatively associated with quantity purchased in studies where population was evenly distributed by gender.

Race:

One out of two studies that measured the effect of race on the dependent variable found a statistically significant relationship. Non-white people were found to purchased lesser quantity of medications than required compared to white counterparts. A similar relationship was observed during an analysis of cost impact on prescription drug utilization. Non-whites are more sensitive to changes in price and thus likely to purchase a lower quantity of medications when the cost rises than do whites. This variable will be included in the study.

Co-morbidities/chronic disease score:

Presence of co-morbidities such as diabetes, hypertension or any other cardiovascular disease was found to be consistently associated with a higher level of adherence to the prescribed regimen. Patients with such co-morbidities were more likely to purchase medications in the prescribed quantity. Some studies analyzed the impact of these disease conditions separately, while others combined them for analysis by converting them into a co-morbidity score.

Number of medications:

Number of cardiovascular medications was associated with a higher level of adherence, while number of non-cardiovascular medications was found to be associated with a lower usage of prescribed medication. A negative association between the number of medications and adherence was significant for a considerably higher number of other medications. For this study, the average number of pills will be used as a determinant of quantity of medication purchased. Number of cardiovascular medications will not be included in the study, as this variable is collecting the same information as another variable, presence of co-morbidities is collecting

Frequency of doses:

Few studies found a significant negative relationship between number of doses per day and the quantity purchased. However, this variable will not be included in the study.

Disease severity/presence of CAD (coronary artery disease):

One study measured the impact of disease severity directly, but other studies analyzed it by including the presence of CAD or CHD as a confounding variable. Most of the studies concluded that patients with CAD or CHD disease conditions or higher disease severity are more likely to purchase medications in the required quantity than patients without these conditions or lower disease severity. For this study, the presence of CAD, CHD or a previous history of heart condition will be used as a determinant of quantity purchased.

Health Status:

The impact of this variable was analyzed by a few studies, which failed to find any significant relationship with the dependent variable. This variable will not be included in the study.

Patient-provider relationship:

One of two studies found a significant relationship between the patients' satisfaction with the physician and the likelihood that they will take lipid lowering medications in the prescribed quantity. The other study found a positive correlation between compliance and the time spent by a physician to explain the disease condition.

None of the reviewed studies evaluated the effect of pharmacist relationship on the quantity purchased, so no conclusion about the effect of this relationship can be made. Both physician and pharmacist relationship will be evaluated in the study.

Cost and Income:

All the reviewed studies were conducted in populations that were either fully covered and had to pay only a very low level of cost-sharing. Except for Coombs & Carnish (2002) and Coombs, Cornish, Hiller, & Smith (2002), who found a negative relationship between cost and quantity purchased, none of the other researchers used it as a determinant of adherence with lipid lowering medications. Though a few studies failed to include cost as an independent variable, they found that patients in a lower income group were less likely to purchase medication in the required quantity than the patients in less indigent groups. These results are consistent with the review of the literature on cost impact on prescription drug purchasing behavior. In addition to cost and income, another variable that is likely to impact the availability of funds is household prescription drug spending. With increased expenditure on drugs other than statin, funds available for purchase of statin will decrease and so does the quantity purchased. Though this variable has not been studied previously, the impact of this variable on quantity purchased will be analyzed.

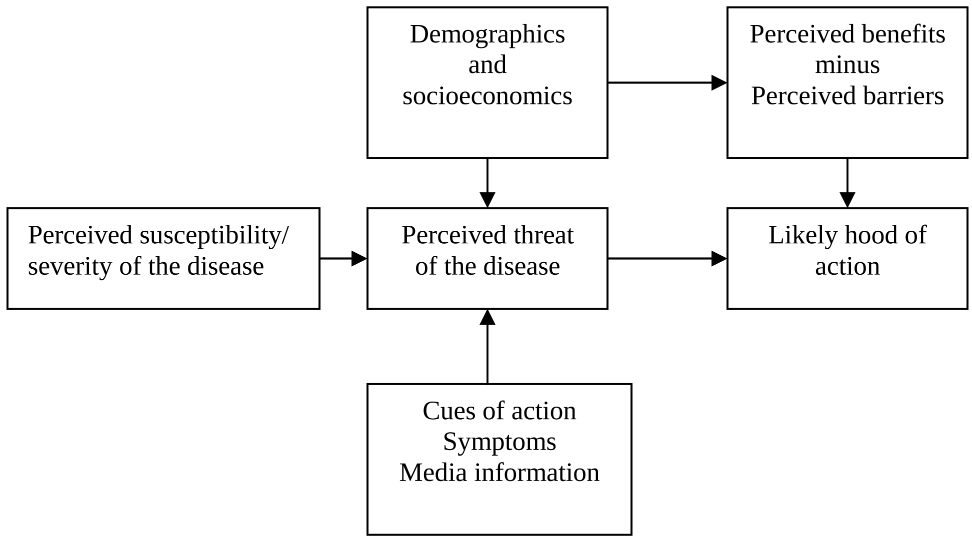
Patient health beliefs (Perceived benefit/perceived side effects/perceived disease severity):

Several studies found significant relationships for the perceived need for medications, perceived benefit of medications in reducing CAD events and the perception of side effects, all of which were associated with the quantity purchased. This association was consistent with the construct of the Health Belief Model, which explains the role of patients' health beliefs in adherence to treatment regimens for various chronic disease conditions (Janz & Becker, 1984; Strencher & Rosenstock, 1996). The constructs of the Health Belief Model will be analyzed to select important variables for inclusion in the study.

The Health Belief Model

The Health Belief Model is one of the most widely studied models in the last four decades to explain health related behavior. It was developed in the 1950s by the United States Public Health Service Department to explain low participation in health preventive and diagnosis programs. Thereafter, it was used in various health settings to explain health behavior pertaining to compliance to medication regimens (Becker, Maiman, Kirscht, Haefner, & Drachman, 1977; Harrison et al., 1992; Janz & Becker, 1984). The objective of this study is not to test or validate the model, but to use it as a source to identify the potential variables likely to impact the quantity of medication purchased.

Figure 7: Health Belief Model: Components and linkages



Adopted from Strencher & Rosenstock (1996).

Components of the Health Belief Model

Perceived Susceptibility:

This construct refers to one's expectation of contracting a disease or facing a particular health condition. For hyperlipidemic patients, perceived susceptibility might include issues related to their increased susceptibility to a heart condition (CAD, CHD, heart attack or stroke). This variable will be included in the study.

Perceived Severity:

This construct refers to one's perception of the medical, clinical or social consequences of a health condition. Clinical consequences may include physical disability, death, or pain and suffering, while social consequences may include effect on social life, family life or loss of productivity. For hyperlipidemic patients, perceived severity might include issues related to the severity of financial, physical or social consequences of higher cholesterol or one of the consequences of high cholesterol (CAD, CHD, heart attack or stroke). This variable will be included in the study.

Perceived benefit:

Perceived benefit refers to one's perception of the benefit of actions taken to reduce those threats. Unless the patient believes that an action would help reduce their susceptibility to or the severity of a health condition, they are unlikely to take action. For hyperlipidemic patients taking statins, perceived benefit might include the benefits of controlling cholesterol and its consequences (CAD, CHD, heart attack or stroke). This variable will be included in the study.

Perceived barriers:

This component of the Health Belief Model refers to a patient's perception of the barriers to taking the recommended actions to reduce perceived threats. Such barriers could be a result of potential negative consequences of action, which may include potential side effects or financial burden of taking such steps. At this stage, a cost-benefit analysis occurs between the potential benefits of the action and potential cost of the action. For hyperlipidemic patients taking statins, perceived barriers may include the cost of the medication or the side effects and inconvenience caused by the medication itself. These variables will be included in the study.

Cues of action:

Cues of action constitute variables that trigger the intended health behavior. They may also include various strategies adopted by health care providers to activate readiness to adopt certain behavior, for example by increasing patient awareness or implementing refill reminder services. In prescription drug purchasing behavior, two sources of information that could trigger refills are refill reminders and exposure to direct-to-consumer advertising. These two variables will be included in the study.

Demographic and socioeconomic variables:

Socioeconomic and demographic variables such as age, gender, race and income play an important part in one's perception of a situation. A change in any of these variables indirectly influences the final health behavior by affecting perceptions of major components of health belief model. These variables have already been identified as the potential determinants of prescription drug purchasing behavior.

Other variables:

Brand quality/generic vs. brand:

Dodds et al.(1991) found that the perception of brand quality is one of the major determinants of perceived value and willingness to purchase. Perceived brand quality is expected to influence quantity purchased by increasing the perceived benefit of the treatment. It will also provide a proxy for patients' satisfaction with the product itself. In general, generic products are perceived to be of lower quality than their branded equivalents. This variable will be included in the study to analyze its effect on the quantity purchased.

Direct to consumer advertising:

Direct to consumer advertising has been shown to increase not only awareness about a disease condition, but also compliance with the medications regimen (Aikin, 2003; Calfee et al., 2002). In a study of time series data of statin consumption and spending on direct-to-consumer advertising, Calfee et al. (2002) found a statistically significant relationship with patients' compliance with the statin regimen.

Involvement in product decision:

Patients who are involved in the selection of brand alternatives are more likely to be aware about the disease condition and might be more exposed to media advertising, which has been shown to have a positive impact on compliance with a treatment regimen. Involvement in the product selection decision might also be an indication of the patients' positive belief in the treatment, and greater satisfaction with the product and physician services.

Refill reminders:

One of the major reasons reported by individuals for being non-complaint with their treatment regimen was that they simply forgot to take their medications. Refill reminders provided by various sources could influence the refill rate by reminding them on time and thus also influence the quantity of medications purchased.

Chapter 3 will present theoretical framework, hypotheses to be tested followed by the methodology describing data collection and data analysis procedure to test those hypotheses.

CHAPTER 3
METHODS

A cross-sectional survey descriptive study design was used to evaluate the role of cost, perceived benefit and perceived value on consumers' prescription drug purchasing behaviors. A direct mail survey and a retrospective database were used to gather information on all the identified variables. This chapter is divided into three sections: 1) population and sample selection, 2) questionnaire development and survey implementation, and 3) proposed hypotheses and relevant data analysis.

Prior to implementation, the study protocol was submitted to the Auburn University Institutional Review Board (IRB) to receive formal approval to use retrospective data obtained from Walgreen Co. Surveys were approved and reviewed by the pharmaceutical & therapeutic (P&T) and the privacy committees of Walgreens Health Initiatives to ensure HIPPA compliance. Patient consent was obtained through a passive consent form included in the survey: patients were informed that the act of returning of the survey would serve as their agreement to participate in the study. Patients were also informed about the objectives of the survey, how their names were obtained and how the data obtained from them would be used for the research (Appendix I). All the patient identifiable information was removed from the database prior to data analysis.

Population and Sample Selection

Sample

The sample to be surveyed was obtained from a population of patients filling their statin prescriptions at a single national chain pharmacy store. The following inclusion and exclusion criteria were applied in order to identify potential subjects.

Inclusion criteria

- Patients taking cholesterol lowering medications belonging to the HMG –CoA reductase therapeutic class (statins).
- Patients receiving a 30-day supply of medication.
- Patients refilling the statin prescription at a retail pharmacy.
- Patients who had at least one prescription, other than statins, dispensed in the six months prior to the starting date.
- Patients who hadn't filled a statin prescription during the six months prior to the starting date of the study.

Exclusion criteria

- Patients who had prescriptions filled for more than one statin during the study period.
- Patients refilling prescriptions through a mail-order pharmacy.
- Patients who did not have any other medication filled in the 12 months after their first statin prescription.

Prescriptions were limited to 30-days supply prescriptions because of the sensitivity of medical possession ratio (MPR) to change in days supply. MPR becomes less sensitive with increasing days supply per prescription, as patients have to refill the prescription less often than they would have refilled with a 30 day supply.

Only new patients were included in the study because compliance tends to decrease with time on the therapy. Restricting the study sample to patients new to the therapy will ensure that, at the time of survey, all patients will be on the therapy for approximately 12 months. The criterion of the presence of at least one statin prescription six months prior to the start date was applied to ensure that a new prescription is actually a new prescription. Similarly, restricting the sample to patients who had other prescriptions dispensed at least once at a pharmacy during the study period will increase the likelihood that the patient still belongs to the same retail pharmacy network, thus potentially reducing the number of patients who might have purchased medications outside the pharmacy chain network. Presence of such patients in analysis may underestimate quantity that patient purchased during the study period.

Sample Size

There is no universal cut off point for a sample size to be used for structural equation modeling or regression analysis. However, researchers have recommended different observation to variable ratios for different statistical procedures. A general rule is that the ratio of observation to variables should at least be 5:1. The minimum recommended ratio for structural equation modeling is the same; however an overall sample size between 100 and 200 is highly desirable (Hair, Anderson, Tatham, &

Black, 1995). Considering that this study has approximately 25 variables, a sample size of 200-300 was estimated to fulfill the minimum sample requirement. Based on the assumption of a 20-25% response rate, and with the goal of obtaining a sample size of over 200, the decision was made to send out at least 1200 surveys.

Sample Selection

A stratified random sampling procedure was adopted to identify the subjects to be surveyed. All patients who started their statin therapy in April 2003 were identified from the Walgreen Co. database using SAS V.8.2. These patients were then categorized into four distinct groups based on the amount they paid to obtain their statin prescription; less than $5, $5- $15, $16-$26, and more than $26. Cost groups were defined in such a way that equal representation of samples could be obtained. A random sampling of 400 patients from each group was performed using the random sampling procedure in SAS® 8.2. A final list of subjects was obtained by applying the exclusion and inclusion criteria and removing subjects with incomplete addresses. In order to combine this data with the final survey data, a unique code was assigned to each subject.

Retail Chain Pharmacy Database

For the purposes of this study, the retail chain pharmacy database was preferred over a pharmacy claims database because the latter does not capture the information on uninsured patients, for whom cost is likely to play an important role in the purchasing decision. A pharmacy claims database is predominantly used to adjudicate prescription drug claims for patients with prescription drug coverage. The use of such a database in the study would have omitted the uninsured patients who are most likely to be affected by change in the cost of the medications. In contrast, the retail pharmacy purchasing database is created at the purchasing level. Every prescription dispensed by a pharmacy is entered into the database whether it is covered or not. All the prescriptions filled at pharmacies belonging to the same retail chain pharmacy network are then stored at a centralized location. Every prescription filled by a patient, irrespective of the location of the pharmacy, is recorded into the database. At any given time, 36 months of continued database is maintained. The following information on the selected sample was then extracted from the database.

- Age
- Gender
- Drug name
- Quantity dispensed
- Days supply
- Dispensing dates
- Patient cost

Questionnaire Development and SurveyIimplementation

Questionnaire Development

The instrument was developed using procedures suggested by various sources (Dillman, 2000; Zeinio, 1981). Surveys were designed to be completed by patients in their homes, without any help from the researcher. A set of questions was obtained from the previously developed and validated scales, although some of the questions were modified to suit the purposes of this study. In the absence of such previously developed scales, additional questions were developed and added to the question set.

The question included in the survey can be categorized into three main parts, described below.

Part I: Experience of having higher cholesterol and taking cholesterol reducing medications.

This section was designed to explore the role of patients' health beliefs in purchasing behaviors. This part had two components. The first component was developed to gather data on patients' perceptions of medication benefits and barriers, while the second focused more on the individual's perception of disease severity and susceptibility associated with higher cholesterol.

Part II: Purchasing experience.

The objective of this section was to gain knowledge about respondents' medication purchasing experience. Questions were included in the survey to obtain information on variables such as: 1) perception of treatment value, 2) perception of product quality, 3) exposure to direct to consumer advertising, 4) availability of refill reminders, 5) distance traveled to fill the prescription, 6) involvement in the brand selection, 7) satisfaction with the physician's advice, 8) satisfaction with the pharmacist's advice, and, 9) reasons behind failure to refill medications in a required quantity.

Part III: Personal and family data.

This section was focused on gaining knowledge on household income, total prescription drug expenditure, presence of co-morbidities, overall health condition, employment status, social support and ethnicity. A detailed description of the development of scales and question set is described in the next section.

Variables Included in the Survey

Part I

Perceived treatment benefit (Items 10b, 10f, 10j, 10o, 10r):

A five item scale was developed to measure the patients' perception of the benefits of taking statin medication in controlling cholesterol and preventing future consequences associated with higher cholesterol. The responses were measured on a 7 point Likert type scale marked from *strongly disagree* to *strongly agree*. Items included in the scale were adapted from a validated scale developed by Horne, Weinman, & Hankins (1999) to measure beliefs about medicines (BMQ). The original scale was comprised of two sections: the BMQ specific section that assessed beliefs about medicines prescribed for patients' personal use, and the BMQ general section that assessed their general beliefs about medication. For this study, the first section, which assessed specific beliefs about medications, was used to develop the scale. The BMQ specific scale was comprised of two 5-item sections. The first section assessed the perceived benefits of the treatment, i.e. the perceived necessity of the medication, while the second section assessed the perceived barriers to taking medications. The original scale was validated in 524 subjects with chronic disease conditions. For the 5-item perceived benefit scale, Cronbach's alpha, the measure of internal consistency, was 0.76. While adapting this scale, the overall structure of the items from the original scale was maintained, except for the replacement of words 'my medicines' by the words 'my cholesterol medication'. An additional two items were modified to gather more specific information about the perceived usefulness of cholesterol medication in reducing cholesterol levels.

Perceived health barriers (Items 10c, 10g, 10j, 10k, 10n, 10u, 10w):

A seven item scale was developed to measure the patient's perception of barriers to taking cholesterol medication as prescribed. Items measured two aspects of the barriers: inconvenience and side effects. The responses were measured on a 7 point Likert type scale marked *strongly disagree* to *strongly agree*. Items to measure inconvenience and side effects were derived from the BMQ scale developed to measure the concerns associated with medications for chronic conditions (Horne et al., 1999). The 5-item perceived barrier scale had a Cronbach's alpha of 0.76 when validated in patients with heart diseases. While adapting this scale, the overall structure of the items from the original scale was maintained, except for the replacement of words 'my medicines' by the words 'my cholesterol medication'. Two more items on the perception inconvenience of taking medications as a barrier were developed and added to the modified BMQ scale.

Perceived susceptibility (Items 10x, 10y, 10z):

A three item scale was developed to measure the patient's perceived susceptibility to the consequences of higher cholesterol. The responses were measured on a 7 point Likert type scale marked *strongly disagree* to *strongly agree*. Items included in the scale were adopted from a scale previously developed by Champion (1984) to measure perceived susceptibility to breast cancer. The original scale had a

Cronbach's alpha of 0.77 and was comprised 6 items, three of which were dropped from the survey because of their lack of relevance to perceived susceptibility to high cholesterol and a need to limit the number of questions asked. While adapting this scale, except for replacing words specific to breast cancer by words relevant to heart disease, the original structure was maintained. Respondents were instructed to consider the range of heart and cholesterol related consequences as a heart disease.

Perceived severity (Items 10a, 10e, 10i, 10m and 10q):

A five item scale was developed to measure the patient's perceived severity of high cholesterol level and its consequences on their life. The responses were measured on a 7 point Likert type scale marked *strongly disagree* to *strongly agree*. Items included in the scale were adopted from the scale previously developed by Champion (1984) to measure perceived severity of a breast cancer examination. The original scale was composed of 12 items, but to reduce the number of questions to a manageable level, items that were least correlated with scale and items that were least relevant to cholesterol or heart disease were dropped. The internal consistency of the original scale was 0.78. While adapting this scale, the structure of the items from the original scale was maintained, except that words specific to breast cancer were replaced by words specific to cholesterol medications and heart conditions.

Part II

Perceived treatment value (Items 10d, 10h, 10l, 10p):

Grewal et al. (1998) used an 8-item scale to measure the concept of value associated with the product/service consumption. The responses were measured on a 7 point Likert type scale marked *strongly disagree* to *strongly agree*. The scale was validated in two different samples: hotel consumers and fast food restaurant consumers. Cronbach's alpha, a measure of internal consistency, was 0.97 in hotel customers and 0.93 in fast food consumers. This instrument was originally used to measure the perceived value associated with the price paid for hotel stays and fast food.

The original scale included 16 items designed to measure two types of value, namely acquisition value and transaction value. The scale developed for the measurement of transaction value, which comprised eight items, was not included in the study as it was aimed at measuring the consumer's perception of taking advantage of a price deal. A prescription medication refill is a repeat purchase behavior, which does not involve a one time price deal. Additionally, transaction value was not found to be associated with purchasing intentions (Al-Sabbahy, Ekinci, & Riley, 2003). The remaining eight items measuring acquisition value were modified by changing the tense of the statement from past to present tense. To limit the number of questions included in the survey, this scale was further reduced to four items by omitting less relevant items. Wordings of the statements were changed to reflect values associated with the purchase of statin medications.

Perception of brand quality (Item13):

Perception of the quality of the product was measured by asking respondents to indicate how they perceive the quality of their brand of medications compared to other brands of medications. To keep the number of questions to a minimum, only one item was developed to measure perception of brand quality. Respondents were asked to compare it on scale of 1-7, with 1 being *poor quality* and 7 being *highest quality*.

Time/convenience (Item18):

The convenience of filling their prescription was measured by asking patients' an open ended question on how many miles they have to travel to refill their prescriptions. This also acts as a proxy for the time cost involved in the refilling of prescriptions.

DTC exposure (Item15):

Respondents were asked to report how many times in the last 3 months they have seen an advertisement on television or in magazines for the cholesterol drug that they have been taking.

Refill reminders (Item 6):

Respondents were asked to check all the sources that reminding them to refill their prescription. The following options were provided: None, Pharmacist, Physician, Spouse, Insurance company, Reminder devices and Others.

Involvement in the product selection (Item 14):

Consumers' involvement in the brand selection was measured by asking them to indicate if the brand of medication they are taking was requested by them or not.

Patient-provider relationship (Item 4 &5):

The relationship between patient and provider was measured by asking patients to indicate, on a scale of 1-7, how supportive they feel their physician and pharmacist have been in helping them to manage their cholesterol levels.

Part III

Social support (Item 18):

Respondent were asked to report if there is anyone in the house who helped them either take medications or refill prescriptions.

Health Status (Item 20):

A single item scale used as a global measure of health status. Respondents were asked to state their perception of their health by comparison with someone the same age.

Co-morbidities (Item 21):

Information on the number and type of chronic conditions was collected by asking respondents to check off conditions that their doctor told them they have. The list of items included in the survey was based on the chronic disease conditions treatable by prescription drugs and diseases that have been shown in the literature to be associated with the quantity of medications purchased by individuals taking cholesterol reducing medications.

Prescription drug budget (Item 19):

Consumers were asked to report the approximate amount they spent to purchase a one month supply of prescription medications. This may not have reflected the true cost, but provided a good measure of their disposable income reserved for prescription drug purchase. Data were collected by asking patients an open-ended question.

Different pharmacies (Item 22):

Additional question were asked to identify the individuals that might not have refilled prescriptions from the Walgreen's retail pharmacy stores. Individuals who said they received mail order prescriptions and filled their cholesterol lowering medications at pharmacies owned by more than one owner were not included in the sample for the final analysis.

Household Income (Item 23):

Respondents were asked to report their approximate annual household income before taxes in the year 2002 by selecting one of the following categories: Less than $15,000, $15,000-24,999, $25,000-$34,999, $35,000-$49,999, $50,000-$74,999, $75,000-$99,999 and $100,000 and above.

Working status (Item 24):

Information on employment status was collected to determine the amount of time available to refill prescriptions. The amount of time available was expected to be lower for working individuals than non-working individuals, and thus so would the opportunity cost associated with filling prescriptions. Respondents were asked to report the number of hours they work per week

Race (Item 25):

Information was collected for six categories: Caucasian, African-American, American Indian, Hispanic, Asian, and Others.

Questionnaire pre-testing

Expert Panel:

The survey was evaluated for face and content validity by a group of experts comprised of four faculty from Auburn University (three from the Department of Pharmacy Care Systems, and one from the Department of Pharmacy Practice), and three pharmacists from Walgreen's Health Initiatives. Recommendations and suggestions made by the expert panel were incorporated in the survey prior to the pre-test.

Based on the recommendation of the expert panel, modification were made to the question set measuring perceived susceptibility. These modifications were implemented to avoid the potential effect of medication taking on the patient's perception of disease susceptibility. Patients were asked to answer these questions assuming that they did not take any cholesterol reducing medications.

Pre-test:

After implementation of expert panel's suggestions, the first draft was administered to a convenience sample of 12 individuals on statin therapy. Six of these individuals were employees of Auburn University, while the other six were employees of Walgreens Health Initiatives. Each individual was then interviewed to determine if the questions were: easy to understand, easily interpretable; created a positive impression among the respondents and motivated individuals to respond. They were also asked to report on the time required to complete the survey.

In most cases, it took 8-15 minutes to fill out the survey. Most of the questions were well understood and well received. An item was added to the survey to determine if patients filled their statin prescriptions over the last 12 months from a pharmacy other than Walgreens.

Data collection

Survey procedure

A researcher at Walgreens Health Initiatives was asked to assign codes to each survey so that collected information could be combined with the utilization data obtained from the Walgreen Co. retail database. Survey printing and mailing was handled by the Walgreen's printing services and the researcher had no access to patient identifiable information at any point in this process.

The following survey procedure was implemented using Dillman's (2000) mail survey methodology.

1) *First contact*: An introductory letter, signed by the director of health outcomes research, Walgreens Health Initiatives, was mailed on June 10th 2004. In this letter patients were informed that Walgreens was conducting a patient survey, which they would be receiving in a few days in mail. Although the expected number of people to be reached was 1200, a total of 1351 letters were sent to allow for the possibility of letters being returned as a result of incomplete addresses.

2) *Second contact*: Patients whose initial contact letters were returned as undeliverable were removed from the second mailing list. Two weeks after the first contact actual surveys with patient consent forms and postage paid returned envelopes were mailed to the remaining patients. As an incentive to fill out these surveys, patients were also provided with a code that they could use to obtain free enrollment in the Walgreens Health Info card. Walgreens Health Info card was offered through Walgreens website (www. Walgreens.com) for an enrollment fee of $9.99. This card is designed to give health care providers easy and secure access to patient health information in case of emergency.

3) *Third contact*: About 105 surveys were obtained within two weeks. These patients were omitted from the third and final mailing. The remaining 1074 patients were contacted with a reminder letter, replacement survey, patient consent form and postage paid envelope.

Survey and Retrospective database merge:

The survey database was created using SPSS data builder ®. This database was then combined with the aggregated patient level data obtained from the Walgreen Co. database using unique codes with the help of statistical software SAS®8.2. No patient identifiable information was included in this database.

Questionnaire Evaluation

Validity:

The face and content validity of the scale was established through consultation with the expert panel during the pre-test stage of the questionnaire development, while construct validity of the instrument was determined by factor analysis. A factor loading score of more than 0.7 was taken to be a measure of the convergent validity of the scale (Hair et al., 1995; Kerlinger & Lee, 2000). Discriminant validity was established by analyzing differences observed in the correlation between the construct and the correlation within the construct.

Additionally, factor analysis results were also used to validate and evaluate the scale items. A total of 25 items representing five underlying constructs were analyzed using factor analysis process with SPSS v.12. Upon extraction of the constructs, varimax rotation was applied to make the results more interpretable. Varimax rotation was preferred over oblique rotation because it produces factors in such a way that extracted components become orthogonal, which helps resolve problems associated with multicollinearity. Varimax rotation also helps assign items to only one construct by assigning it to a component on which it loads heavily. However, oblique rotation was also performed to validate the results obtained from varimax rotation.

Items loading strongly onto multiple components and items forming a completely different construct were deleted from the analysis.

Reliability:

Internal consistency evaluation (Cronbach's alpha) was performed to analyze the reliability of the scale and its applicability in the theoretical frame work of the study. This measure examines the relationship between the items and the composite score to determine if the item belongs to the underlying construct. As this instrument was administered only once, measurement of other reliability measures was not possible. Results of the reliability analysis were used to determine if items should be included or excluded from the data analysis.

Non response bias:

Once all the surveys were obtained, additional steps were taken to analyze the threat of non response bias. Since the sample was selected through an analysis of a retrospective database, information on both respondents and non-respondents was available to compare the difference among the groups, in terms of age, gender, cost and MPR.

Data obtained from the mail survey and retrospective database was used to test the hypotheses and research questions stated in the next section.

Hypotheses and Research Questions

Research Question 1

What are the relationships between quantity of medications purchased, measured in terms of MPR, perceived treatment value, perceived treatment benefits and cost of medication to the patient?

Research objectives:

a) Develop a model illustrating relationships among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost

b) Test the direct relationships between perceived benefit, cost, perceived value and quantity of medications purchased as illustrated in the model.

The following hypotheses were developed to achieve the above research objectives

Hypotheses:

1 H_{01}: The model developed to illustrate the relationships among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost does fit the data.

H_{a1}: The model developed to illustrate the relationships among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost does not fit the data.

2 H_{02}: There is no relationship between perceived treatment value and quantity of medications purchased.

H_{a2}: There is a relationship between perceived treatment value and quantity of medications purchased.

3 H_{03}: There is no relationship between the perceived benefit of statin treatment and perceived treatment value.

H_{a3}: There is a relationship between the perceived benefit of statin treatment and perceived treatment value.

4 H_{04}: There no relationship between cost and perceived treatment value.

H_{a4}: There is a relationship between cost and perceived treatment value.

5 H_{05}: There is no relationship between perceived benefit of statin treatment and quantity of medications purchased.

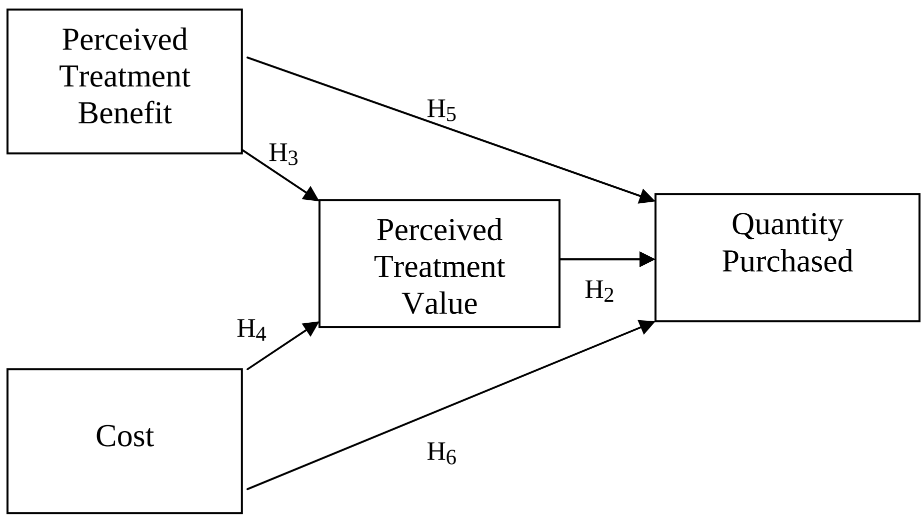
H_{a5}: There a relationship between perceived benefit of statin treatment and quantity of medications purchased.

6 H_{06}: There is no relationship between cost and quantity of medications purchased.

H_{a6}: There is a relationship between cost and quantity of medications purchased.

These hypotheses relate to the arrows in the model shown in Figure 8. This model was validated by using the statistical technique ‘Structural equation modeling’ (SEM) embedded in AMOS 5.

Figure 8. Proposed study model.



Variables:

Dependent and independent variables in Research Question 1, Objective 2 are as follows:

Hypothesis	**Independent Variable**	**Dependent Variable**
H_{02}	Perceived treatment value	Quantity purchased
H_{03}	Perceived treatment benefit	Perceived treatment value
H_{04}	Cost	Perceived treatment value
H_{05}	Perceived treatment benefit	Quantity purchased
H_{06}	Cost	Quantity purchased

Data Analysis

The overall model and the hypotheses represented by each path in the model were analyzed by structural equation modeling. Structural equation modeling (SEM) is the most appropriate technique for this analysis as it permits estimation of multiple equations and hypotheses simultaneously. This technique is especially useful when the dependent variable of one equation becomes the independent variable for other equations. Such causal network analyses performed by SEM characterize real-world processes better than other simple correlation based models (Gefen et al., 2000). Another advantage of SEM is that along with analysis of the relationships, it also evaluates the loading of items on the constructs, incorporating measurement error as a part of the model.

The data were analyzed using the statistical software package SPSS® V12.0 and AMOS 5 for Windows. The significance of $p<0.05$ of an individual path was used as a measure of the relationship between the two linked variables. Overall significance of the model was established by the chi-square test and various SEM fit indices are explained below.

Overall model fit indices:

Many overall fit indices have been proposed but there is no universal agreement on which one to use. However, employment of multiple measures is recommended to analyze the acceptability of a model. Hair et al (1995) recommended following three types of overall fit measures:

1) Absolute fit measures:

Absolute fit measures are useful in assessing the absolute good ness of fit of the model. Goodness of fit indices basically measure the fit between the covariance of an observed matrix with that of the proposed model matrix. The three mostly widely used indices are Chi-square statistics, the ‘Goodness-of-fit’ index (GFI) and root mean square residual (RMSR). Recommended acceptance levels of these measures are: non-significance for Chi-square statistics, a better than 0.9 fit for GFI and a less than 0.08 fit for RMSR.

2) Incremental fit measures:

Incremental fit measures are useful in assessing the incremental fit of the proposed model over a null model. The most widely used indices among this type are the ‘Normal fit index (NFI) and the Tucker –Lewis index (TL). For both these measures, the recommended acceptable level of fit is less than 0.9. As shown in Table 1, the values of NFI (0.87) and TL (0.89) obtained were quite close to the acceptable level.

3) Parsimonious fit measures:

Parsimonious fit measure assesses the parsimony of a proposed model by evaluating the number of estimates used to achieve the model fit and model fit. Two widely used measures are the ‘Adjusted goodness-of-fit’ index (AGFI) and the normed chi-square. Recommended acceptance levels for the measures are: greater than 0.9 for AGFI and between 1.0 to 2.0 for the normed chi-square.

Operational Definitions of variables included in Research Question1

Quantity of medications purchased:

The quantity of medications purchased was measured in terms of the Medical Possession Ratio (MPR), which is a ratio of the number of days supply of medication purchased to the number of days in the observation period. In this study, the observation period was limited to 12 months from the first date of refill.

$$\text{MPR} = \frac{\text{Number of days supply obtained during observation period}}{\text{Number of days in observation period}}$$

As the study was limited to a time period of one year and to patients receiving prescriptions of 30–days supply, the denominator was same for all the observations. For example: If a patient refilled the prescription 6 times in the first year of treatment, the numerator would be 6*30 = 180 days. The MPR would thus be 180/360=0.5

Perceived treatment value:

A composite factor score obtained from a factor analysis of individual items of perceived treatment value scale was used as the measure of perceived treatment value in the SEM analysis. The scale development and data collection method is described under the questionnaire development section (see the questionnaire in Appendix I).

Perceived treatment benefit:

A composite factor score obtained from a factor analysis of individual items of perceived treatment benefit scale was used as the measure of perceived treatment benefit in the SEM analysis. The scale development and data collection method is described under the questionnaire development section (and see the questionnaire in Appendix I).

Patient cost:

The co-payment paid by a patient to receive the prescription at a drug store.

Research Question 2

The second research question was: What are the determinants of quantity of medication purchased by a patient, measured in terms of MPR, and how are they related to each other?

Research objectives:

a) Identify the direct correlation among dependent and independent variables

b) Identify the strongest predictors of quantity of medications purchased.

The following hypothesis was developed to achieve the above research objectives.

Hypothesis:

H_{07} : Perceived treatment value, perceived treatment benefit, cost, demographic variables (age, gender, race, income and working status) and personal circumstances (hospitalization, disease severity, co-morbidities, number of medications, satisfaction with the provider, etc) and perceived health beliefs (perceived susceptibility, perceived severity and perceived barriers) do not predict the quantity of medications purchased.

H_{a7} : Perceived treatment value, perceived treatment benefit, cost, demographic variables (age, gender, race, income and working status) and personal circumstances (hospitalization, disease severity, co-morbidities, number of medications, satisfaction with the provider, etc) and perceived health beliefs (perceived susceptibility, perceived severity and perceived barriers) do predict the quantity of medications purchased.

Variables:

Operational definitions of dependent and independent variables included in Research Question2 are presented below.

Dependent variables:

Quantity of medications purchased: this variable will be measured in terms of MPR, as explained under Question 1.

Independent variables:

Variable	Definition
Age	Age of the respondent (years)
Brand quality	Perception of brand quality on a 7 point scale (1=very low….7=very high)
Co-morbidity: Depression	Presence of depression (1=yes, 2=no)
Co-morbidity: Diabetes	Presence of diabetes (1=yes, 2=no)
Co-morbidity: Hypertension	Presence of hypertension (1=yes, 2=no)
Cost	Patient co-pay per prescription plus dispensing fee
Direct-to-consumer advertising	Number of time consumer remembers seeing the products advertised in the past 3 months
Disease severity	Presence of CHD/CAD/history of heart attack/stroke (1=yes, 2=no)
Work status	Number of hours worked, per week.
Frequency of dose	Number of statin doses per day, calculated by quantity dispensed/days supply
Gender	Gender of the respondent (0=male, 1=female)
Household income	Yearly income on a 9 point scale (1= <10,000….9= >$80,000)
Involvement in the decision	If patient asked for a specific brand of medication (1=yes, 2=no)
Overall health	Overall health perceived by consumer on a 5 point scale (1=very bad….5=very good)

Variable	Definition
Perceived barriers	Perceived barriers to taking medication measured on a 7 point perceived barrier scale (1=low….7=high)
Perceived benefit	Perceived benefit of the treatment measured on a 7 point perceived benefit scale (1=low….7=high)
Perceived severity	Perceived barriers to taking medication measured on a 7 point perceived severity scale (1=low….7=high)
Perceived susceptibility	Perceived barriers to taking medication measured on a 7 point perceived susceptibility scale (1=low….7=high)
Perceived value	Perceived value of the cholesterol medication measured on a 7 point perceived value scale (1=low….7=high)
Pharmacist relationship	Satisfaction with pharmacist services on a 7 point scale (1=not at all satisfied….7=very satisfied)
Physician relationship	Satisfaction with physician advice on a 7 point scale (1=not at all satisfied….7=very satisfied)
Prescription drug expenditure	Monthly expenditure on a 6 point scale (1= <$100.…6= >$500)
Quantity purchased	In terms of the Medical Possession Ratio (MPR), days supply received/days supply prescribed
Race	Race of the respondent (1=white, 2=nonwhite)
Refill reminders	Receiving refill reminders (1=yes, 2=no)
Social support	Someone to help at home (1=yes, 2=no)

Data analysis:

Research Question 2 was exploratory in nature and was divided into two objectives:

1) Exploring the direct relationships between dependent and independent variables. This analysis was performed by analyzing the bi-vitiate correlation matrix among dependent and independent variables.

2) Segmenting individuals into different groups based the strongest predictor of the quantity of medications purchased. This analysis was performed by using Chi-square automatic interaction detector (CHAID) technique.

A statistical technique CHAID (Chi-square Automatic Interaction Detector), embedded in statistical software 'Answer Tree 3.0' was used to study the relationship between MPR and a number of independent variables

CHAID is one of the most popular techniques used in the area of marketing for the purpose of market segmentation and identifying characteristics of the population. It was first proposed by the Koss (1980). It is an important tool for evaluating the complex interaction among predictor variables and displays the result in an easy to understand tree format. CHAID creates the first branch of the tree by identifying the strongest predictor of the dependent variables, which then controls the overall structure of the tree. It also groups the values of independent variables into a manageable format, either by splitting continuous variables into statistically significant multiple groups or by collapsing statistically non-significant groups into a single group. Each of the branches is then reevaluated for the next strongest predictor to generate the second level of branches. The process is continued until the predetermined stopping criteria is reached.

CHAID was preferred over traditional multivariate technique for the following reasons:

1) To avoid problems associated with multicollinearity: The presence of highly correlated independent variables in the multiple regression model creates the problem of multicollineraity. Inclusion of such highly correlated variables and the interactions between them may result in many non significant parameter estimates. Inclusion or exclusion of such parameters may also result in changes in the magnitude and signs of parameter estimates. The CHAID technique is robust with respect to such problems as it handles one variable at a time in a given sample subset.
2) Robust to different types of independent variables: One of the major advantages of using CHAID analysis is its flexibility in allowing the use of nominal, ordinal and continuous variables in the analysis. In a traditional multivariate regression analysis, nominal variables must be converted into dummy variables, resulting in a further increase in the number of independent variables to be analyzed. In cases of relatively small sample sizes, any increase in the number of independent variables would further reduce the variable to observation ratio.
3) Handling of missing values as separate category : Another major advantage of using CHAID technique is for the handling of missing values. It treats missing value as another category and uses missing data whenever possible. As it looks at one variable at a time, missing values are included in the

nalysis and a missing value for the same observation for another variable thus does not affect the overall sample size.

Under multiple regression analysis any observation with missing values must be omitted from the analysis unless it is replaced by an unobserved value. Implementation of these remedies would have resulted in either creating unobserved values or a further reduction in the usable sample size.

Data was analyzed in two phases:

In the first phase of CHAID analysis, all the independent variables were included in the model and it was left up to the CHAID algorithm to identify the most significant factors determining the segmentation of groups into different quantity (MPR) groups.

Since the chi-square technique is sensitive to small sample size and the overall tree structure is controlled by the first controlling variable, further exploratory analysis was performed to see if relationships varied if different variables were chosen as the controlling variable. This was done by choosing each of the significant variables produced in the first step in turn. Such analysis is helpful in gaining information on how individuals with different characteristics would behave in different situations.

To keep the proposed tree simple and limit the number of tree nodes to only the highly significant variables, nodes were generated at a significance level of 0.01 with bonferroni modification. There is no universal rule on the minimum size of parent and child nodes; this is usually based on the sample size and left up to the researcher's discretion. As the basic analysis technique used in the CHAID algorithm is the Chi-square, a criterion of minimum cell frequency of 5 was applied to the child node. The size of the parent node was limited to 10 observations. Tree gain statistics were evaluated to identify the factors leading to a tree node with the lowest and highest MPR. Tree risk statistics were measured to evaluate the predictive ability of the tree.

Descriptive statistics and inferential results relevant to proposed research questions and hypotheses will be presented in Chapter 5.

CHAPTER 4

RESULTS

This chapter is divided into five major sections; 1) response rate and non-response bias analysis, 2) descriptive statistics, 3) scale evaluation 4) analysis of results relevant to Research Question 1, and 5) analysis of results relevant to Research Question 2.

Response rate

Out of 1351 surveys were mailed to the defined sample population, 148 surveys were returned because of incorrect addresses. Of the remaining 1203 surveys subjects, 197 were returned, yielding a response rate of 16.4 %. Of the 197 received surveys, only 181 were included in the final analysis. Seven surveys were omitted because of incomplete responsees (more than 5 missing responses on variables used in the data analysis), and an additional 9 were removed because subjects suggested that they were receiving their medications from pharmacies other than Walgreens.

Comparison of respondents vs. non- respondents

Analysis of selection bias between respondents and non-respondents is important in order to extend the generalizabiltiy of results to the defined population. Selection bias was analyzed by comparing respondents and non-respondents in terms of age, gender, cost of prescription (co-payment) and quantity of medications purchased during the study period (MPR).

As shown in Table 2, the respondent group had a higher percentage of female respondents (63.9%) compared to the non respondent group (52.2%). Chi-square analysis of these two groups suggested a statistically significant gender difference across the groups ($P<.0.002$). Similarly, the average age of the respondents was significantly higher (59.1 years) than the non respondents (56.9 years). Comparison of these two groups using a t-test resulted in a statistically significant difference ($p < 0.03$) across these two groups.

Respondents also had a higher MPR than non respondents ($p< 0.001$). On average, respondents obtained 60% of the prescribed medication, while non-respondents obtained only 49.5 % of the prescribed medications. Further analysis of the number of refills obtained (Table2) revealed that the proportion of individuals obtaining only one prescription in 12 months was higher in the non-respondent group, and the proportion of individuals obtaining 12 or more prescriptions was higher in the respondent group.

This result implies that females, relatively older individuals, and individuals who refilled their medications more often were more likely to respond to the survey. However, no such difference was observed in terms of the average amount that respondents and non-respondents paid to receive their statin prescriptions. As summarized in Table 2, on average respondents paid about $24.5 per prescription, compared to non-respondents, who paid $23.4 per prescription. T-test analysis suggested that the difference between these two groups was statistically not significant ($p < 0.585$).

Table 2: Comparison of Respondents vs. Non-respondents.

Variables		**Respondents**	**Non-respondents**	**Statistics**
N		197	1006	
Age	Mean	59.11 (12.3)	56.9 (13.8)	< 0.03
Gender				
	M	64.0	52.2	
	F	36.0	47.8	< 0.002
Cost	Mean	24.5 (27.2)	23.4 (24.4)	0.585
MPR	Mean	0.60 (0.35)	0.49 (0.34)	< 0.001
Prescription Fills	≤1 (%)	12.18%	16.60%	
	≥12 (%)	22.84%	15.61%	0.016

a: Chi-square test was used to compare the gender difference across the group.
Other variables were compared by using t-test.

Summary:

There was a significant difference between respondents and non-respondents. Respondents were more likely to be female and relatively older, and refilled their prescription more often than non-respondents. However no difference was observed in the amount that they paid to receive their statin medication.

Descriptive Statistics

Demographics:

Table 3 summarizes the demographic statistics of the final sample (N=181) used in the analysis. As shown in the table, 65% of the subjects were female. The average age of the subjects was 58.9 years, ranging from 25 to 95; approximately half of them (48%) were between the ages of 51-65. The sample was predominantly comprised of Caucasians (78%). Latinos, Asians and Native Americans together accounted for less than 10%, while African American accounted for only 8% of the respondents. Approximately 34.5% percent of the sample was made up of non-working individuals.

About one in three (30%) individuals reported earning less than $25,000 a year, and a cross tabulation between income and gender indicated that 80% of those were females (80%). Similarly, a third (30 %) of the individuals reported incomes of more than $50,000. More than 16% of the sample decided not to report their income. Most of the sample (70%) also indicated that they had someone at their home to help them take their medications.

Health Characteristics:

Statistics on patients' health characteristics are summarized in Table 4. Approximately four out of five individuals (78%) reported having one of the four co-morbidities: hypertension, heart disease, depression and diabetes. Of all the respondents, 30% said they had a heart disease, 54% said they had hypertension, 29% said they had depression, and 32% said they had diabetes. When asked about their perception of their health compared to others of their age, the majority (48%) felt that their health was better than others, 30% perceived it to be same as others , and about 18% felt that it was worst than others.

As shown in Table 4, on average respondents took 6.8 pills per day, ranging from 1 to 39 per day. More than 60% took less than 6 pills per day. Only 8% reported taking more than 12 per day.

Prescription drug purchasing behavior:

The results shown in Table 5 focus on the behaviors relevant to purchasing cholesterol reducing medications. The average medication possession ratio, a measure of the quantity of medications purchased, for the respondents was 0.62, ranging from 0.08 to 1.00. In the first 12 months of the statin therapy, one out of ten respondents (10.5%) filled only one prescription and one out of four (26%) filled three or less than three prescriptions, while only one of four actually (24%) completed their full course of therapy by purchasing 12 or more prescriptions.

About 45% respondents suggested that they get some sort of reminder (Pharmacist, Physician, Reminder device, or insurance company) to refill their medication. The average cost per statin prescription was $24.5 (SD= 27.3), ranging from $0 to $139. Among the 181 respondents, 13% paid nothing to get their prescription, 24 % paid between $1- $15, 31.5% paid between $16- $25, 22% paid between $26 -$50, while the remaining 9.4% paid more than $50 per prescription. More than 90 % of the respondents paid less than $50 per prescription, indicating that most of the respondents were covered by some sort of prescription drug coverage. On average, respondents reported that they spent an average of $102 per month on prescription drug medication, ranging from $0 to $ 900 per month.

When asked if the statin brand of medication that they were taking was requested by them or not, only 19 respondents (10.5%) said that they did ask for it and cross tabulation with the variable *gender* suggested that most of individuals requesting a particular brands were females.

Table 3: Descriptive statistics on patient demographics.

Variable		Frequency	Percent	Mean (SD)
Sample size		181		
Age				58.2 (11.9)
	<35	5	2.8	
	35-50	43	23.8	
	51-65	87	48.1	
	66-80	42	23.2	
	>80	4	2.2	
Gender				
	F	116	64.1	
	M	65	35.9	
Race				
	White	141	77.9	
	Hispanic/Latino	9	5.0	
	African American	15	8.3	
	Asian	2	1.1	
	Native American	5	2.8	
	Others	2	1.1	
	Missing	7	3.9	
Income				
	< $15,000	24	13.3	
	$15,000-24,999	30	16.6	
	$25,000-$34,999	20	11.0	
	$35,000-$49,999	20	11.0	
	$50,000-$74,999	37	20.4	
	$75,000-$99,999	12	6.6	
	>$100,000	9	5.0	
	Missing	29	16.0	
Work Hrs				23.7 (21.9)
	0	64	35.4	
	1-20	13	7.2	
	21-40	47	26.0	
	>40	38	21.0	
	Missing	19	10.5	
Social Support				
	Yes	126	69.6	
	No	48	26.5	
	Missing	7	3.9	

Table 4: Descriptive statistics on patient health characteristics.

Variable		Frequency	Percent	Mean (SD)
Sample size		181		
Health Status				
	Much worst	13	7.2	
	Worst	19	10.5	
	Same	55	30.4	
	Better	62	34.3	
	Much better	24	13.3	
	Missing	8	4.4	
Co-morbidities				
	Heart Disease	55	30.4	
	Hyper tension	98	54.1	
	Depression	53	29.3	
	Diabetes	58	32.0	
Number of pills				6.8 (5.3)
	0-3	37	20.4	
	4-6	71	39.2	
	7-9	35	19.3	
	10-12	18	9.9	
	>12	15	8.3	
	Missing	5	2.8	
Total Cost				102.3 (129.7)
	<25	41	22.7	
	26-50	29	16.0	
	51-100	40	22.1	
	101-200	26	14.4	
	>200	16	8.8	
	Missing	29	16.0	

Table 5: Descriptive statistics on prescription drug purchasing behavior.

Variable		Frequency	Percent	Mean (SD)
Sample Size		181		
MPR				0.62 (0.35)
Number of prescription Fills				7.3 (4.3)
	1	19	10.5	
	2	23	12.7	
	3	8	4.4	
	4	11	6.1	
	5	7	3.9	
	6	11	6.1	
	7	12	6.6	
	8	8	4.4	
	9	9	5.0	
	10	11	6.1	
	11	18	9.9	
	>12	44	24.3	
Cost (Co-pay)				24.5 (27.3)
	0	23	12.7	
	1-5	21	11.6	
	6-15	23	12.7	
	16-25	57	31.5	
	26-35	30	16.6	
	35-50	10	5.5	
	>51	17	9.4	
Brand request	Yes	19	10.5	
	No	144	79.6	
	Missing	18	9.9	
Reminder				
	Yes	82	45.3	
	No	99	54.7	

Scale Evaluation

Scale Validity:

A total of 25 items representing five underlying constructs were analyzed by factor analysis process using SPSS v.12. To identify items constituting a construct, initial factor analysis was performed on all 25 items irrespective of their initial use in the questionnaire. The name of the construct, name of corresponding items and their means are presented in Table 6.

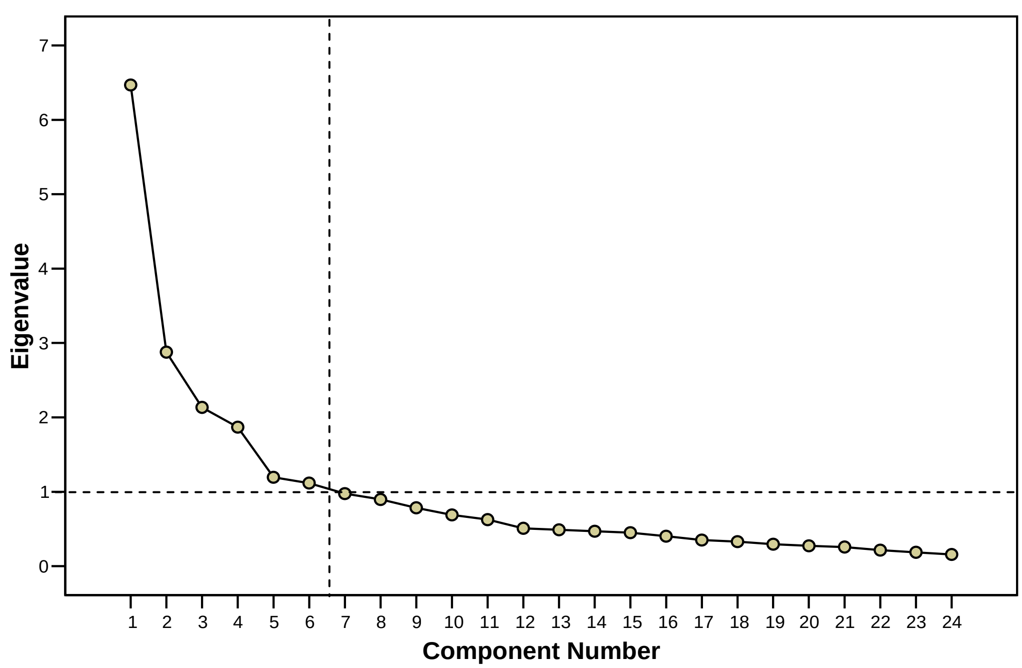
Table 6: Proposed scales and corresponding items: prior to factor analysis.

Construct	Item name	Mean	Std. Deviation
Perceived Benefit	Ben_1	6.0	1.4
	Ben_2	4.9	1.7
	Ben_3	5.8	1.4
	Ben_4	5.7	1.5
	Ben_5	5.2	1.6
Perceived Value	Val_1	4.7	1.9
	Val_2	4.3	2.0
	Val_3	5.0	1.9
	Val_4	4.3	2.0
Perceived Barrier	Se_1	3.0	2.0
	Se_2	4.6	1.9
	Se_3	3.7	2.1
	Se_4	5.0	1.9
	Se_5	2.4	1.8
	In_1	2.6	1.8
	In_2	2.2	1.7
Perceived Susceptibility	Sus_1	5.6	1.6
	Sus_2	4.8	1.9
	Sus_3	5.4	1.6
Perceived Severity	Sev_1	5.9	1.6
	Sev_2	6.2	1.3
	Sev_3	5.8	1.5
	Sev_4	5.0	1.9
	Sev_5	3.4	1.8

Component extraction:

The results of the factor analysis and varimax rotation are presented in Table 6. The criterion of an eigenvalue value greater than one was applied to extract the number of factors. As shown in Figure 9, there were six factors that had an eigenvalue of greater than 1. The highest initial eigenvalue (6.46) was observed for the construct *perceived benefit*, while the lowest eigenvalue (1.16) was observed for a totally new construct made up of two items: Se_4 & Se_3.

Figure 9: Screen plot of extracted components and their eigenvalues.



Scale modification:

Except for a few items in the perceived severity and perceived barrier scale, most of the items loaded significantly (> 0.5) on the intended scales. Upon inspection of the factor analysis results, the following changes were made to the proposed scale.

Item Se_4 was deleted from the analysis as this item did not load on any other components and measured a totally new construct. A closer inspection of this item revealed that the item measuring the intended construct *perceived barriers*, Item Se_3, the second item of the sixth component, had to be moved to another construct as it also loaded significantly higher (0.56) on this component.

Item Sev_3 (number 10 I on survey), was made a part of another scale as it loaded heavily (0.76) on a component measuring perceived benefit. Closer inspection of this item revealed that the question was actually asking about the benefits of taking medication rather than the perceived severity of the disease condition. Item Sev_5 was deleted from the final analysis because it did not load significantly on any of the five components (<0.5). Although this item was intended to measure the component *perceived severity*, it loaded heavily on a component intended to measure the construct *perceived barrier*.

High factor loadings of items onto a single construct and the relatively lower level of factor loadings on the different variables also helped establish the convergent and discriminant validity of the developed constructs. Direct correlations between the items showed that items measuring perceived benefit, perceived value, perceived severity and perceived susceptibility were positively correlated with each other but negatively correlated with items measuring perceived barriers, which is consistent with the theory.

Table 7: Component Matrix: A result of factor analysis after varimax rotation.

Construct	Item	Component					
		1	2	3	4	5	6
Perceived Benefit	Ben_4	**.778**	-.076	.197	.010	.066	.044
	Ben_3	**.776**	-.185	.124	.163	.159	-.107
	Sev_3	**.764**	-.157	-.008	.171	.122	-.131
	Ben_5	**.716**	-.137	.166	-.007	.075	-.023
	Ben_1	**.704**	-.352	.134	.111	.253	-.039
	Ben_2	**.578**	-.022	.151	.135	.451	-.154
Perceived Barrier	In_2	-.202	**.764**	-.055	.022	-.306	-.034
	In_1	-.186	**.739**	-.050	-.017	-.185	.096
	Se_5	-.261	**.676**	-.147	.009	.107	-.197
	Se_1	-.398	**.605**	-.046	-.005	.028	.188
	Se_2	.022	**.503**	.079	-.019	.220	.459
	Sev_5	.145	**.418**	.145	.040	.196	.080
Perceived Value	Val_4	.048	-.024	**.860**	-.057	.148	.014
	Val_2	.160	-.024	**.851**	.155	-.021	-.047
	Val_1	.393	-.101	**.687**	.078	.148	-.260
	Val_3	.561	.039	**.590**	.116	-.098	.035
Perceived Susceptibility	Sus_3	.124	.008	.022	**.898**	-.023	-.008
	Sus_1	.171	-.056	.074	**.881**	-.032	.068
	Sus_2	.040	.082	.075	**.837**	.112	-.017
Perceived Severity	Sev_2	.147	.081	.034	-.098	**.797**	.008
	Sev_4	.065	-.095	-.008	.034	**.711**	-.012
	Sev_1	.280	.033	.170	.156	**.560**	.251
New Component	Se_4	-.126	-.007	-.128	.029	-.011	**.810**
	Se_3	-.217	.557	-.078	.026	.105	**.581**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 6 iterations.

Scale reliability:

Reliability of the scale determined after the factor analysis described in the previous section was established by measuring Cronbach's alpha, a measure of internal consistency. The final selection of items, the corresponding construct and the reliability of those constructs is summarized in Table 8. Though there is no universal cut off point for an acceptable alpha level, most researchers in the social behavior sciences use 0.7 as a cutoff point for acceptable and unacceptable levels of alpha (Kerlinger, 2002). However, if alpha is too high (above >0.9), then items in the scale might be redundant and some of the items might be unnecessary. According to Devellis(1991), an alpha of less than 0.6 is unacceptable; between 0.6-0.65 is undesirable; between 0.65-0.7 is minimally acceptable; between 0.7 -0.8 is respectable; and a value in the range 0.8- 0.9 is very good.

All scales, except for the perceived severity scale, had alpha values in the very good range, i.e. between 0.8-0.9. Perceived severity had an alpha of 0.64, which although it falls in the undesirable range, given that the scale is made up of only three items, is still within an acceptable range.

Perceived benefit scale:

The finalized perceived benefit scale was composed of six items: Ben_1, Ben_2, Ben_3, Ben_4, Ben_5, and Sev_3. The scale had a Cronbach's alpha of 0.87, which is well above the acceptable level. Deletion of any of these items did not improve the reliability level. Factor loading scores of these items on a construct, when analyzed with only these six items, were used to generate the composite score for the variable *perceived benefit*.

Perceived barrier scale:

The finalized perceived barrier scale comprised a total of six items: Se_1, Se _2, Se _3, Se _5, In_1, and In_2. The scale had a Cronbach's alpha of 0.80, which is well above the acceptable level. Deletion of any of these items did not improve the reliability level. Factor loading scores of these items on the construct *perceived barrier*, when analyzed with these six items alone, were used to generate the composite score for the variable *perceived barrier*.

Perceived value scale:

The finalized perceived value scale was composed of a total of four items: Val_1, Val _2, Val _3, and Val _4. The scale had a Cronbach's alpha of 0.83, which is well above the acceptable level. Deletion of any of these items did not improve the reliability level. Factor loading scores of these items on a construct *perceived values*, when analyzed with these four items alone, were used to generate the composite score for the variable *perceived value*.

Perceived susceptibility scale:

The finalized perceived susceptibility scale was comprised of three highly correlated items: Sus_1, Sus_2, and Sus_3. The scale had the highest Cronbach's alpha among all the scales measured in this study, at 0.85. This alpha level was within the acceptable level, but item total statistics suggested that deletion of item Sus_2 may result in a slight improvement in the overall alpha level to 0.86. However, this suggestion was not implemented and Sus_2 was retained as a part of the scale because of the high scale validity and because deletion of this item would have resulted in a scale of only two items. Factor loading scores of these items on a construct *perceived susceptibility*, when analyzed with these three items alone, were used to generate the composite score for the variable *perceived susceptibility*.

Perceived severity:

The finalized perceived severity scale was comprised of total of three items: Sev_1, Sev_2 and Sev_3. The scale had the lowest Cronbach's alpha of 0.64 among all the measured scales. Though this scale did not achieve a desirable level of reliability, it was still in the acceptable range. Deletion of any one of these three items did not improve the reliability alpha level. Factor loading scores of these items on a construct *perceived severity*, when analyzed with these three items alone, were used to generate the composite score for the variable *perceived severity*.

Table 8: Reliability Statistics

Perceived Benefit:

Reliability Statistics

Cronbach's Alpha	Standardized Cronbach's Alpha	N of Items
.873	.878	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Ben_1	27.4077	35.903	.731	.551	.844
Ben_2	28.4918	34.651	.594	.393	.869
Ben_3	27.6479	35.042	.758	.595	.839
Ben_4	27.7634	35.663	.673	.469	.852
Ben_5	28.1924	35.237	.636	.462	.859
Sev_3	27.6188	35.463	.695	.513	.848

Perceived Barrier:

Reliability Statistics

Cronbach's Alpha	Standardized Cronbach's Alpha	N of Items
.802	.804	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Se_1	15.5308	43.313	.627	.406	.755
Se_2	13.8721	48.292	.445	.306	.798
Se_3	14.7619	43.138	.605	.422	.761
Se_5	16.0516	47.738	.512	.304	.782
In_1	15.9033	46.172	.585	.531	.766
In_2	16.3134	47.438	.591	.541	.766

Perceived Value:

Reliability Statistics

Cronbach's Alpha	Standardized Cronbach's Alpha	N of Items
.831	.831	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Val_1	13.5831	23.825	.685	.476	.774
Val_2	13.9837	22.912	.718	.523	.759
Val_3	13.3201	25.641	.607	.403	.809
Val_4	13.9407	24.064	.628	.437	.801

Perceived Susceptibility:

Reliability Statistics

Cronbach's Alpha	Standardized Cronbach's Alpha	N of Items
.854	.861	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Sus_1	10.2249	10.275	.753	.608	.775
Sus_2	11.0146	8.942	.672	.453	.865
Sus_3	10.3920	10.071	.774	.628	.755

Perceived Severity:

Reliability Statistics

Cronbach's Alpha	Standardized Cronbach's Alpha	N of Items
.620	.639	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Sev_1	11.1477	7.158	.454	.235	.488
Sev_2	10.8128	7.932	.481	.248	.477
Sev_4	12.0540	6.123	.387	.151	.618

Descriptive statistics on the scale items:

Prior to the factor analysis, missing values were replaced by series means. All of the items were measured on the scale of 1-7. As each of the items in the scale contributed disproportionately towards total scale variation, composite scores were calculated to weight factor loadings in the final score. Descriptive statistics on these variables are presented in Table 9.

Table 9: Descriptive Statistics for scale variables (N=181)

Variable	Mean	Std. Deviation
Perceived Benefit	5.59	1.17
Perceived Barrier	3.03	1.34
Perceived Value	4.56	1.60
Perceived Severity	5.70	1.21
Perceived Susceptibility	5.28	1.50

On average, respondents seemed to perceive 1) above average levels of benefits of taking medications 2) above average levels of the severity of high cholesterol and 3) above average levels of susceptibility to the consequences of high cholesterol. They seemed to be in the middle of the road when it comes to the perceived barriers of taking medications. Though the mean of perceived value is lower than that for other variables, overall it is still on the positive side, indicating that respondents think that they are getting a reasonable value for their money from cholesterol medications.

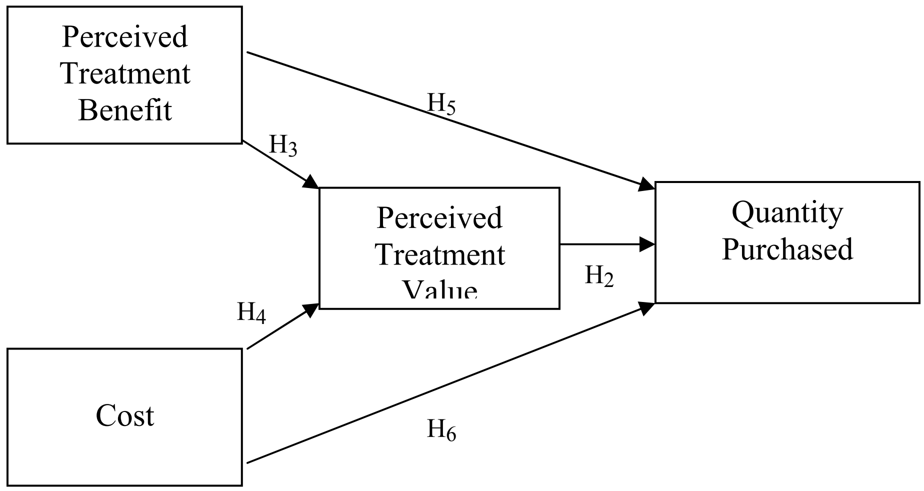
Hypotheses and Research Questions

Research Question 1

The first research question was: What are the relationships between the quantity of medications purchased, the perceived treatment value, and its immediate antecedents, perceived benefits and cost?

The proposed model, as shown in Figure 10, was validated using the statistical technique 'structural equation modeling' (SEM) using AMOS 5.

Figure 10. Proposed study model.



The following hypotheses were tested by validating a model proposing relationships between these variables.

Hypotheses:

1 H_{01}: The model developed to illustrate the relationship among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost does fit the data.

2 H_{02}: There is no relationship between perceived treatment value and quantity of medications purchased.

3 H_{03}: There is no relationship between perceived benefit of statin treatment and perceived treatment value.

4 H_{04}: There no relationship between cost and perceived treatment value.

5 H_{05}: There is no relationship between perceived benefit of statin treatment and quantity of medications purchased.

6 H_{06}: There is no relationship between the cost and quantity of medications purchased.

Overall model estimation:

Covariance rather than a correlation matrix was used to estimate the model as models estimated with covariance matrix are more generalizable and tend to be more useful for validating theory and causal relationships (Hair, 1995). There were no indications of untoward parameter estimates; all the estimated parameter exhibited correlation signs as expected. Significance of model parameters was determined at alpha = 0.05.

Model Identification:

The estimated model was recursive and a unique solution was reached. The problem of model identification was absent.

Analysis of offending estimates:

No theoretical inconsistencies were observed among the proposed model estimates. There was no standardized estimate with a value > 1 and large standard errors. All standard errors associate with estimated parameters were less than 0.19.

Overall model fit:

1) Absolute fit measures:

As shown in Table 10, the chi-square test was significant, x^2 = 128.04, and failed to achieve the desired level of fit. However, it was also advised (Bentler 1992) that it not be used as the sole measure of model fit because of its sensitivity to sample size. Among other measures of absolute fit , GFI reached a fully acceptable value of 0.901, while RMSR had a marginally acceptable value of 0.09 compared to the desired <0.08 value. Another goodness of fit index, the comparative fit index (CFI), was also applied to the data because it is less likely to produce a biased result when a small sample is used. CFI of the proposed model (0.917) easily achieved the recommended level of fit.

2) Incremental fit measures:

As shown in Table 10, the values of NFI (0.87) and TL (0.89) were quite close to the acceptable level of 0.9.

3) Parsimonious fit measures:

The recommended acceptance levels for the selected parsimonious fit measures AGFI and normed chi-square were greater than 0.9 and less than 2.0, respectively. As shown in Table 01, the AGFI value of 0.85 and normed chi-square value of 2.51 were at a marginal acceptance level.

Figure 11. SEM Model estimation: Proposed model.

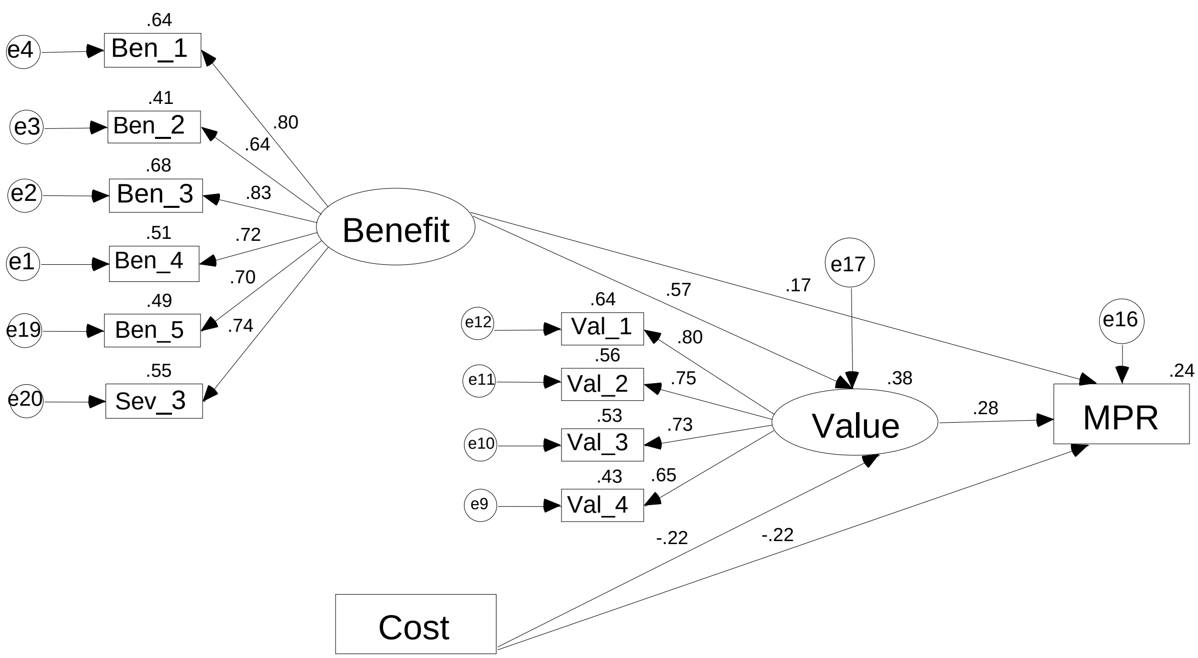


Table 10: Overall model fit measures: Proposed model

Chi-square	128.030
Degree of freedom	51.000
Significance level	0.000
GFI	0.901
CFI	0.917
RMSR	0.092
NFI	0.872
TL	0.893
AGFI	0.848
Nor me Chi-Square	2.511

Parameter estimates: Proposed model

Independent Variable	Dependent Variable	Estimate (Unstandardized)	Estimate (Standardized)	P
Value	MPR	.073	.279**	.006
Benefit	Value	.712	.572**	.000
Cost	Value	-.011	-.221**	.002
Benefit	MPR	.056	.173	.065
Cost	MPR	-.003	-.224**	.001
Value	VAL1_1	1.169	.800**	.000
Value	VAL2_1	1.123	.747**	.000
Value	VAL3_1	1.022	.727**	.000
Value	VAL4_1	1.000	.655**	
Benefit	BEN1_1	1.031	.800**	.000
Benefit	BEN2_1	1.048	.642**	.000
Benefit	BEN3_1	1.104	.827**	.000
Benefit	BEN4_1	1.000	.717**	
Benefit	BEN5_1	1.050	.702**	.000
Benefit	SEV3_1	1.028	.745**	.000

** Correlation is significant at the .01 level(2-tailed).
* Correlation is significant at the .05 level(2-tailed).

Model respecification:

As shown in Table 10, analysis of the modification indices suggested the presence of relationships among various variables. Only relationships that made theoretical sense as well as suggested significant improvement in the model fit were considered for the model respecification. None of the suggestions that showed a presence of relationship among residuals across two different variables were considered for respecification. The model was respecified by drawing the covariances between e9-e12, e9-e10, e3-e19 and cost-benefit. The results of the revised model are presented in Table 11.

Table 11 : Modification Indices: Proposed Model

Variables			M.I.	Par Change
Benefit	<-->	Cost	7.509	-6.181
E11	<-->	Benefit	6.761	-.312
E12	<-->	Benefit	4.164	.226
E10	<-->	Benefit	5.597	.271
E9	<-->	Benefit	5.881	-.321
E9	<-->	e11	16.713	.697
E9	<-->	e20	12.164	-.432
E9	<-->	e10	4.034	-.327
E4	<-->	e12	7.706	.250
E4	<-->	e9	4.089	-.217
E3	<-->	e12	7.576	.375
E3	<-->	e19	5.216	-.273
E1	<-->	e10	9.464	.344

Overall model fit measures: Revised model:

Model Identification:

The revised model reached a unique solution and suffered from no problems associated with model identification.

Analysis of offending estimates:

No theoretical inconsistencies were observed among the revised model estimates. There was no standardized estimate with a value of more than 1.0 and large standard errors. All standard errors associate with the estimated parameters were less than 0.18.

Overall model fit:

1) Absolute fit measures:

    As shown in Table 12, the chi-square test was still significant, but the X^2 value dropped from 128.0 to 92.4. GFI improved from 0.90 to 0.93, and RMSR was reduced from 0.092 to 0.076, achieving a minimum acceptance level of 0.08.

2) Incremental fit measures:

    Prior to respecification, NFI (0.87) and TL (0.89) were quite close to the acceptable level of 0.9. Respecification brought these measures, NFI (0.907) and TL (0.932), from marginally acceptance levels of fit to full acceptance levels of fit , i.e. more than 0.9.

3) Parsimonious fit measures:

The AGFI index improved from its previous value of 0.85 to 0.89, closer to the acceptance level of 0.9. A similar kind of improvement was observed in the normed chi-square ratio, where the value came down from 2.52 to 1.96, thus entering the acceptance range of less than 2.0.

Figure 12. SEM model estimation: Revised model.

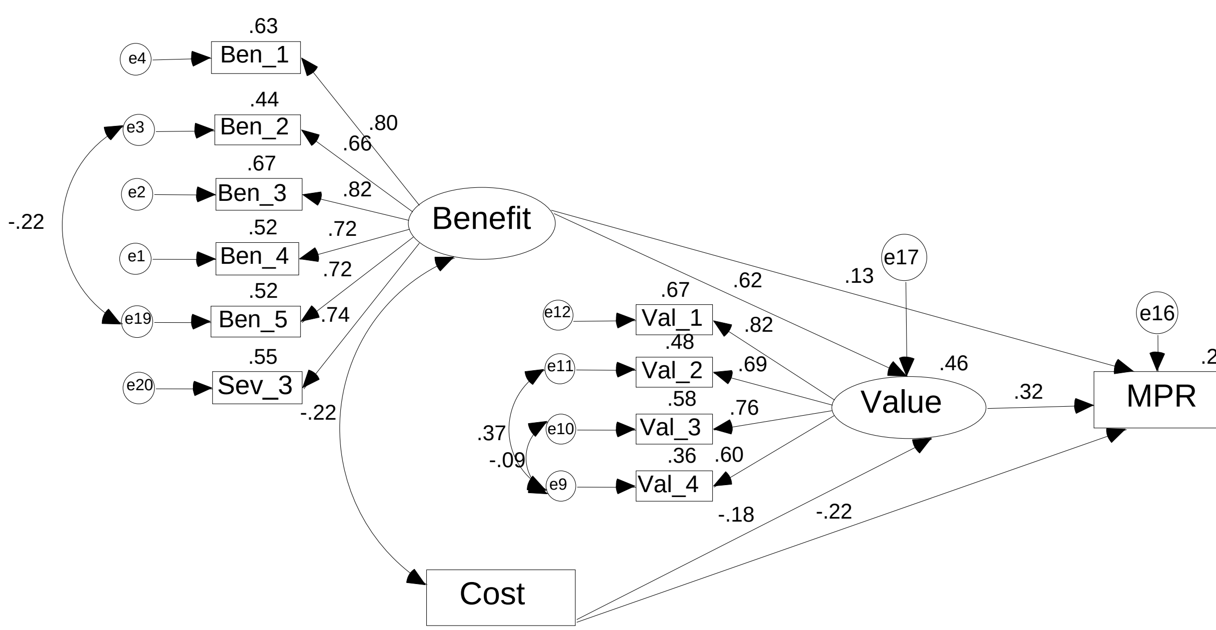


Table 12: Overall model fit measures: Respecified model

Chi-square	92.386
Degree of freedom	47.000
Significance level	0.000
GFI	0.929
CFI	0.951
RMSR	0.073
NFI	0.907
TL	0.932
AGFI	0.881
Normed Chi-Square	1.966

Parameter estimates: Respecified model

Independent Variable	Dependent Variable	Estimate (Unstandardized)	Estimate (Standardized)	P
Value	MPR	.091	.317**	.005
Benefit	Value	.707	.618**	<.0001
Cost	Value	-.008	-.182*	.011
Benefit	MPR	.043	.130	.197
Cost	MPR	-.003	-.216**	.002
VAL1_1	Value	1.307	.818**	<.0001
VAL2_1	Value	1.134	.691**	<.0001
VAL3_1	Value	1.171	.763**	<.0001
VAL4_1	Value	1.000	.601	
BEN1_1	Benefit	1.017	.795**	<.0001
BEN2_1	Benefit	1.076	.664**	<.0001
BEN3_1	Benefit	1.081	.816**	<.0001
BEN4_1	Benefit	1.000	.723	
BEN5_1	Benefit	1.067	.719**	<.0001
SEV3_1	Benefit	1.017	.742**	<.0001

** Correlation is significant at the .01 level(2-tailed).
* Correlation is significant at the .05 level(2-tailed).

Parameter estimates:

As summarized in Table 12, all the proposed relationships, except for the direct relationship between perceived benefit and MPR, had the expected signs and were statistically significant at the 0.05 level. Prior to the respecification, the relationship between perceived benefit and MPR had the correct sign, but was not significant (P =0.065). The respecification model had no impact on the signs and the relationships among these variables.

Hypothesis testing:

$H_{01:}$ The model developed to illustrate the relationships among the quantity of medications purchased, the perceived treatment value, the perceived treatment benefits and prescription drug cost does not fit the data.

The above null hypothesis was rejected because all the measures of fit indices were significant and suggested acceptable levels of model and data fit. Overall model fit explained 27% of the variation in the quantity of medications purchased.

$H_{02:}$ There is no relationship between perceived treatment value and quantity of medications purchased.

The above null hypothesis was rejected because the relationship between perceived treatment value and quantity of medications purchased was significant. As shown in Figure 12, the value of the standardized parameter estimation between these two variables was 0.32, suggesting that perceived treatment value alone explained 10.2% of the variation and had a positive impact on MPR, a measure of quantity of medication purchased.

$H_{03:}$ There is no relationship between the perceived benefit of statin treatment and perceived treatment value.

The above null hypothesis was rejected because the relationship between perceived treatment benefit and perceived treatment value was statistically significant ($P < 0.001$). As shown in Figure 12, the value of the standardized parameter estimation between these two variables was 0.62, suggesting that perceived benefit alone explained 38.4% of variation and had a positive impact on perceived value.

$H_{04:}$ There is no relationship between cost and perceived treatment value.

The above null hypothesis was rejected because the relationship between cost of statin medication and perceived treatment value was statistically significant ($P < 0.01$). As shown in Figure 12, the value of the standardized parameter estimation between these two variables was -0.18, suggesting that cost alone explained approximately 3.2% of variation and had a negative impact on perceived value.

$H_{05:}$ There is no relationship between the perceived benefit of statin treatment and quantity of medications purchased.

The null hypothesis failed rejection because the relationship between perceived benefit of statin medication and quantity of medication purchased was statistically not significant (P=.197). As shown in Table 11, the relationship was initially significant at an alpha value of 0.1 (0.065), but became insignificant after model respecification (as shown in Table12). Perceived benefit was strongly correlated with perceived value, which was a strong predictor of quantity of medications purchased. Because of such a high correlation with another independent variable, it became insignificant when used in a model with perceived value. Upon removal of the relationship between perceived value and quantity of medication purchased from the respecified model, its relationship with quantity of medications purchased became significant at the 0.01 significance level (P< 0.007).

$H_{06:}$ There is no relationship between cost and quantity of medications purchased.

The null hypothesis was rejected. The relationship between cost of statin prescription and quantity of medication purchased was statistically significant (P< 0.002). As shown in Figure 12, the value of standardized parameter estimation between these two variables was 0.22, suggesting that the cost of statin medication alone explained 4.8% of the variation and had a negative impact on quantity of medications purchased. As discussed earlier, it also had a significant relationship with perceived value, which itself had a significant impact on quantity of medication purchased. Upon removal of the relationship with value, the standardized parameter estimation improved to 0.23 and also resulted in an improvement of the statistical significance to $p<0.001$.

Summary:

Overall, a good model fit was obtained with the proposed model. Few of the indices that failed to achieve the desired level of fit in the proposed model achieved full acceptance level after the implementation of the theoretically consistent relationship suggested by the modification indices. Except for the direct relationship between perceived benefit and quantity of medications purchased, all the hypotheses were statistically significant. Perceived benefit and cost of statin medication in combination explained approximately half of the variation (46%) present in the variable perceived value. Perceived value, along with the other two variables, explained about 27% of the variation in quantity of medications purchased. The cost of statin medication impacted quantity purchased two ways, both directly and through perceived value. While the direct relationship between perceived benefit and quantity purchased was not significant, it did have a strong impact through perceived value.

Results Relevant to Research Question 2

The second research question was: What are the determinants of quantity of medication purchased by a patient, measured in terms of MPR, and how are they related to each other?

Research objectives:

a) Identify the direct correlation among dependent and independent variables: This analysis was performed by analyzing the bi-vitiate correlation matrix among dependent and independent variables.

b) Identify the strongest predictors of quantity of medications purchased: This analysis was performed by using the Chi-square automatic interaction detector (CHAID) technique.

Analysis of direct correlation among dependent and independent variables:

As shown in Table 13, the bi-variate Person's correlation between the study variables was measured by using SPSS V12. The significance of the correlation was defined as alpha <0.05. Analysis of such relationships is important in analyzing direct relationships among dependent and independent variables.

Table 13: The Bivariate Correlation Matrix of All Variables.

	Benefit	Barrier	Value	Severity	Susceptibility	Age	Race_bi
Benefit	1.000	-.474 **	.502 **	.396 **	.249 **	.030	-.130
Barrier	-.474 **	1.000	-.220 **	-.058	-.019	.042	-.032
Value	.502 **	-.220 **	1.000	.206 **	.188 *	.073	-.071
Severity	.396 **	-.058	.206 **	1.000	.096	-.099	.011
Susceptibility	.249 **	-.019	.188 *	.096	1.000	-.036	.157 *
Age	.030	.042	.073	-.099	-.036	1.000	.032
Race_bi	-.130	-.032	-.071	.011	.157 *	.032	1.000
Gender_bi	.061	.052	.062	-.046	.081	-.042	-.023
Income	-.062	.029	.068	.150	.080	-.218 **	.180 *
Social_sup	-.054	.098	-.052	-.015	-.094	.044	-.133
Work	-.165 *	.056	-.119	.190 *	-.027	-.372 **	.116
Tcost	-.076	-.114	-.373 **	-.215 **	-.108	.126	-.009
Num_pills	.113	-.142	.032	-.077	.131	.220 **	.047
Health	.111	-.134	.205 **	.093	-.083	.252 **	-.056
Heart Dis.	.019	-.025	.032	-.134	.236 **	.154 *	-.048
Depression	.063	-.102	-.003	-.048	-.020	-.159 *	-.028
Hypertension	.104	-.030	.119	.066	.157 *	.103	- .195 *
Diabetes	-.015	.012	.015	-.064	.063	.100	-.149
Pat_cost	-.207 **	.042	-.301 **	-.250 **	-.156 *	.205 **	.020
Dist_travel	.030	-.051	-.053	-.023	.091	.118	.043
Brand_req	-.135	-.016	-.102	-.003	-.128	.002	.104
Brand_quality	.624 **	-.474 **	.400 **	.162 *	.169 *	.065	-.255 **
Phy	.389 **	-.244 **	.183 *	.126	.126	.081	-.215 **
Pharm	.209 **	.018	.306 **	.076	.100	.213 **	-.120
Imp	.599 **	-.347 **	.357 **	.196 **	.316 **	.018	-.069
MPR	.364 **	-.325 **	.407 **	.223 **	.084	-.174 *	-.064

** Correlation is significant at the .01 level(2-tailed).

* Correlation is significant at the .05 level(2-tailed).

Table 13: The Bivariate Correlation Matrix of All Variables (continued)

	Gender _bi	Income	Social_sup	Work	Tcost	Num_pills	health
Benefit	.061	-.062	-.054	-.165 *	-.076	.113	.111
Barrier	.052	.029	.098	.056	-.114	-.142	-.134
Value	.062	.068	-.052	-.119	-.373 **	.032	.205 **
Severity	-.046	.150	-.015	.190 *	-.215 **	-.077	.093
Susceptibility	.081	.080	-.094	-.027	-.108	.131	-.083
Age	-.042	-.218 **	.044	-.372 **	.126	.220 **	.252 **
Race_bi	-.023	.180 *	-.133	.116	-.009	.047	-.056
Gender_bi	1.000	-.261 **	.244 **	-.110	-.075	.031	-.019
Income	-.261 **	1.000	-.273 **	.430 **	-.158	-.065	-.048
Social_sup	.244 **	-.273 **	1.000	.029	-.024	-.038	-.046
Work	-.110	.430 **	.029	1.000	-.049	-.290 **	-.062
Tcost	-.075	-.158	-.024	-.049	1.000	.152	-.126
Num_pills	.031	-.065	-.038	-.290 **	.152	1.000	-.115
Health	-.019	-.048	-.046	-.062	-.126	-.115	1.000
Heart Dis.	-.062	-.268 **	-.026	-.311 **	.167 *	.211 **	-.079
Depression	.128	-.129	.056	-.095	.110	.214 **	-.277 **
Hypertension	.035	-.075	-.032	-.127	.105	.194 *	-.038
Diabetes	-.060	.156	-.231 **	.074	-.151	.295 **	.146
Pat_cost	-.049	-.051	-.058	.080	.532 **	-.013	.072
Dist_travel	.028	-.007	-.134	-.131	.143	.203 **	-.039
Brand_req	.169 *	-.098	-.073	-.083	.038	.064	-.107
Brand_quality	.049	-.072	-.013	-.125	.059	.115	.189 *
Phy	.030	-.088	-.049	-.114	.148	.101	.221 **
Pharm	.072	-.064	-.041	-.094	-.200 *	.038	.161 *
Imp	.082	.076	-.086	-.011	.057	.125	.011
MPR	-.034	.106	-.041	.045	-.241 **	-.099	.131

** Correlation is significant at the .01 level(2-tailed).
* Correlation is significant at the .05 level(2-tailed).

Table 13: The Bivariate Correlation Matrix of All Variables (continued)

	Heart Dis.	Depression	Hypertension	Diabetes	Pat_cost	Dist_travel
Benefit	.019	.063	.104	-.015	-.207 **	.030
Barrier	-.025	-.102	-.030	.012	.042	-.051
Value	.032	-.003	.119	.015	-.301 **	-.053
Severity	-.134	-.048	.066	-.064	-.250 **	-.023
Susceptibility	.236 **	-.020	.157 *	.063	-.156 *	.091
Age	.154 *	-.159 *	.103	.100	.205 **	.118
Race_bi	-.048	-.028	-.195 *	-.149	.020	.043
Gender_bi	-.062	.128	.035	.060	-.049	.028
Income	-.268 **	-.129	-.075	-.156	-.051	-.007
Social_sup	-.026	.056	-.032	.231 **	-.058	-.134
Work	-.311 **	-.095	-.127	-.074	.080	-.131
Tcost	.167 *	.110	.105	.151	.532 **	.143
Num_pills	.211 **	.214 **	.194 *	.295 **	-.013	.203 **
Health	.079	-.277 **	.038	-.146	.072	-.039
Heart Dis.	1.000	.125	.269 **	.074	.083	.057
Depression	.125	1.000	.214 **	.258 **	.061	.158
Hypertension	.269 **	.214 **	1.000	.297 **	.035	.103
Diabetes	.074	.258 **	.297 **	1.000	.059	.108
Pat_cost	.083	.061	-.035	-.059	1.000	-.012
Dist_travel	.057	.158	.103	.108	-.012	1.000
Brand_req	-.069	.054	-.141	-.238 **	.027	-.010
Brand_quality	.084	.080	.213 **	.072	-.031	.063
Phy	.075	-.085	.073	-.045	.033	.011
Pharm	.006	-.104	.206 *	.095	-.191 *	.090
Imp	-.000	-.066	.127	-.011	-.090	.033
MPR	.157 *	.140	.028	-.030	-.344 **	-.108

** Correlation is significant at the .01 level(2-tailed).
* Correlation is significant at the .05 level(2-tailed).

Table 13: The Bivariate Correlation Matrix of All Variables (continued)

	Brand_req	Brand_quality	Phy	Pharm	Imp	MPR
Benefit	-.135	.624 **	.389 **	.209 **	.599 **	.364 **
Barrier	-.016	-.474 **	-.244 **	.018	-.347 **	-.325 **
Value	-.102	.400 **	.183 *	.306 **	.357 **	.407 **
Severity	-.003	.162 *	.126	.076	.196 **	.223 **
Susceptibility	-.128	.169 *	.126	.100	.316 **	.084
Age	.002	.065	.081	.213 **	.018	-.174 *
Race_bi	.104	-.255 **	-.215 **	-.120	-.069	-.064
Gender_bi	.169 *	.049	.030	.072	.082	-.034
Income	-.098	-.072	-.088	-.064	.076	.106
Social_sup	-.073	-.013	-.049	-.041	-.086	-.041
Work	-.083	-.125	-.114	-.094	-.011	.045
Tcost	.038	.059	.148	-.200 *	.057	-.241 **
Num_pills	.064	.115	.101	.038	.125	-.099
Health	-.107	.189 *	.221 **	.161 *	.011	.131
Heart Dis.	.069	.084	.075	.006	.000	.157 *
Depression	.054	.080	.085	.104	.066	.140
Hypertension	.141	.213 **	.073	.206 *	.127	.028
Diabetes	.238 **	.072	.045	.095	.011	.030
Pat_cost	.027	-.031	.033	-.191 *	-.090	-.344 **
Dist_travel	-.010	.063	.011	.090	.033	-.108
Brand_req	1.000	-.010	-.023	-.042	-.032	-.120
Brand_quality	-.010	1.000	.463 **	.240 **	.521 **	.318 **
Phy	-.023	.463 **	1.000	.220 **	.428 **	.100
Pharm	-.042	.240 **	.220 **	1.000	.207 **	.157 *
Imp	-.032	.521 **	.428 **	. 207 **	1.000	.278 **
MPR	-.120	.318 **	.100	.157 *	.278 **	1.000

** Correlation is significant at the 0.01 level(2-tailed).
* Correlation is significant at the 0.05 level(2-tailed).

Perceived Value:

Perceived value had a positive significant correlation with the dependent variable MPR. Except for the significant negative correlation with the total cost, its correlations with other independent variables were very similar to that found for the correlation between perceived benefit and other independent variables. However, the extent of the direct correlation with patient cost and MPR was stronger than with perceived benefit. It was positively correlated with perceived benefit, perceived severity, perceived susceptibility, importance of medication taking, pharmacist and physician advice and brand quality. It was negatively correlated with total cost and patient cost.

Perceived Severity

Perceived severity was found to be positively correlated with the dependent variable MPR. Among independent variables, it was also positively correlated with perceived benefit, perceived value, importance of medication taking and number of work hours. It was negatively correlated with total cost and patient cost.

Perceived Susceptibility:

Perceived severity was positively correlated with the dependent variable MPR. It was also positively correlated with perceived benefit, perceived value, and importance of medication, brand quality, heart disease and hypertension. It was negatively correlated with patient cost.

Age:

Age was negatively correlated with MPR. As most of the respondents were retirees, age was also found to be negatively correlated with their income and working hours. Older individuals also took a higher number of pills per day, paid more for the statin prescriptions, reported having heart disease at a higher percentage, reported having depression at a lower percentage, and perceived their health to be worse than others of the same age

Race:

There was no significant correlation between race and MPR. However, compared to non-caucasian individuals, Caucasians reported higher levels of perceived susceptibility and higher levels of income. They also reported lower incidences of hypertension, lower levels of satisfaction with physician support and lower levels of perception of brand quality than non-caucasian individuals.

Gender:

Though female gender was negatively correlated with MPR, the correlation was statistically not significant. However compared to males, females reported lower income levels, higher social support and higher probability of requesting their brand of medication.

Income:

There was no statistically significant correlation between income and the dependent variable MPR. Caucasians and people who worked for longer hours a week reported higher income than their counterparts. Females, older patients, individuals with heart disease, and individual with some kind of social support also had lower income levels.

Social Support:

There was no significant direct correlation between availability of social support and the variable *MPR*. However it was positively associated with female gender and negatively correlated with income and individuals with diabetes.

Work:

There was no significant direct correlation between the number of hours an individual worked in a week and the dependent variable MPR. As mentioned earlier this variable was negatively correlated with age and positively correlated with income. It also had a negative correlation with number of pills taken per day and heart disease.

Total cost:

The total prescription drug expenditure per month was negatively correlated with MPR. Patients who paid higher amounts for their statin prescriptions also had higher prescription drug expenditure per month.

Number of Pills:

No significant direct correlation between number of pills and MPR was observed. Older individuals and individuals with any of the co-morbidities, including heart disease, hypertension, diabetes and depression, took a higher number of pills per day. It was negatively correlated with number of hours that individuals work per week.

Health:

The individual's perception of overall health compared to someone of their age was not correlated with the dependent variable MPR. People who perceived their health to be better than others were older, had higher perceived value, had higher perception of brand quality, were more satisfied with the advice they received from their physician and pharmacist and were less likely to be suffering from depression.

Heart Disease:

Individuals with heart disease had higher MPR than the individuals with no heart disease. These individuals also had higher perceived susceptibility, a higher chance of having hypertension, a lower income, took a higher number of pills per day, and worked fewer hours per week.

Depression:

There was no significant direct correlation between depression and the dependent variable MPR. This was positively correlated with number of pills per day and other co-morbid conditions, namely hypertension and diabetes. As mentioned earlier, these individuals also perceived their health condition to be worst than others of the same age.

Hypertension:

There was no significant direct correlation between hypertension and the dependent variable MPR. This variable was also positively correlated with heart disease, hypertension, depression, higher number of pills per day and non-Caucasian race. Individuals with hypertension had higher perceived susceptibility, higher satisfaction with pharmacist advice and also perceived their brand of medication to be of higher quality than other medications available in the market.

Diabetes:

Diabetes was not correlated with the dependent variable MPR. However it was positively correlated with other co-morbid conditions, namely heart disease, hypertension and depression and number of pills taken per day. It was negatively correlated with brand request.

Patient Cost:

The amount that patients paid to receive their statin prescription was negatively correlated with the dependent variable MPR. It was also negatively correlated with perceived benefit, perceived severity, perceived value and perceived susceptibility. Individuals who had to pay high prices to get their prescriptions were found to be less satisfied with the advice they received from their pharmacist. These individuals also tend to be older, with a higher per month prescription drug expenditure.

Distance traveled to get the prescription:

Though distance traveled to pick up their medication was negatively correlated with MPR, the relationship was statistically non significant. This was one of the least correlated variables. It was correlated significantly with only one variable: number of pills taken per day.

Brand request:

Whether a patient asked for their brand of medication or not was found to be uncorrelated with the dependent variable MPR. However numbers of such request were particularly high in females and individuals with diabetes.

Brand quality:

Perceived brand quality was highly correlated with the perceived treatment benefit and its correlation pattern with other variables was very similar in nature to that of perceived benefit. It was positively correlated with perceived benefit, perceived value, perceived severity, perceived susceptibility, importance of taking medications, number of pills per day, satisfaction with physician and pharmacist support, and the dependent variable MPR. It was negatively correlated with perceived barriers. Perception of brand quality was particularly high in non-caucasians and individuals with hypertension.

Physician support:

There was no significant correlation between physician support and the dependent variable MPR. Satisfaction with physician support was higher in individuals who perceived their health to be better than others of the same age, who perceived higher brand quality, who perceived higher treatment benefit, who perceived higher value, who put higher importance on taking medications and who had higher level of satisfaction with pharmacist advice. Satisfaction with physician support was particularly high in non-caucasian individuals.

Pharmacist support:

Unlike satisfaction with physician support, satisfaction with pharmacist support was positively correlated with the variable MPR. Satisfaction with pharmacist support was high in individuals who perceived their health to be better than others, who perceived higher brand quality, who perceived higher treatment benefit, and who placed higher importance on taking their medications. This was particularly high in older individuals with higher satisfaction with physician support. However satisfaction with pharmacist services was lower in individuals paying more for their statin medications and with higher prescription drug expenditures per month.

Importance of taking medication:

The importance of taking medication as prescribed was positively correlated with the dependent variable MPR. It had the strongest direct correlation with perceived benefit and turned out to be another variable that had correlation patterns similar to that of perceived benefit. It was positively correlated with perceived value, perceived susceptibility, perceived severity, perceived brand quality, and satisfaction with physician and pharmacist support. It was negatively correlated with only one variable, perceived barrier, and unlike perceived benefit it was not correlated with the cost of the statin medication and the number of hours worked.

MPR:

The medication possession ratio, a measure of the quantity of medications purchased, was positively correlated with perceived benefit, perceived value, perceived severity, perceived susceptibility, heart disease, perceived brand quality, importance of taking medications as prescribed and satisfaction with physician and pharmacist support. It was negatively correlated with age, perceived barrier, patient cost of statin medication, and total prescription drug expenditure.

The role of these variables in discriminating between individuals in different groups based on the quantity of medication purchased and factors influencing those decisions are described in the next section, which focuses on answering Objective 2 of Research Question 2.

Research Question 2, Objective 2.

CHAID results:

Phase 1: In the first phase the CHAID algorithm was used to determine the most significant variables. The hierarchy of variables according to their significance is presented in Table 14.

As shown in Table 14, *perceived value* was the most significant variable used to split respondents into groups of different *MPR*, followed in turn by *cost of statin medication*, *importance of taking medication*, *benefit of taking medication* and *barriers to taking medication*.

Table 14: Most significant variables predicting split in respondents based on quantity of medications purchased.

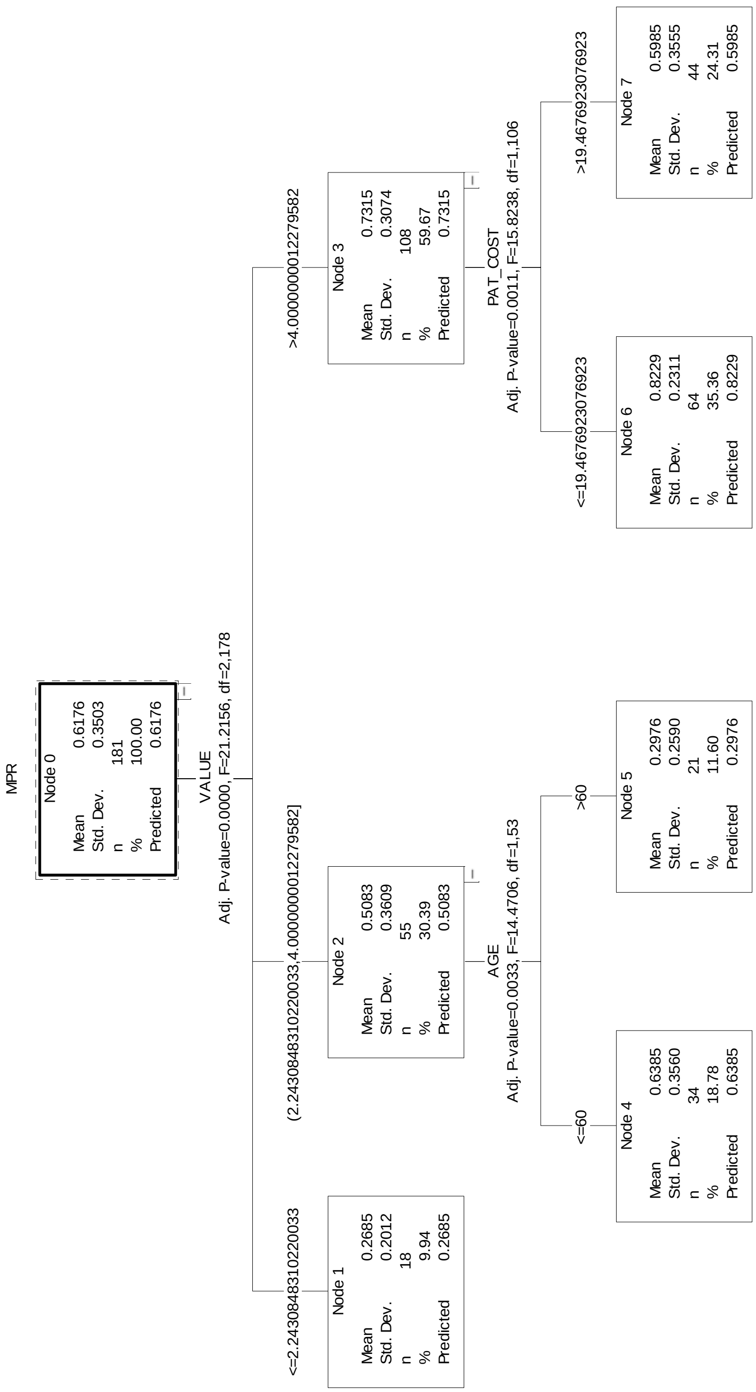
	Variable	Number of Nodes	Significance (p)
1	Value	3	0.0000002
2	Cost	5	0.0000024
3	IMP	2	0.0000072
4	Benefit	2	0.0000326
5	Barrier	2	0.0000666

Tree evaluation:

Controlling variable: Perceived Value:

Perceived value was the most significant variable predicting the differences in MPR among the respondents. As shown in Figure 13, there were three distinct groups, the first with perceived value less than 2.24, the second with perceived value between 2.24 and 4.00, and the third with perceived value of more than 4.00. Perceived value was found to be positively correlated with MPR. Among the individuals with a perceived value of more than 4.00, the next best predictor was *cost of statin prescription*. The individuals with a prescription cost of more than $19.50 had a significantly lower MPR than the individuals with prescription cost less than $19.50. On the other hand, the next best predicting variable among the individuals with medium level (2.24-4.00) was *age*. Individuals who were over 60 years of age had significantly lower MPR values than individuals aged below 60. According to Table 9, individuals with a perceived value less than 2.24 had the lowest MPR (node 1), while the individuals with a high perceived value (more than 4.00) and low prescription drug cost had (node 6) the highest MPR (0.82) among the respondents. As per the risk statistics, this tree classified 91.7% of cases correctly (Table 15).

Figure 13: CHAID tree with controlling variable: Perceived Value.



Controlling variable: Cost

The *cost* of the statin prescription was the second most significant variable predicting the MPR of the respondents. CHAID analysis of these variables resulted in 5 different cost groups (Figure 14).: less than \$4.38, \$4.38 -\$11.25, \$11.25 -\$19.50, \$19.50-\$40.5 and more than \$40.00. Overall, cost had a negative impact on the dependent variable *MPR*; individuals with a low prescription cost had a higher MPR than individuals with a higher prescription cost. Among the group with the lowest prescription cost (less than \$4.38), the next best predicting variable was *perceived barrier*. Individuals with a high perceived barrier had a lower MPR than individuals with a low perceived barrier. On the other hand, the next best predictor among the high prescription drug cost group (\$19.50-\$40.5) was the perceived importance of taking the medication, and among the medium prescription drug cost group (\$11-\$19.5) was the number of pills taken per day. Individuals with a high perceived importance of taking medications or taking fewer pills per day (<7) had a higher MPR than individuals who perceived taking medication to be of low importance, or who took a high number of pills per day (>7). As shown in Figure 7, individuals with a high prescription drug cost and a low perceived importance of taking medication (node 15) had the lowest MPR among all the respondents, while individuals with medium or low costs and a low barrier taking fewer number of pills per day had the highest MPR (Node 13 & 15). As per the risk statistics, this tree classified 92.3% of cases correctly (Table 15).

Figure 14: CHAID tree with controlling variable: Cost of statin

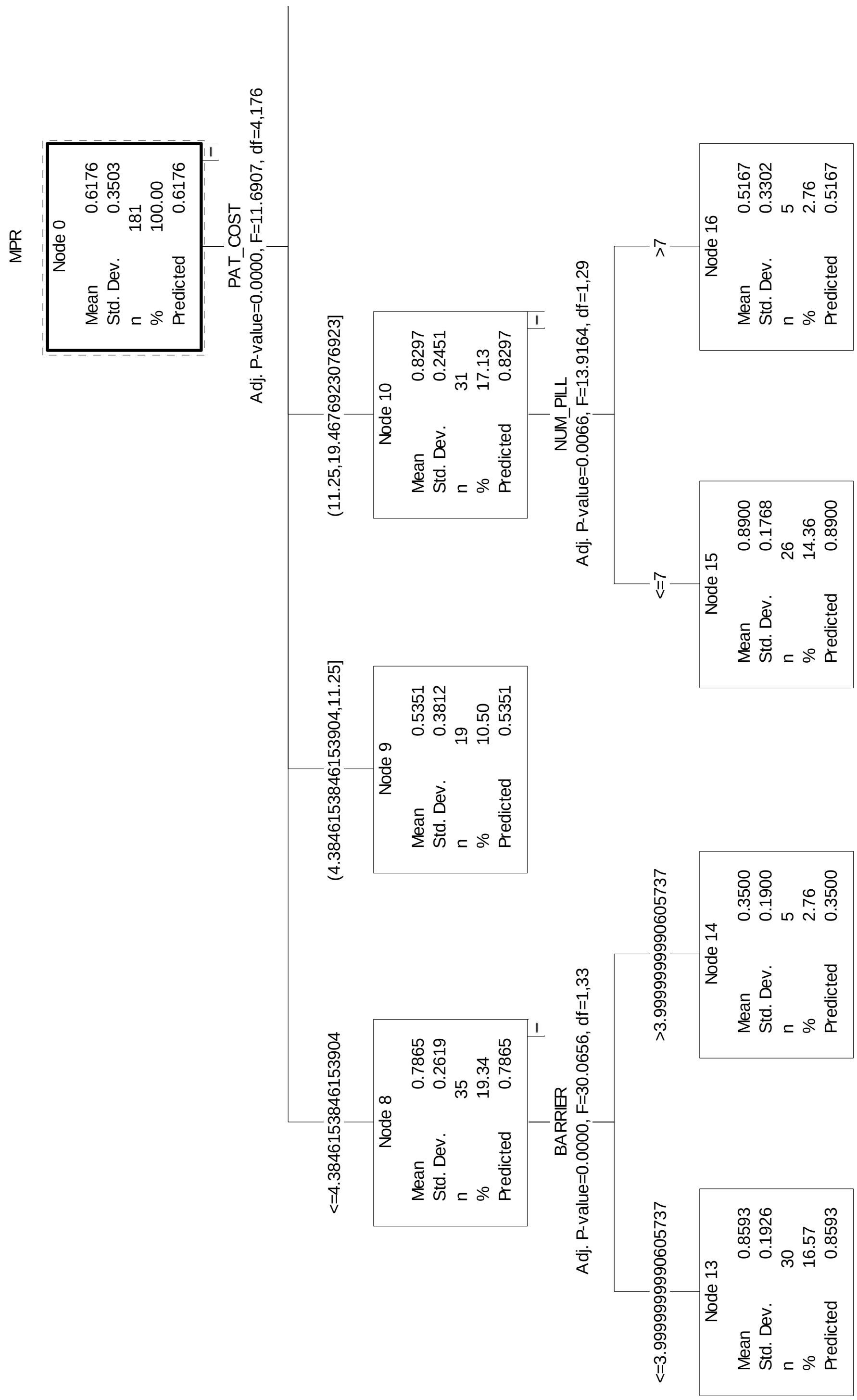
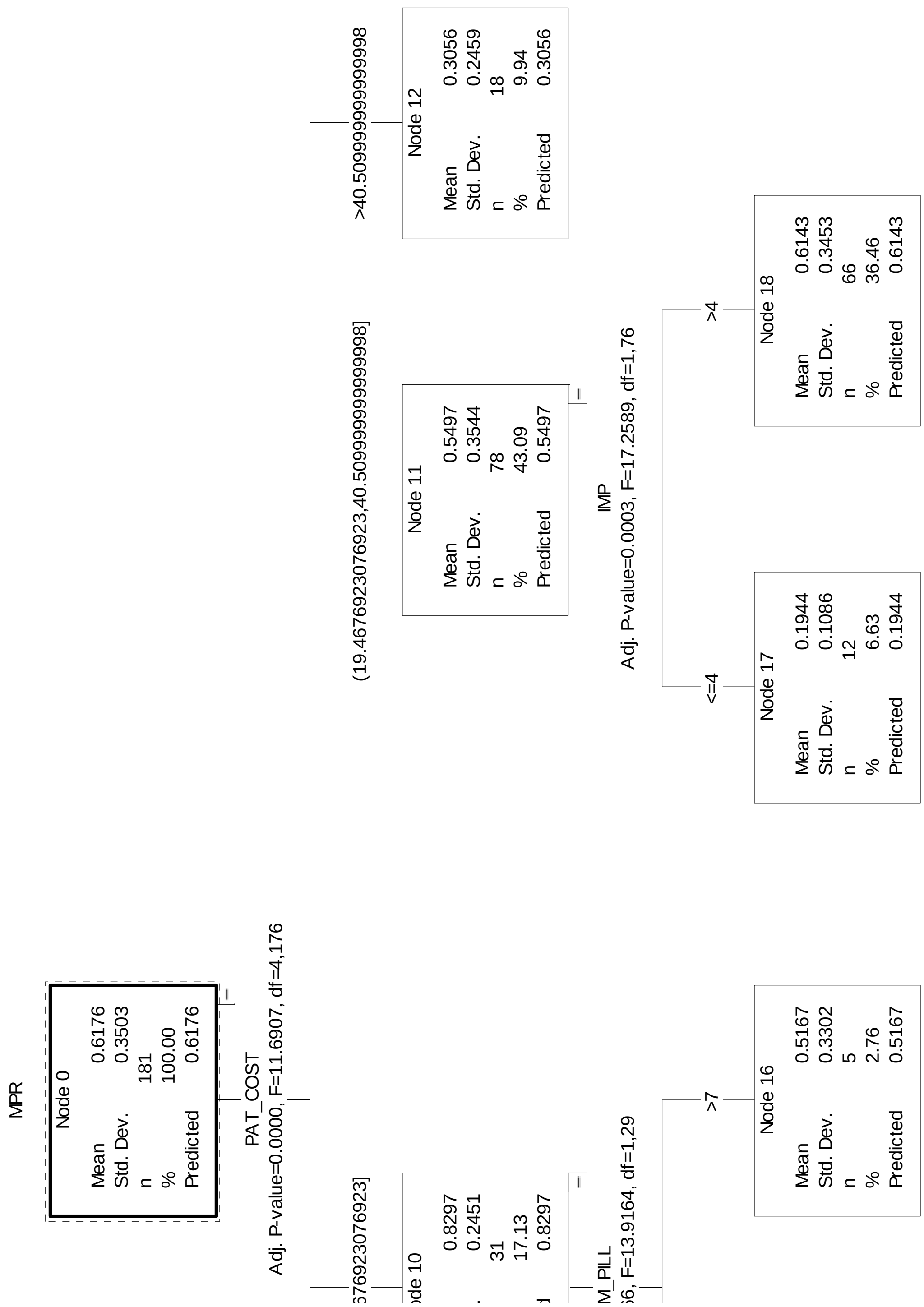


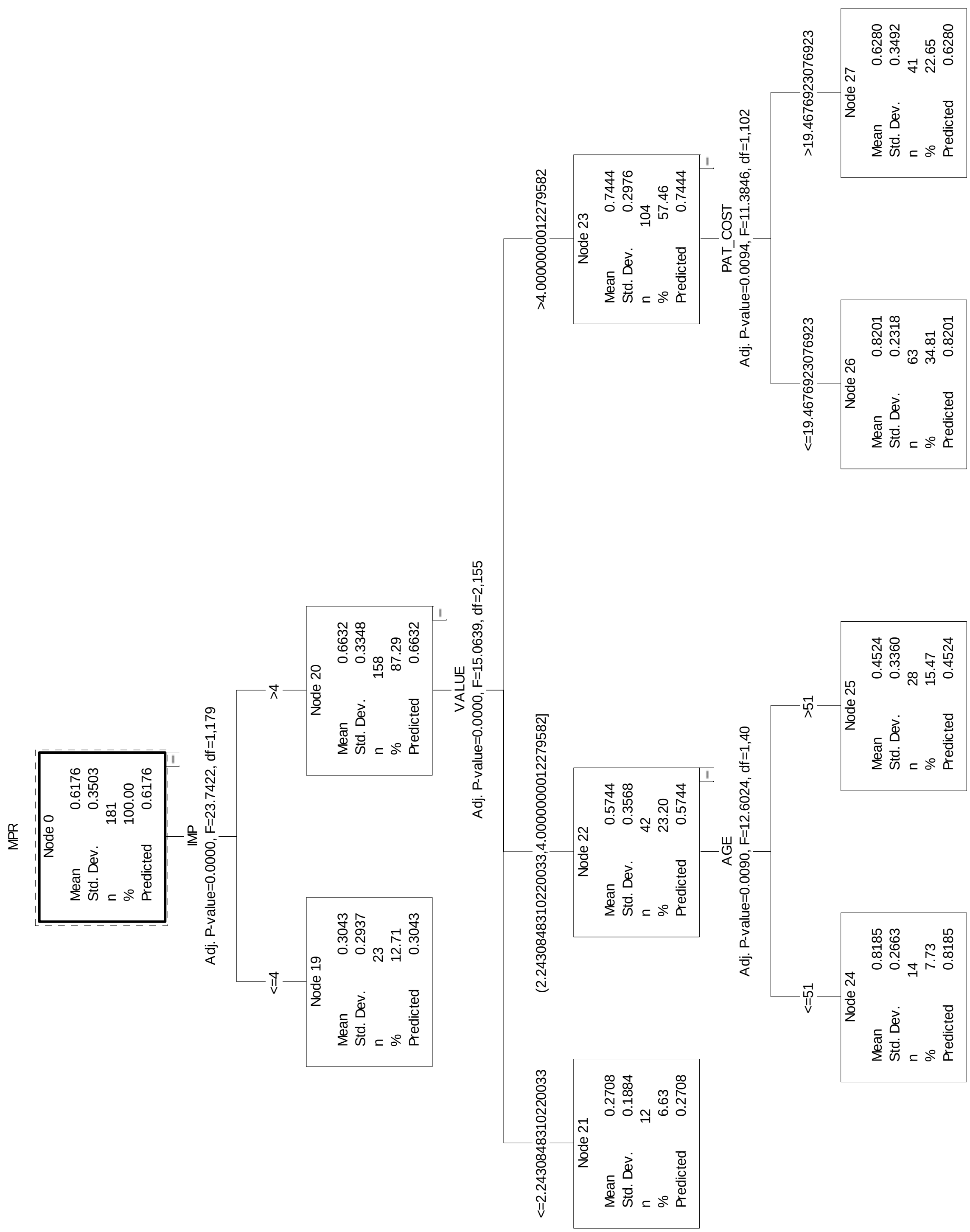
Figure 14: CHAID tree with controlling variable: Cost of statin (Continued)



Controlling variable: Importance of taking medication:

Patients' perception of the importance of taking medication was the third most significant variable predicting the MPR of the respondents. CHAID analysis of these variables as a controlling variable resulted in 2 groups: low importance(less than 4) and high importance (more than 4). Overall, *importance* had a positive impact on the MPR. As shown in Figure 15, the MPR of the high importance group was approximately double that of the low importance group. The majority of the respondents were in the high importance group (87%), and among this group the behavior of the individual was similar to that observed in a tree where the controlling variable was *perceived value*. The next best predicting variable was *perceived value* followed by *patient cost* for individuals with higher value and *age* for individuals with medium perceived value. As per the risk statistics, this tree classified 92.0% of cases correctly (Table 15).

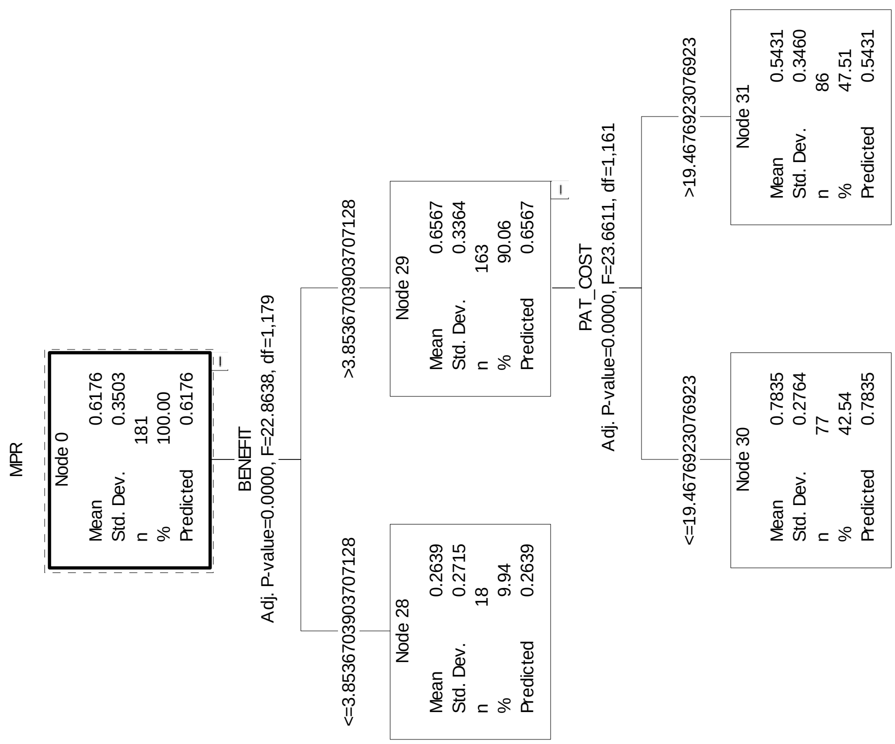
Figure 15: CHAID tree with controlling variable: Importance of taking medications



Controlling variable: Perceived benefit

The perceived benefit of taking medication was the fourth largest significant variable in predicting the MPR of respondents. Perceived benefit produced the simplest tree among all the analyzed variables. CHAID analysis of these variables as a controlling variable resulted in 2 groups: low benefit (less than 4) and high benefit (more than 4). Overall, perceived benefit had a positive impact on the MPR. As shown in Figure 16, the MPR of the high benefit group was approximately 2.5 times more than the MPR of the low benefit group. The majority of the respondents were in the high benefit group (90%), and among this group the next best predicting variable was *prescription cost*. Respondents with high perceived benefit and low prescription cost had the highest MPR, and respondents with a low perceived benefit had the lowest MPR. As per the risk statistics, this tree classified 90.5% of cases correctly (Table 15).

Figure 16: CHAID tree with controlling variable: MPR



Controlling variable: Perceived barriers.

Perceived barriers to taking cholesterol medication was the fifth largest significant variable in predicting the MPR of respondents. CHAID analysis of these variables as a controlling variable resulted in 2 groups: low barrier (less than 3.2) and high barrier (more than 3.2). Overall, perceived barrier had a negative impact on MPR. As shown in Figure 17, the MPR of the low barrier group was approximately 1.5 times more than the MPR of the high barrier group. The next best predicting variable among individuals with a high barrier was the perceived importance of taking medication. Individuals who placed a high importance on taking their medication had a significantly higher MPR than individuals who did not take it as seriously. On the other hand, the next best predicting variable in the low barrier group was prescription cost; individuals with a low prescription cost had a higher MPR than individuals with a high prescription cost. Respondents with a low barrier and a low prescription cost had the highest MPR (Node:36), while respondents with a high barrier and low importance had the lowest MPR (Node:34). As per the risk statistics, this tree classified 90.9% of cases correctly (Table 15).

Figure 17: CHAID tree with controlling variable: Perceived barrier

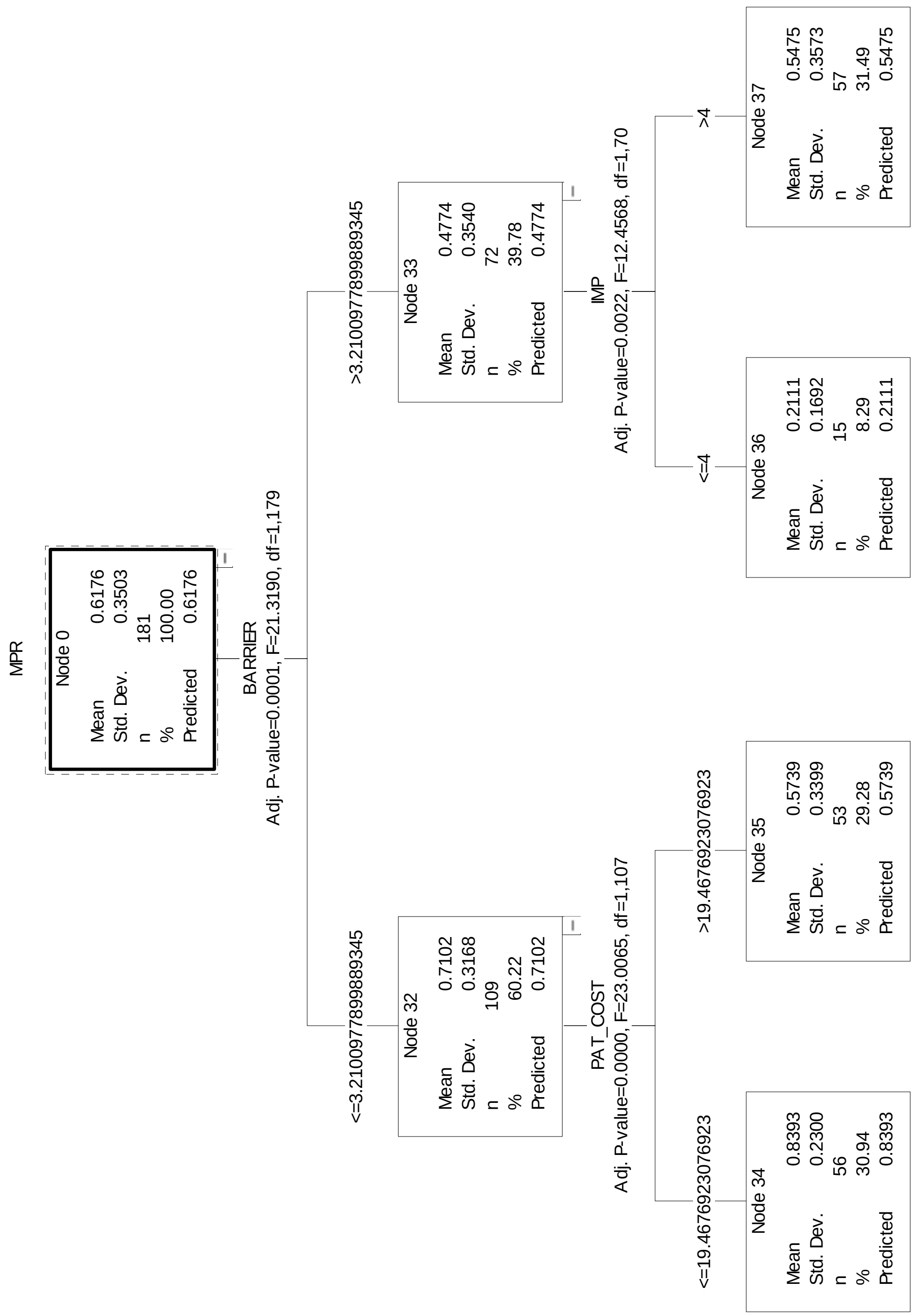


Table 15: CHAID analysis summary: Risk estimates and Percentage classified

Control Variable	Node	Node: N	Node: %	MPR	Risk Estimation	% Correctly classified
Value	6	64	35.40	0.82	0.083	91.7%
	4	34	18.80	0.64		
	7	44	24.30	0.60		
	5	21	11.60	0.30		
	1	18	9.90	0.27		
Cost	15	26	14.40	0.89	0.077	92.3%
	13	30	16.60	0.86		
	18	66	36.50	0.61		
	9	19	10.50	0.54		
	16	5	2.80	0.52		
	14	5	2.80	0.35		
	12	18	9.90	0.31		
	17	12	6.60	0.19		
Imp	26	63	34.80	0.82	0.080	92.0%
	24	14	7.70	0.82		
	27	41	22.70	0.63		
	25	28	15.50	0.45		
	19	23	12.70	0.30		
	21	12	6.60	0.27		
Benefit	30	77	42.50	0.78	0.095	90.5%
	31	86	47.50	0.54		
	28	18	9.90	0.26		
Barrier	34	56	30.90	0.84	0.091	90.9%
	35	53	29.30	0.57		
	37	57	31.50	0.55		
	36	15	8.30	0.21		

Summary:

CHAID analysis emphasized that there are a few variables that play a critical role in individuals' decision making. Based on which variable is most critical in each individual's decision making, the sampled population can be segmented in different groups. It was also observed that the factors that influence the behavior were different in each segment.

The interpretation of the above findings and a plausible explanation for the negative outcomes will be discussed in Chapter 6. The implications and limitations of these findings, along with suggestions for future research will also be discussed.

CHAPTER 5

DISCUSSION

The primary purpose of this study was to analyze the impact of cost, perceived benefit, and perceived value on the quantity of medications purchased, measured in terms of MPR, by patients with chronic disease conditions and to evaluate the relationships among them. The secondary purpose was to explore the relationships and interactions between these factors and the quantity of medications purchased and identify the variables that impact adherence.

The two major research questions of the study were:

1) What are the relationships between quantity of medications purchased, measured in terms of MPR, perceived treatment value, perceived treatment benefits and cost of medication to the patient?

2) What are the determinants of quantity of medication purchased by a patient, measured in terms of MPR, and how are they related to each other?

This chapter will interpret the study's findings, illustrate the implications, discuss study limitations and provide recommendations for future research.

Research question1

One of the important variables in the analysis was perceived value, a combination of perceived benefit and cost. As described in the literature review, perceived value has been shown to impact the consumer when purchasing consumer durable products. However, its role has not been tested in repeat purchase behavior for chronic medications. Validation of the proposed SEM model, illustrating the relationships among cost, perceived benefit, cost, value and quantity of medications purchased, and relevant hypotheses demonstrated the same relationship in the purchasing of statin medications are discussed below.

Perceived value

The findings of the study imply that MPR by an individual patient is likely to increase with an increase in the perceived value of the purchase. A patient is less likely to purchase the required quantity of medications if he/she believes that the statins are not worth the cost. These results were consistent with the value definitions proposed by Zeithmal (1988), Dodds, Monroe, & Grewal, (1991), and Anderson et al (1993). As described in Chapter 2, in the literature perceived value is defined as a trade off between perceived benefit and cost. The same relationship was observed in the medication purchasing behavior in this study. Combining cost and perceived benefit explained almost half of the variation (46%) in perceived value. However, though perceived benefit and cost explained a large portion of perceived value, the inclusion of the direct effect of these two variables on quantity purchased in the model did not change the direct relationship between perceived value and quantity purchased. The presence of such a relationship implies that there are factors other than cost and benefit that also affect patient perception of perceived value of medications. In the patients taking chronic medications, perceived value could be a much broader concept than a simple tradeoff between cost and benefit. Cost, along with other variables, can be a part of the 'give' component that a patient loses in the tradeoff and benefit, along with other variables, can be part of the 'receive' component that a patient obtains during the tradeoff. Analysis of the correlation matrix revealed a high correlation among factors such as severity of disease, susceptibility to disease consequences, brand quality, importance of taking medications, pharmacist and physician advice, which are likely to contribute towards the 'received' aspect of value. On the other hand, the high correlation between total prescription drug expenditure and perceived barriers is more likely to contribute towards the 'give' aspect of value. The concept of the 'receive' and the 'give' is also consistent with the two decisional balance measures of the Transtheoretical Model, the 'pros' and the 'cons'. In the Transtheoretical Model, behavioral change progresses through a series of stages, and movement from stage to stage is dependent on the decision balance between potential gains and losses of consuming those products. Thus, individuals will evaluate the value of the decision at each stage and then make product purchasing decisions accordingly.

In the literature, the direct relationship between perceived value and willingness to buy ranged from 0.7-0.8 (Grewal et al., 1998), high compared to the value of 0.4 between perceived value and quantity purchased found in this study. This difference could be attributed to two major reasons. The first reason is the measurement of intermediate rather than final outcomes. In the consumer durable market, the relationship was explored between value and willingness to buy rather than the actual purchasing behavior. In reality, individuals may show a willingness to buy, but this may not always result in an actual purchase, thus overestimating the impact. The second reason is the nature of the product. Individuals buying consumer durable products may be informed about the product, but unlike the prescription drug market, they can choose the product themselves. For prescription drugs, individuals are less likely to have all the information about the products and their treatment decision are mostly controlled by the physician.

Perceived benefits:

Bi-variate correlation analysis revealed a strong correlation between perceived benefit and quantity purchase. Validation of the SEM model suggests that perceived benefit had an impact on quantity purchased by improving the patient's perception of the overall value of the medication. These results indicate that individuals with a higher perceived benefit with regard to the statin medications are more likely to also have a higher perceived value of the medication, and are thus more likely to purchase higher quantities.

The correlation matrix also suggested a positive relationship between the perceived benefit of medications and increased severity, increased susceptibility, increased brand quantity, increased satisfaction with pharmacist and physician advice, and decreased barriers, such as side effects and cost. These overall results are found to be consistent with the literature and social behavior theories, including the Health Belief Model and the Transtheoretical Model.

Cost:

The results implied that cost impacted quantity purchased in two ways: a direct impact and an indirect impact through perceived value. This implies that there may be two types of individuals, whose behavior is impacted by cost differently: 1) individuals who limit their medication purchase because they cannot afford it and 2) individuals who can afford the medications but limit their purchase because they do not perceive sufficient value of the medication for the given cost.

Individuals in the first category are more sensitive to the cost of prescriptions than the individuals in the second category. Higher sensitivity to cost may be due to low income and/or a lack of prescription drug coverage, both of which limit individuals' ability to buy the required quantity of medications.

Individuals in the second category can afford the medications, but may change the quantity of medications purchased after evaluating the benefits and value that they are deriving from it. As hypothesized, cost was negatively associated with perceived value and perceived value was positively associated with the quantity purchased. Such relationships indicate that some individuals will still buy medications at a higher cost as their perception of benefit is also high, thus yielding a higher value of purchase. On the other hand it also indicates that patients may not buy more medications at a lower cost if the perceived benefit is also low, thus yielding a relatively low perceived value.

These results are consistent with the previous research reported in the literature, which shows the impact of cost on quantity purchase (Leibowitz et al.,1985 ; Poisal & Chulis,2000; Joyce et al., 2002, Dor & Encinosa ,2003; Huskamp et al. ,2003).

However, unlike this study, the previous results might not be a real reflection of the cost impact on a purchasing decision at the individual level. As shown in this study, the impact of cost on an individual's behavior needs to be analyzed by taking perceived benefit into consideration. Traditional methods may underestimate the impact of cost on individuals with low perceived benefit, while overestimating it in individuals with high perceived benefit.

Overall model:

The overall model performed well, with the data fitting the model. The model fit suggests that the model variables perceived benefit, cost, perceived value and quantity purchased are dependent on each other. Additionally, as a result of multicollinearity, direct relationships between pairs of variables are also influenced by the inclusion of other variables in the model. These results imply that the proposed dynamic relationships among these variables should be taken into consideration while analyzing the impact of any of these variables on quantity purchased, and one should be cautious about interpreting the strength of the impact of each variable when analyzing them independently.

Analysis of the relative strength of the relationships among these variables further suggests that 1) cost had a stronger direct effect on the quantity purchased than perceived benefit alone, and 2) perceived benefit had a stronger impact on the perceived value of medications than the cost of the medication. The differences in the strength of the relationships among these variables suggest that higher perceived benefit is a strong motivation for a patient to buy medications in required quantity, but they not do so if they can't afford to pay for it, and those who can afford to purchase medication will do so only after estimating its value by comparing cost and benefits.

Most of the proposed relationships were consistent with the literature. However, evaluation of the modification indices suggested the presence of a negative correlation between the cost of statin medications and the perceived benefit of taking those medications. According to Dodds et al. (1991), the price of the product has a positive impact on the product benefit and costlier products are usually perceived as higher quality products. However, the opposite relationship was found among those purchasing statin medications. Patients who paid a high price for prescription medication also perceived those medications to be less beneficial. There could be multiple possible reasons behind such an observation, the first one of which could be the retrospective nature of the study. Patients were asked about their perception of benefits 12 months after they started taking medication. If a patient had stopped taking the medication because of high cost, then they may not have realized the benefits of the medication and thus may have perceived them to be less beneficial. The second reason could be the insurance company or PBMs as source of information. The insurance company or PBM may try to promote more cost effective therapies by labeling them as preferred drugs, thus patients receive medications with higher benefits at lower cost. The perception that a given medication is preferred may itself increase the perceived benefits associated with it, which is consistent with the economics theory on given goods. Since these medications are also available at a comparatively lower cost, a negative relationship between lower cost and higher benefit can thus be expected.

Model implications:

The results of the model validation can be useful in practice to improve overall compliance through increased repeat purchases of statin medications. Decision makers can use the results of this model to analyze cost impact on purchasing behavior.

Based on the study's results, individuals purchasing prescription drugs can be categorized into the following three groups;

1) Individuals who are highly impacted by cost. In the model, these individuals are represented by a significant direct correlation between cost and the quantity of medication purchased. For such individuals, cost is a major decisive factor in the purchasing decision, and they may put relatively less emphasis on the benefits of the drug. These individuals might do so because they have no prescription drug coverage and cannot afford to buy these medications. These are highly cost sensitive individuals, and reducing prescription drug costs will significantly increase the quantity of medication that they purchase. Decision makers need to identify these individuals in advance in order to make appropriate interventions. These individuals are more likely to be people from lower income groups or people with no prescription drug coverage.

2) Individuals who take both the perceived benefits of statin medication and its cost into consideration when making a purchasing decision. For these individuals, both the costs and benefits of the medication are equally important. They can afford to buy all the prescribed quantity of medication but will not buy it if they think it is not worth the cost, thus producing less value for them. For

such individuals, messages emphasizing the benefits of the medication coupled with cost incentives may help increase the quantity of medications that they purchase. Decision makers can identify such individuals by surveying in advance to reveal their perception of benefits and the importance of cost in their decision making.

3) Individuals who are least impacted by cost and put a relatively high emphasis on the benefit of medication. For these individuals, the major driving force behind taking medication is the perceived benefit of the medication. Cost may not play an important role, either because of higher household income or lower cost per prescription. Individuals in this group can be motivated to buy the required quantity of medications by communicating the benefits and importance of taking medications. Decision makers can identify such individuals by surveying in advance to understand their perception of the benefits. These individuals are more likely to be covered by prescription drug programs, and thus may pay only a small portion of the medication costs.

Research question2:

Direct and indirect relationships among the quantity purchased and more than 25 independent variables were explored using a correlation matrix and CHAID analysis. Out of 25 variables included in the analysis, the following variables were found to be positively correlated with the quantity purchased:

- Perceived value
- Perceived benefit
- Perceived brand quality
- Importance of taking medications
- Perceived severity
- Satisfaction with pharmacist advice
- Presence of heart disease

The following variables were found to be negatively correlated with the quantity purchased:

- Patient cost
- Perceived barrier
- Total prescription drug expenditure
- Age

Though most of the other variables included did not have a statistically significant correlation with quantity purchased, the sign of the direct correlation was consistent with the theory. Possible reasons behind the lack of statistical significance could be the small sample size and lack of variation in the independent variable.

Correlation of these variables with quantity purchased was consistent with the literature. However, the strength of the relationship was different, not only with the dependent variable quantity purchased, but also with each other. This further implies that in practice different variables may play important roles in different individuals. A factor playing a key role in one's decision to purchase a medication may not play the same role for others. For example, if an individual discontinues taking medications because he or she cannot tolerate the side effects, the role of other factors such as cost or potential benefit of medications may become less important in that individual's decision. Even if this individual can afford medication and sees the potential benefit of taking it, they will stop using the medication because of the adverse side effects they experience. On the other hand, the cost of the medication may play an important role for individuals who can tolerate the medication and are in a position to take it. CHAID analysis was performed to analyze such key factors. It also provided information on different factors that further influenced the decisions of the subgroup population defined by identified key factors.

The next section will interpret the results for the subgroups defined by the following five key factors identified by CHAID analysis. Implications of these results from a decision maker's perspective are discussed and suggestions on the use of these results in practice to improve compliance are also provided.

Key factors influencing compliance

As discussed earlier in the results section, the following five factors played key roles in determining the quantity of medications purchased. These are discussed in turn below.

1) Perceived value
2) Cost of the medications
3) Importance of taking medications
4) Perceived benefit of taking medications
5) Perceived barriers.

Perceived value:

Perceived value was the strongest predictor of all, differentiating individuals based on quantity purchased. The impact of value on quantity purchased was consistent with the consumer behavior theory described earlier. The quantity of medications purchased increased with the increase in the perceived value of medications. Perceived value basically divided individuals into three distinct groups: individuals with low, medium and high perceived value. Among these groups, in addition to perceived value, the factors that further determined the purchasing behavior were different.

This result implies that individuals with high perceived value were likely to purchase a greater quantity of medications than individuals with lower perceived value, However, not all the individuals who had a high value purchased high quantities of medications. Their behavior was further determined by the cost of medications. Individuals with high perceived value and low cost of medications were most likely to buy the required quantity of medications than individuals with high perceived value but high cost of medications. Individuals with higher value may want to buy medications, but might be constrained from doing so because of the high cost of medications, and thus may not be able to afford to buy the required quantity because of limited income. Compliance improvement strategies may include providing some cost incentives to those with higher cost sharing for chronic medications.

In the individuals with a medium level of value, the next best predictor was age. This suggested that among these individuals, older individuals are less likely to buy the required quantity of medications than comparatively younger individuals (age<60). This observation appears to be consistent with the theory, as increasing age may lead to decreasing physical health and mental health, which further impacts individuals' ability to purchase medications. Perhaps in the older individuals, compliance can be improved by simplifying therapy regimens and communicating ways to improve the individual's ability to remember to take medication.

In the individuals with low perceived value, no variable was found to have a significant impact on the behavior. A perceived value less than <2.2 appears to be the critical level at which no other factors matter. If individuals see no value in buying a medication, they are unlikely to buy it no matter what other factors are present. In this group, compliance can be improved by communicating messages that emphasize the overall value of the medication. Also, as mentioned earlier, perception of value can be improved by increasing patients' perception of the benefit of medications to control their cholesterol and possibility avoid future complications.

Cost of medications:

The cost of the statin medication was the second best predictor of the quantity of medications purchased. The model based on cost also did the best job of prediction among all the variables. The impact of cost on quantity purchased was consistent with the economic theory. Quantity of medications purchased increased with a decrease in the cost of medications. Behavior and factors influencing behavior differed depending on how much patients paid for their medications.

Individuals that had the lowest cost of prescription (<$4) had the highest MPR. However, not all the individuals with low prescription drug cost bought medications in high quantity. Their behavior was further determined by the medication barriers, such as side effects and inconvenience. The group of individuals who had both the lowest cost of medication and low barriers had the highest MPR among all identified subgroups. These results further imply that individuals may have the capacity to buy but are discouraged from doing so due to the high side effects of the medications. Compliance levels of such individuals can be improved by addressing patient concern about medication side effects and implementing strategies that might help reduce some of the side effects.

In the subgroup that had a medium level of cost sharing ($19 to $20), purchasing behavior was mainly determined by their perception of the importance of taking the medications. Individuals in this group had to pay considerable amounts to obtain medications, however they tend to do so more often if they also feel that it is important. If patients did not feel the importance of medications and also had to pay more to get those medications, then the chances of them buying the medications in the required quantity were likely to decrease considerably. Compliance of such individual can be increased either by providing cost incentives or by communicating messages that educate them about the importance of taking the medications.

A prescription cost of $40 and above seems to be a critical value at which most of the patients discontinued their medications, and other factors seemed to have no effect on these individual's behavior. This group had the lowest MPR among all identified subgroups and was most likely to stop taking medication solely because of higher cost. To improve compliance in these individuals major cost incentives must be provided.

Importance of taking medication:

The perceived importance of taking medication was another major predictor of quantity purchased. As expected, and in agreement with previous studies reported in the literature, the quantity purchased increased with an increase in perceived importance. Here, individuals were divided into two groups; low and high importance. The majority of individuals (88%) agreed that it is important for them to take medications and had a relatively high MPR. However, the mean MPR of this group was close to that of the overall sample mean, and further behavior of these individuals was controlled by the perceived value of the medications, which further divided this group into different sub groups. The segmentation and factors of high importance for this group was consistent with the behavior observed and discussed above for perceived value. One of the major differences, however, was the presence of a small group of individuals who had very low importance and no other factor that significantly influenced their behavior. These results suggest that if an individual feels that it is not important to take their medication as prescribed, he or she will not buy medications in the required quantity. Strategies that can be used to improve their compliance may include creating and communicating messages that will emphasize the importance of taking medications as prescribed.

Perceived benefit:

The impact of perceived benefit was consistent with the relationships demonstrated by the models described earlier, namely the Health Belief Model and the Transtheoretical model. As expected, the quantity of medications purchased increased with an increase in the perceived benefit of statin medications. For perceived benefit, the sampled individuals were again divided into two groups: low benefit and high benefit. The results suggested that individuals who did not see any benefit in taking the medication had a low MPR. A small portion of individuals who did not see any benefit associated with taking the medication had the lowest MPR seen, and the presence of other positive factors seemed to have no impact on their decision. Compliance levels of these individuals can easily be improved through communicating the usefulness and effectiveness of medications to control their cholesterol. The high correlation of perceived benefit with perceived severity and susceptibility also indicates that increasing individuals' awareness of the potential complications of the disease condition and its impact on their overall health and life style is also likely to help improve compliance.

On the other hand, for individuals who already think this medication will benefit them, the next important factor affecting their decision was the cost of the medication. This suggests that even if a patient perceives a high benefit but sees that the drug is costly, they will not buy medications in the required quantity. They may still purchase more medications than individuals with low perceived benefit, but this will be lower than for individuals who perceived a higher benefit and paid a low cost for their medications. Compliance of these individuals can be increased either by further increasing their perception of benefit, or by providing cost incentives.

Perceived barrier:

As shown in the literature for both the Health Belief Model and the Transtheoretical model, perceived barrier also played a significant role in determining patients' behavior. The quantity purchased decreased with an increased perception of barriers. Individuals with low barriers had relatively high MPRs, but patients who also had to pay more purchased comparatively lower quantities of medications. Individuals with a high perceived barrier purchased significantly lower quantities of medications, although their behavior was further influenced by their perception of the importance of the medications. This suggests that patients may experience significant side effects but may still take medications if they think it is important for them. These two factors can be used to identify these individuals in advance and implement customized compliance improvement strategies aimed at reducing the barriers and increasing importance. These strategies might include simplification of regimens, educating patients about the side effects and providing educational material explaining the importance of the medications. However, as seen earlier for other variables, perceived barrier also seems to have a critical value beyond which other factors may not influence an individual's decision. In such patients, either a change of therapy or change of dose regimen may be the most efficient way to improve their compliance.

Implications:

There is no one factor that influences individuals' decisions, but multiple factors that act simultaneously. At the same time, all the identified factors may not play the key role in every individual's decision. The set of factors that may influence an individual's decision are dependent on that individuals' perceptions and characteristics. These factors seem to be in equilibrium at an individual level, and a change in the strength of one factor may have an impact on the role of another factor in that individual's decision. This is evident from the observation that most of the identified key variables had a critical value, beyond which other factors seemed to play little or no part.

In order to devise effective compliance strategies, it is important to analyze the set of factors that might affect individuals and also to determine the weight of each factor in the decision making process. The highest percentage of improvement with the least effort can be expected in individuals where one of the factors has reached a critical value. Addressing that factor alone may result in significant improvement. Additionally, identification of such individuals and such factors may also result in optimum utilization of resources. Wastage of resources can be reduced by targeting strategies where they will do most good.

Effective compliance improvement strategies can be developed by analyzing patient characteristics such as, age and cost of medication and asking some specific questions when patients fill their first prescription may help decision makers identify individuals at high risk of discontinuing medications. The most important factors and critical values, along with the expected compliance for these groups, are provided in the next section, which is on resources. Decision makers will be able to use them as a guideline and target individuals with customized messages.

CHAID analysis of the above five importance factors suggests that individuals with the characteristics shown in Table 16, had higher MPRs and can thus be omitted from an intervention program in order to avoid wasting resources on the individuals who are least likely to discontinue medications.

Table 16: Characteristics associated with individuals with high MPR

Characteristics	MPR	Percentage of total population
Perceived barrier <4 Cost per prescription <$4	0.89	17%
Perceived barrier <3.2, Cost per prescription <$19	0.84	31%
Perceived value >4 Cost per prescription <$19	0.82	35%
Perceived importance >4, Perceived value >4 Cost per prescription <$19	0.82	35%
Perceived benefit >3.8, Cost per prescription <$19	0.78	42.%

On the other hand, compliance improvement resources should be focused on individuals with the characteristics shown in Table 17, namely those who are most likely to discontinue taking their medications.

Table 17: Characteristics associated with individuals with low MPR

Characteristics	**MPR**	**Percentage of total population**
Perceived value < 2.24	0.27	10%
Perceived value < 4 Age>60	0.30	11%
Cost per prescription >$40	0.30	10%
Cost per prescription >$19 Perceived importance <4	0.19	7%
Perceived importance <4	0.26	10%
Perceived benefit <3.8	0.26	10%
Perceived barrier > 3.2, Perceived importance <4	0.21	6%

Decision makers can select which groups are to be targeted based on available resources, the target population, and the ease and effectiveness of implementing appropriate compliance intervention strategies. The more factors that are used to identify patients, the more easily patients at risk of discontinuing medication can be identified.

The overall results can be summarized into six selective conditions, namely patients with a drug cost of over $19, perceived barriers greater than 3.2 on a 7 point scale, perceived benefit of less than 3.8 on a 7 point scale, perceived importance of less than 4 on a 7 point scale, perceived value of less than 4 on a 7 point scale and whether the patient is above age 60. The likelihood of a patient discontinuing their medications is expected to increase based on the above criteria.

Study Limitations

The following limitations of the study were identified, with the accompanying need to be cautious in interpreting and generalizing the results.

A cross-section survey descriptive study design was used for this study. This confers many of the limitations associated with non-experimental studies compared to purely experimental studies performed in controlled environments. One of the major limitations of the study is the lack of a controlled environment. This study identified the relationship among different variables; however caution should be exercised in extrapolating the strength of the relationships to different populations.

One of the major limitations of the study was the low response rate. The higher the response rate, the more likely it is that the study sample will be representative of the population. However, even though significant efforts were taken to achieve a high return rate, only 181 out of 1200 respondents returned their survey. As a result, the final usable response rate was only 15.2%. Findings also suggested that respondents differed from non-respondents in terms of age, gender and quantity purchased. Though it was possible to compare respondents and non-respondents on some of the variables by using data in the database, it was not possible to check if there were any differences among these groups in terms of some of the patient reported variables collected through the survey, such as perceived benefit, perceived value or perceived severity. It is thus important to consider this limitation of the study if the results are to be generalized to the entire study population or to an outside population with different demographics and utilization data.

No statistical difference in the cost of the statin medication paid by respondents and non-respondents was found. However, significant differences among respondents and non-respondents were found in terms of compliance, gender and age. Respondents had a higher MPR and were more likely to be of older age and of female gender. Higher compliance among respondents may also be attributed to their loyalty towards Walgreens. Customers who continue to refill their medications at Walgreens may be more responsive to a survey coming from Walgreens than individuals who stopped taking their medications or filled their prescriptions elsewhere. One should thus exercise caution while interpreting the results in populations with different demographics.

The small sample size, which resulted from the low response rate, is also a potential limitation of the study. A small sample size can decrease the power of the test, thus small differences are less likely to be detected. Many of the variables showed the expected sign of the relationships but were not significant. With a larger sample size, this result could have been different. The presence of statistical significance suggests a strong relationship, but the absence of statistical significance in other studied variables needs to be interpreted in the light of sample limitations.

The estimated impact of highly correlated variables, such as perceived benefit, perceived barriers, perceived importance or perceived value, needs to be interpreted with caution. These variables are correlated with each other, which may influence the effect of an individual variable on the quantity of medication purchased when taken with other variables. Since most of the variables acted together on the dependent variable, the precise effect of an individual variable cannot be singled out from the influence of other variables.

The SEM model explained only one third of the variation in the observed data, suggesting that there are other factors that were not included in the study and that would have explained some of the unexplained variation. The estimated impact of the variables measured in the analysis should thus be used with caution, understanding that the possible effect of additional variables was not allowed for.

The study population was collected from a retail pharmacy database. All patients that fit the inclusion criteria, irrespective of type of insurance, benefit design, type of HMO, or pharmacy limitations, were included in the study. All the variables included in the study are likely to influence the dependent, as well as some of the independent, variables. Any changes in these variables might affect individuals' access to care or their ability to purchase medications. These changes particularly influence individuals' ability to pay for their prescriptions and may have a significant impact on the role of cost on purchasing behaviors. This should be borne in mind when applying these results in a population with a well defined benefit plan, or in a population that are members of predominantly one type of HMO.

Information on the quantity of medications purchased and some of the other independent variables, such as cost, came from the pharmacy claims database. Thus accuracy of the information was based on the accuracy of the database. As this data was collected by some one other than the researcher and for a different purpose, it was not possible to measure the accuracy of the data. There may be some element of random error in the collected data introduced by the human errors associated with data entry at the point of prescription dispensing. Though the impact of such errors is expected to be minimal and random across different groups, caution should nonetheless be exercised in interpreting and generalizing the results due to this study limitation.

Another limitation of the pharmacy database was tracking of all the prescriptions that an individual patient filled during the study period. Data on the quantity of medications that patient had purchased in the first 12 months of therapy was obtained from the database of only one retail pharmacy chain. The analysis was thus based on the assumption that the patient filled all their prescriptions in one or other of the stores owned by the retail chain, and the absence of a fill was treated as a gap in treatment. With this assumption, the quantity of medications purchased by the patient, who might have filled one or more of their prescriptions outside of the chain network, were potentially underestimated. The researcher tried to control for this weakness by omitting patients from the analysis who said they refilled at least one prescription at other pharmacies. However, such reports were based on individuals' ability to remember past behavior, which may have led to some variation in the measurement of this dependent variable. Decision makers should be aware of this limitation of the database while interpreting the study results.

Finally, this study was performed for only one disease condition and in patients using medications from only one therapeutic class, HMG-CoA reductase. As patient characteristics, perceptions of disease condition, perception of medication, and cost of medications varies by disease condition, generalizabiltiy of these results to other disease condition is limited.

Suggestions for Future Research

As discussed earlier in the literature review, this is the first time the concept of perceived value has been tested in the purchasing of prescription drug medications. This study was able to identify it as an important variable influencing quantity purchased, and hence the compliance with a chronic medication regimen. Future research should continue to explore the components of perceived value and its role in medication purchasing.

The study found that in medication purchases, unlike with consumer durable products, perceived value is a broader concept that goes beyond the cost of a medication and the benefit it conveys alone. Factors determining the overall 'Give' and 'Receive' components of the perceived value of medications should be explored in the consumer's decision. Additionally, the impact of value should be explored in more controlled conditions, for example by measuring perceived value at the time of first refill and then following up those patients for the next 12 months to observe if this has impacted repeat purchasing of the medication.

This study revealed that perceived benefit and cost explained almost half of the variation in perceived value; however more than half of the variation is still unexplained. Considering that perceived value turned out to be one of the best predictors of behavior, further exploration of the determinants of perceived value might provide useful information in terms of development of compliance improvement strategies.

This study was limited to only one therapeutic class; it would be interesting to discover if the same relationship extends to other disease conditions. For example, the role of perceived value can further be explored in the purchasing of medications prescribed for highly symptomatic disease conditions. This study also found that perceived benefit and cost of the medication played important roles in determining perceived value. Such benefits are expected to be more evident in symptomatic disease conditions, and thus may have a different level of impact on purchasing behavior for medications.

Similarly, this study suggested that cost had both a direct and an indirect impact on the quantity of medications purchased. However, the small sample size limited further analysis into the identification of reasons behind such behaviors. It would be interesting from a decision maker's perspective to identify characteristics of the individuals who are directly impacted by cost. These individuals could serve as a good target for programs designed to improve generic drug utilization and overall compliance with the medication regimen.

One of the important findings of the study was the strong negative relationship between cost and perceived benefit of medication. This nature of the relationship was opposite in direction compared to the relationships previously established in consumer durable products. Possible reasons behind such findings have already been discussed in an earlier section, but further studies need to be done to evaluate the nature and cause of the relationship.

Exploration of the relationships among different variables found that most of the cognitive variables are correlated with each other and are likely to influence each other. This study found that they are related to each other, but further studies need to be done to determine the precise cause and effect relationship among these variables. For example, as tested in Research Question1, an improvement in the perceived benefit may also lead to an improvement in the perceived value of the medications. The number of variables that must be measured in order to identify individuals at risk of discontinuing medications may be reduced if such relationships can be clearly established.

Additionally, this study reported preliminary results that established the critical levels at which individual patients are at highest risk of discontinuing medications. However the ability to predict behavior requires further analysis in a more controlled environment. It also needs to be tested in different population and in different disease conditions.

This is the first study that analyzed the role of perceived value in prescription drug purchasing behavior. The results of this study and suggested future research in the same area may be helpful in improving compliance with chronic medications or may be used by pharmaceutical companies to develop pricing or advertise strategies for medication purchasing decisions that are predominantly controlled by individual patients.

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APPENDICES

APPENDIX I : Patient Survey

Walgreens

Patient Survey

The purpose of this survey is to understand patients' view of high cholesterol and how they manage their **cholesterol lowering medications (Statins).** In questions throughout this survey, the term 'heart disease' refers to a range of heart conditions - heart attack, stroke, coronary artery disease (CAD), coronary heart disease (CHD), or acute coronary syndrome (ACS).

Please answer questions 1-9 by circling the appropriate response and providing the information requested.

1. What is your cholesterol level? ________ *(please leave blank if you do not know)*

2. When was your cholesterol levels last tested? ______ year ______ month ☐ do not know

3. How important is it for you to continue taking cholesterol medications in the next six months?

   1 2 3 4 5 6 7
   Not at all important — Extremely important

4. How supportive has your physician been concerning lowering your cholesterol?

   1 2 3 4 5 6 7
   Not at all supportive — Extremely supportive

5. How supportive has your pharmacist been concerning lowering your cholesterol?

   1 2 3 4 5 6 7
   Not at all supportive — Extremely supportive

6. Circle all of the following people that remind you to refill your prescriptions.

Doctor	Pharmacist	Family member	Reminder Device
Insurance Company	None	Other ______________________________	

7. Considering all of the medications that you take, what is the number of total pills or tablets do you take each day? ________

8. If you have not refilled your cholesterol medication in the past 3 months, what are the reasons?

   ____

   ____

9. In last 12 months how many times did you refill your cholesterol medication prescription?

   ____

1 1

10. Using the rating scale shown below, please indicate how much you **agree** or **disagree** with each of the following statements:

1	2	3	4	5	6	7
Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**

a) Having heart disease scares me	1	2	3	4	5	6	7
b) Cholesterol medication will help me improve my future health	1	2	3	4	5	6	7
c) Taking my cholesterol medication makes me feel uncomfortable	1	2	3	4	5	6	7
d) My cholesterol medication provides me with a quality health benefit at a reasonable cost	1	2	3	4	5	6	7
e) Having heart disease would change my whole life	1	2	3	4	5	6	7
f) My life would be difficult without cholesterol medication	1	2	3	4	5	6	7
g) I worry about the long term effects of my cholesterol medication	1	2	3	4	5	6	7
h) My cholesterol medication meets my needs at a fairly low cost	1	2	3	4	5	6	7
i) The problems that I might face due to high cholesterol levels will have long term consequences if I do not use my medication	1	2	3	4	5	6	7
j) My cholesterol level will go up if I do not take my medications	1	2	3	4	5	6	7
k) Having to take my cholesterol medication worries me	1	2	3	4	5	6	7
l) Given the effectiveness of my medication in controlling my cholesterol, it is a good value for the money	1	2	3	4	5	6	7
m) Having heart disease would endanger my career	1	2	3	4	5	6	7
n) I do not want to become dependent on my cholesterol medication	1	2	3	4	5	6	7
o) My cholesterol medication keep my cholesterol under control	1	2	3	4	5	6	7
p) I think the cost (co-payment) that I am currently paying to get my cholesterol medication is fair	1	2	3	4	5	6	7
q) When I think about heart disease my heart beats faster	1	2	3	4	5	6	7
r) My cholesterol medication helps reduce my chances of getting heart disease in the future	1	2	3	4	5	6	7
s) I sometimes do not take my cholesterol medication because of side effects	1	2	3	4	5	6	7

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Using the rating scale shown below, please indicate how much you **agree** or **disagree** with each of the following statements:

1	2	3	4	5	6	7
Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**

t) I do not refill my cholesterol medication regularly because it is too costly 1 2 3 4 5 6 7

u) Taking cholesterol medication everyday is inconvenient 1 2 3 4 5 6 7

v) I reduce doses of my cholesterol medication in order to save money 1 2 3 4 5 6 7

w) My cholesterol medication disturbs my daily routine 1 2 3 4 5 6 7

11. Pretend that you are not taking any cholesterol medications. Answer the next three questions as if you were **not taking** your cholesterol medication. Please use the rating scale described above (1=Strongly Disagree; 7=Strongly Agree.)

a) There is a good possibility that I would have heart disease 1 2 3 4 5 6 7

b) My lifestyle makes it more likely that I would get heart disease 1 2 3 4 5 6 7

c) My chances of getting heart disease in the next ten years are great 1 2 3 4 5 6 7

Please answer questions 12-16 by circling the appropriate response and providing the information requested.

12. Rate the overall value that you are getting from your cholesterol medication.

1 2 3 4 5 6 7
Low Value High Value

13. How would you rate the quality of your brand of cholesterol medication compared to alternative brands?

1 2 3 4 5 6 7
Low quality High Quality

14. Did you ask your doctor to prescribe your brand of cholesterol medication? ☐ Yes ☐ No

15. In the last 3 months how many times were you exposed to any advertisement for your brand of cholesterol medication? ____________ ☐ Do not know

16. Do you live with a spouse or significant other? ☐ Yes ☐ No

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17. If you did not have insurance for prescription medications, what do you think a month of your cholesterol medication (Statin only) would cost? _______$

18. How far do you travel to pick up your medicine? __________miles

19. On average, how much money do you spend on all your prescription medications per month? $______

20. How would your rate your health in comparison to others your age? *(circle one)*

Much worse Worse Same Better Much better

21. Has a doctor ever told you that you have any of the following medical conditions?

Yes	No	
☐	☐	Heart Disease (CAD, CHD, stroke, heart attack)
☐	☐	Depression
☐	☐	_High blood pressure
☐	☐	Diabetes
☐		Others *(please specify)* ____________________________________

22. In the last 12 months, did you refill your cholesterol prescription at pharmacies owned by different companies? ☐ Yes ☐ No

23. What is your annual household income? *(circle one)*

Less than $15,000 $15,000-24,999 $25,000-$34,999 $35,000-$49,999
$50,000-$74,999 $75,000-$99,999 $100,000 and above

24. On average, how many hours do you work each week? _____________ hours

25. What is your ethnicity? *(circle one)*

White/ Caucasian Hispanic/Latino Black/African-American
Asian Native American Other________________

Thank you for completing this survey.
Please return it in the enclosed postage-paid envelope.
Thank you!

APPENDIX II : Patient consent form

Date

Dear Walgreens Pharmacy Customer,

You are invited to participate in a survey to help Walgreens better understand how patients view their cholesterol and manage their medications. This survey will help Walgreens improve the health care and pharmacy services we provide.

In several days you will receive a survey in the mail. This survey is a part of Walgreens' effort to improve patients' management of cholesterol and cholesterol medications.

Your responses will assist us in learning how patients manage their cholesterol medications and what factors cause them to skip medications, take medications as prescribed or stop using medications.

Once your receive the survey, please take a few minutes to complete and return it in the postage-paid envelope that will be enclosed. Your responses will be strictly confidential and you are assured that only Walgreens will have access to any patient identifiable information.

As a token of our appreciation for filling out the survey we will also include a small gift that may be redeemed at www.walgreens.com.

Thank you for helping Walgreens improve patient care.

Sincerely,

Kwan Y Lee, PhD, SM
Director, Health Outcomes

APPENDIX III : Remainder Letter

Date

Dear Walgreens Pharmacy Customer,

Approximately two weeks ago you received a cholesterol survey in the mail from Walgreens. Your responses to this survey are extremely valuable and will assist us in understanding how patients manage their cholesterol medications. This information may help us develop programs to assist patients with high cholesterol.

In case you have misplaced your survey we have enclosed an additional copy, including a postage-paid envelope. The enclosed questionnaire asks your opinions about your cholesterol medication and your views on heart disease. This survey should take about 15 minutes to complete. Please be sure to complete the front and back sides of both pages.

Your responses will be kept strictly confidential.

If you have additional questions, please contact me at 847-964-6761

(Kwan.Lee@walgreens.com).

Thank you,

Kwan Y Lee, PhD, SM

Director, Health Outcomes