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**Physician prescribing decisions: The effects of situational
involvement and task complexity on information acquisition and
decision making**

Chinburapa, Vijit, Ph.D.

The University of Arizona, 1991

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PHYSICIAN PRESCRIBING DECISIONS: THE EFFECTS OF
SITUATIONAL INVOLVEMENT AND TASK COMPLEXITY ON
INFORMATION ACQUISITION AND DECISION MAKING

by

Vijit Chinburapa

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A Dissertation Submitted to the Faculty of the

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In Partial Fulfillment of the Requirements
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DOCTOR OF PHILOSOPHY
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In the Graduate College

THE UNIVERSITY OF ARIZONA

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THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Vijit Chinburapa entitled Physician Prescribing Decisions: The Effects of Situational Involvement and Task Complexity on Information Acquisition and Decision Making

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

Lon N. Larson

4/29/91
Date

J. Lyle Bootman

4/29/91
Date

JoLaine R. Draugalis

4/29/91
Date

Merrie Brucks

4/29/91
Date

Christopher P. Puto

April 29, 1991
Date

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Dissertation Director Lon N. Larson

May 6, 1991
Date

STATEMENT BY AUTHOR

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SIGNED: Vijit Chinkurgo

To my beloved husband, Tan Leong Hin for his loving support, understanding, and encouragement, and to my mother and father who instilled in me the love for learning and the values essential to live a meaningful life.

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ABSTRACT

This research utilized a structural analysis of final judgment and a process-tracing method to examine the effects of situational involvement and task complexity on information acquisition and the decision-making process. In addition, the predictive accuracy of the linear model in predicting drug choice across decision situations was assessed.

A contingency model for the selection of decision strategies based on a cost/benefit principle was used as a framework in the study. A randomized mixed model factorial design was conducted in which a sample of forty eight physicians, recruited from the University Medical Center at the University of Arizona, indicated their preferences and choices for hypothetical anti-infective drugs.

Subjects were randomly assigned to experimental and control groups. Subjects in the experimental group were told via the written scenario to assume that his/her decision would be reviewed and evaluated by peers and (s)he would be asked to justify drug choice. No mention of peer review was made in the scenario used by the control group. Subjects in both groups were required to perform the two choice tasks and conjoint ranking task. The number of drug alternatives in a choice set was varied between three and six alternatives.

The Mouselab program was used to monitor physician's information acquisition behavior. The measures concerning the amount of information searched, order, duration, direction of search, and the chosen alternative were observed. The conjoint LINMAP program was used to estimate drug attribute importance weights.

Results of the study provide support that the information acquisition and decision-making process is contingent on the characteristics of decision tasks. A significant number of subjects shifted from using compensatory to noncompensatory decision-making processes when task complexity increased. The study did not find support for the effects of situational involvement on the decision-making process. However, subjects in the two groups were found to differ in choice outcomes and the attention given to specific drug attribute information. Finally, the study found support for the robustness of the linear models in predicting drug choice across contexts.

CHAPTER 1

INTRODUCTION

An estimated two-thirds of all patient visits to physicians result in the writing of a prescription (Stolley and Lasagna, 1969; Mackowiak and Gagnon, 1985). Drug therapy plays an important role in the delivery of health care and represents about 6.8% of the total U.S. health care expenditures. Approximately \$34 billion was spent for drug and medical sundries out of the total health care expenditure of \$500.3 billion in 1987. Prescription drugs accounted for about 61% of total expenditures for drug and sundries (Letsch, Levit, and Waldo, 1988).

Physicians, through their prescribing decisions, play a central role in determining the use and expenditures of prescription drugs. However, physician prescribing decisions are not always rational or appropriate. Substantial findings have been reported in the literature concerning inappropriate drug prescribing (Melmon, 1971; Ray, Federspiel, and Schaffner 1976, 1977, 1980; Knapp, et al. 1980). For example, Melmon (1971) reported that 15% of all hospital days were spent to treat adverse drug reactions of which 70% were preventable through appropriate drug prescribing. Knapp, et

al (1980) also associated inappropriate antibiotic prescribing with a longer length of hospital stay.

Hence, the quality of physician prescribing decisions can be improved. However, the development of successful intervention programs designed to improve or affect drug prescribing requires an understanding of the cognitive processes underlying physician prescribing decisions.

Problem Statement

Drug prescribing is a complex process involving many variables that influence drug selection. Several studies have found that nonpharmacological factors such as physician characteristics, drug advertising, sources of drug information, patient demands and expectations affect physician prescribing behaviors (Haayer, 1982; Hemminki, 1975, 1975a; Linn and Linn, 1982; Miller, 1973, 1974; Schwartz, Soumerai, and Avorn, 1989; Smith, 1977; Stolley, et al., 1972; Worthen, 1973). Although these studies described factors that related to physician prescribing behavior, they failed to incorporate or consider the cognitive processes underlying physician prescribing decisions.

A few researchers have presented cognitive models that attempt to explain the drug prescribing process. Knapp and Oeltjen (1972) found that physician drug choice is a function of (1) physician expectancy of patient benefit if the drug

were prescribed, (2) the magnitude of beneficial effect, (3) the expectancy that side effects could occur, and (4) the magnitude of the side effects. The relative importance of the four factors in influencing drug choice was found to vary with disease severity and physician specialty.

Lilja (1976) proposed a model of drug choice process and used multiple regression analysis to determine the relative importance of three drug attributes - efficacy, side effects, and cost - in determining the physician's overall attitude toward antibiotic and antidiabetic drugs. High efficacy was found to be the most important decision criterion when prescribing either type of drug. The second most important criterion in selecting antibiotic drugs and antidiabetic drugs was cost and side effects, respectively.

The Fishbein Behavioral Intention Model and its derivatives have been utilized by a few researchers as a conceptual framework in explaining physician drug prescribing (Chinburapa, et al., 1987; Denig, Haaijer-Ruskamp, and Zusling, 1988; Epstein, Read, and Winickoff, 1984; Harrell and Bennett, 1974). According to the model, physician prescribing intention serves as an immediate determinant of actual prescribing behavior. Prescribing intention, in turn, is a function of the weighted sum of 1) subjective beliefs that a particular drug possesses or is associated with salient drug attributes and the evaluation of those attributes

(attitudinal component) and; 2) the normative beliefs that specific individuals or groups think he should or should not prescribe the drug and his motivation to comply with those referents (subjective norm component). The model is operationalized in the form of a multiple regression equation and statistics such as a multiple correlation coefficient and resultant squared multiple correlation are used to indicate the variance explained or the fit of the model to the data. The model was found to explain from 26% to 64% of the variation in prescribing intention (Chinburapa, et al., 1987; Denig P, Haaijer-Ruskamp, and Zusling, 1988; Harrell and Bennett, 1974).

Segal and Hepler (1982, 1985) proposed and tested a cognitive model of drug prescribing. The model, based on Vroom's expectancy theory, postulates that a physician's drug choice is a function of both the subjective beliefs that certain outcomes will occur from various drug choices and the values attached to those outcomes. The model was found to correctly predict drug choice in 70-87% of cases using both hypothetical and actual prescribing decisions.

Although the aforementioned models of drug prescribing considered cognitive processes underlying decisions and usually accounted for a substantial portion of the variance in prescribing behavior, there are certain limitations associated with the models.

First, previous studies usually utilized an analysis of final judgment or decision output such as ranking or rating and employed statistical methods, mostly multiple regression, to test the fit of an algebraic model to the data in order to infer that an individual used a particular process in decision making. However, these studies did not directly observe or collect information regarding the actual process used by physicians in making the drug choice. According to Einhorn (1970):

"...the fitting of any mathematical model to cognitive functioning is at best a "paramorphic" process. That is, even if a model is highly accurate in describing the judgmental process, it does not necessary mean that the process has actually worked in exactly the way the model has specified. Different models may be equally powerful with respect to describing the process."

Thus, cognitive processes underlying decisions cannot be sufficiently understood by solely studying input-output relationships and process-tracing methods needed to be included (Ford, et al., 1989; Payne, Braunstein, and Carroll, 1978; Svenson, 1979). Process-tracing techniques are data collection methods that collect the data on predecisional behavior to identify what information is attended to and how the information is processed before the decision is made.

Decision researchers have recommended the use of a multimethod approach of combining process-tracing techniques with the traditional method of model fitting or an analysis of

final judgment to study the cognitive processes underlying judgment and choice, because the two methods can provide complementary analysis (Einhorn, Kleinmuntz, and Kleinmuntz, 1979; Payne, Braunstein, and Carroll 1978). For example, the relative importance of an attribute in influencing judgment may be difficult to determine from a process-tracing method. However, a structural analysis of final judgments provides statistical weights that can be used to obtain this type of information. In addition, a process-tracing method provides information concerning what attributes are attended to. This information is important because an attribute that has a small range of values cannot receive a high statistical weight in the regression equation although that attribute may be used and attended to by a decision maker (Einhorn, Kleinmuntz, and Kleinmuntz, 1979).

The second limitation of past studies of drug prescribing is the failure to recognize the extent to which the cognitive processes underlying decisions are contingent upon the characteristics of the decision task, individual decision makers, and decision environment. It was assumed that physicians use linear compensatory decision-making processes in which all relevant drug attributes are considered, tradeoffs among attribute values are made, and an overall evaluation is formed independently on each alternative and the

drug alternative with the highest overall evaluation value is chosen.

However, substantial evidence has been found in the literature that there is not a single, context-free decision-making process. Instead, individuals appear to use a variety of compensatory and noncompensatory processes in making decisions, depending upon choice environment and other factors (Bettman, 1979; Bettman and Jacoby, 1976; Billing and Marcus, 1983; Einhorn, 1970, 1971; Lussier and Olshavsky, 1979; Payne, 1976, 1982; Svenson, 1979).

Compensatory processes such as the additive and additive difference model consider all relevant attribute information and tradeoff the high and low values on attributes in making the decision concerning multiattribute alternatives. In contrast, noncompensatory processes, such as conjunctive, disjunctive, lexicographic, and elimination by aspect, do not involve tradeoffs among attribute values and only consider a subset of available information in making the decision. Compensatory decision-making processes are considered to be more complex, require greater cognitive effort, and are more difficult to apply than noncompensatory processes (Einhorn, 1971).

Previous studies indicated that individuals use compensatory processes when choosing among few alternatives. However, when faced with many alternatives, individuals tend

to use noncompensatory processes such as elimination by aspects in which individuals eliminate alternatives from consideration based on a cut-off value on the most important attribute, the second most important attribute, and so on, until one alternative remains (Payne, 1976, 1982; Tversky, 1972)

Consequently, the previous decision models that were based on one decision context and on an assumption that the individual used a linear compensatory decision-making process may not accurately describe or represent the process used in decision contexts in which the individual used noncompensatory processes (Johnson and Meyer, 1984; Johnson, Meyer, and Ghose, 1989). In summary, previous studies of drug prescribing that solely utilized algebraic models to study drug choice and assumed an invariant decision-making process across decision contexts may not be adequate to represent the cognitive processes underlying medical decision making.

Additionally, no published studies in the area of drug prescribing have explicitly examined factors that affect the use of various decision-making processes. Two variables that are potentially relevant and were examined in this research are the complexity of the decision task or information load and the situational involvement of physicians. Task complexity is a characteristic of the task that affects information processing demands of individuals. Situational

involvement is a motivational variable related to the "perceived consequences" of making a poor prescribing decision. These two variables are considered relevant and important for studying physician prescribing decisions for a number of reasons.

First, different treatment situations vary in the number of available treatment alternatives, and possibly, in the extent to which they invoke situational involvement on the part of physicians. Coleman et al (1959) compared the use of certain classes of drugs in two conditions: respiratory infection and mild-to-moderate hypertension. Respiratory infections were classified as clear-cut situations in which there were few alternatives of treatments, while hypertension represented an uncertain situation in which there were many treatment alternatives. It was found that the physicians were more similar in their treatment of hypertension than in the treatment of respiratory infection. Thus, treatment situations with differing levels of uncertainty and number of treatment alternatives were found to affect physician drug prescribing.

Second, an increase in the number of drugs available for treating a patient results in increased task complexity or amount of information that physicians must process. Thus, the question of whether increased task complexity or information load affects the physician's information acquisition and the

decision-making process is a potentially relevant research question that deserves examination.

Finally, as quality assurance programs, drug use evaluation, and intervention programs designed to improve quality of physician prescribing become more prevalent in the health care organizations, it is more likely that physician prescribing decisions will be scrutinized. Thus, it is important and interesting to examine the effects of situational involvement resulting from drug use evaluation and peer review on the cognitive processes underlying physician prescribing decisions.

To date, no published studies have examined the effects of situational involvement and task complexity on physician drug prescribing. The knowledge that physicians use different information acquisition and decision-making processes, depending upon task characteristics, situation, and motivation, has implications for improving physician prescribing decisions. According to Wright (1972):

"Predictions as to what happens to a person overall judgment of a product when a belief about some single characteristic is changed are entirely dependent on which treatment strategy the person is using relative to that product".

For example, if the physician uses a linear compensatory decision-making process, an intervention that changes the belief value of any drug attribute will affect the overall

judgment, regardless of the level of the prior belief about the attribute.

In contrast, if the physician uses one of the noncompensatory processes such as the conjunctive strategy in which he/she establishes a cut off level for each drug attribute and eliminates those alternatives that do not meet the cutoff values on all attributes. Here, the overall judgment or attitude will increase when beliefs are changed for those attributes that previously fell below the cutoff values. A positive change in the belief for those attributes that already exceed the cutoff values will not make a difference in an overall judgment. These differences between compensatory and noncompensatory decision processes are very important to the implementation of a successful intervention program to influence physician drug prescribing.

In addition, the importance of drug attributes in influencing drug choice may vary depending upon which decision strategy is used by physicians. This has implications for deciding what attribute information to provide to physicians and how much information to provide in a given situation. It is also important to be able to identify treatment situations in which different decision strategies may be used in order to more effectively influence physician prescribing decisions.

Purpose of the Study

The purpose of this study was to examine the effects of situational involvement and task complexity on physician prescribing decision processes. More specifically, the study employed a process-tracing technique to examine physician information acquisition processes while making prescribing decisions. Information acquisition process is related to the decision-making process in that individuals tend to acquire information in a manner consistent with the underlying cognitive process used in making a decision (Montgomery and Svenson, 1976; Newell and Simon, 1972; Payne 1976, 1976a; Svenson, 1979).

Noncompensatory processes compared to compensatory processes are implied by: (a) a lower proportion of the amount of available information searched; (b) a larger variability in the amount of information searched across alternatives; and (c) a larger variability in the amount of information searched across attributes. A compensatory process is implied by: (a) a larger proportion of the amount of available information searched; (b) a constant search pattern across alternatives; and (c) a constant search pattern across attributes (Johnson, Meyer, and Ghose, 1989; Payne, 1976, 1976a). Additionally, since a compensatory process is considered to be more complex and requires more cognitive effort than a noncompensatory process, it is assumed that the time spent per item of

information acquired is greater when subjects use a compensatory than when subjects use a noncompensatory decision-making process.

In addition to the process-tracing technique, the study utilized an analysis of final judgment to determine the predictive accuracy of fitting the linear compensatory model to the choice data under the different levels of task complexity and situational involvement of physicians.

As previously stated, past studies of physician drug prescribing have applied a linear compensatory model to understand and predict choice across decision environments. Thus, it is interesting to examine the predictive accuracy of the linear model if it is applied to predict the drug choice made in decision contexts in which noncompensatory processes are used.

Specifically, this research utilized conjoint analysis based on the additive main-effects model (linear compensatory) to obtain the part-worth or the relative importance of drug attributes in influencing physician drug preferences. The part-worth of drug attributes obtained were then used to predict physician drug choice across different levels of situational involvement and task complexity. It was hypothesized that the part-worth obtained from the linear model would predict drug choice more accurately in the condition of high situational involvement (i.e., compensatory

processes) than in the condition of low situational involvement (i.e., noncompensatory processes) across levels of task complexity. The predictive accuracy of the linear model would also be higher in the low-complexity task (i.e., compensatory processes) than in the high-complexity task (i.e., noncompensatory processes)

Task Complexity and Decision Making

A major variable that affects the use of decision-making process is task complexity. It has been postulated that increased task complexity results in the use of various simplified decision strategies in order to reduce information-processing demands and cognitive efforts (Newell and Simon, 1972; Payne, 1982). A number of studies provide strong empirical support for this hypothesis (Johnson, Meyer, Ghose, 1989; Lussier and Olshavsky, 1979; Payne, 1976; Wright, 1974). According to Payne (1982), three characteristics of the task that are likely to affect task complexity include: the number of alternatives in the choice set, the number of attributes used to describe an alternative, and the amount of time available for making a decision.

Payne (1976), and Lussier and Olshavsky (1979), utilized process-tracing techniques to study the effect of task complexity on decision-making strategies. Task complexity was manipulated by varying the number of alternatives in a choice

set and the number of attributes per alternative. It was found that when choosing between two alternatives, subjects used compensatory decision-making processes such as the additive or additive difference model. When choosing among several alternatives, subjects used a noncompensatory process such as elimination-by-aspect or conjunctive strategy. However, the studies found that increases in the number of attributes per alternative did not affect the use of decision strategies.

Payne (1982) reviewed the literature on effects of task complexity on the use of decision strategies. He concluded that the hypothesis that changes in task complexity result in changes in decision-making strategies tends to be strongly supported when task complexity is manipulated via the number of alternatives. As a result, this study will experimentally manipulate complexity of the decision task by varying the number of alternatives in the choice set.

Involvement and Decision Making

In addition to task complexity, another important variable that affects the use of various decision-making strategies is the involvement of the decision maker. Involvement is considered to be an important mediating variable of consumer behavior (Mitchell, 1979). Involvement can be conceived of and operationalized in several ways.

Involvement has been defined to include the concept of commitment (Howard and Sheth, 1969; Lastovicka and Gardner, 1979; Robertson, 1976), communication involvement (Krugman 1965, 1966), personal relevance (Celsi and Olson, 1988; Greenwald and Leavitt, 1984; Zaichkowsky, 1985), purchase importance (Engel and Blackwell, 1982), situational involvement (Houston and Rothschild, 1978), and ego involvement (Sherif and Cantril, 1947). According to Rothschild (1984),

"... involvement is a state of motivation, arousal or interest. This state exists in a process. It is driven by current external variables (the situation; the product; the communications) and past internal variables (enduring; ego; central values). Its consequences are types of searching, processing, and decision making".

Houston and Rothschild (1978) differentiated three types of involvement: situational involvement, enduring involvement, and response involvement. Situational involvement is defined as "the ability of a situation to elicit from individuals concern for their behavior in that situation". Enduring involvement represents the stable characteristics of the individual that are independent of the decision situation and are related to prior experience and the individual's values or goals. Response involvement is seen as a consequence of situational and enduring involvement and is defined as "the complexity or extensiveness of cognitive and behavioral processes characterizing the overall consumer decision process".

In this study, involvement referred to enduring and situational involvement. Response involvement was not considered because it is a consequence and not an antecedent of involvement. Enduring involvement was measured and used to determine whether subjects in the experimental and control group differed in preexisting level of involvement with the decision. Situational involvement is a temporary state of motivation or arousal invoked by a particular decision situation and was manipulated in the study. Situational involvement has also been referred to as task involvement. Clarke and Belk (1979) identified task involvement as a situational variable influencing purchase effort. Situational involvement or task involvement is closely related to the concept of perceived risk (Bloch and Richins, 1983; Houston and Rothschild, 1978; Laurent and Kapferer, 1985). Perceived risk consists of "uncertainty" and "consequences" components. "Uncertainty" refers to the subjective probability of negative consequences occurring from the decision. The "consequences" component refers to the perceived importance of avoiding the negative consequences.

According to Houston and Rothschild (1978), situational involvement is affected by the "consequences" component of perceived risk. Therefore, in this research, situational involvement was manipulated by varying the perceived importance of avoiding the negative consequences that

potentially result from prescribing decisions. This was done by having physicians in the experimental group assume that their prescribing decision would be reviewed and evaluated by a drug use review committee. In this review, the prescriber would discuss and justify his or her choice of drugs with their peers.

The manipulation was hypothesized to increase physicians' situational involvement by increasing the importance of avoiding the negative consequences of a "bad" judgment. High situational involvement was hypothesized to motivate physicians to process information more thoroughly and to consider all relevant information in making the drug choice (compensatory process). When situational involvement was low, physicians were hypothesized to spend less cognitive effort processing information and would not consider all relevant information in making prescribing decisions (noncompensatory process).

Evidence to support the hypothesis comes from research in the area of persuasion, social psychology, and business. According to Janis and Mann (1977), individuals who expected to justify their opinions were more likely to expend cognitive effort in processing information such as considering a wide variety of alternatives and information.

Chaiken (1980) found that subjects who were expected to defend their opinion (high involvement) used a systematic

information processing strategy in which the content of the message was considered, whereas less involved subjects used a simple decision rule to process information and were influenced by peripheral cues such as the likability or the credibility of the sources of the messages.

Hagafors and Brehmer (1983), using social judgment theory, found some support for the hypothesis that having to justify one's judgment led to higher consistency in judgment. The effects were found to be stronger when task predictability was low and no outcome feedback was given. The authors stated that high consistency was an indication of subjects using an analytical decision strategy, while low consistency in judgment indicated a more intuitive strategy.

Tetlock (1983) examined the effect of accountability (i.e., the need to justify one's opinion to others) on the complexity of thought on a controversial social issue. It was found that subjects who were accountable to a person whose opinions were unknown used more complex information processing strategies by considering all available information and evidence in forming their views in order to arrive at a defensible position than did subjects who were not accountable for the opinions or who were accountable to a person whose opinions were known.

In sum, there is substantial evidence in the literature regarding effects of task complexity - as operationalized as

the number of alternatives in the choice set - and situational involvement - as operationalized as a motivational variable resulting from the need to discuss and justify the decision to others - on the use of different decision-making processes.

Theoretical Framework

In this section, the theoretical framework that was used to generate the research hypotheses is discussed. This framework offers an explanation of why the use of decision-making strategies varies across different situations.

The cost/benefit framework for the selection of decision strategies was used as a conceptual framework for the study. The framework suggests that the choice of a decision strategy is a function of perceived costs and perceived benefits. Perceived costs include effort and time spent in acquiring information and making the decision. Perceived benefits of a strategy refer to the ability of a strategy to select the correct alternative (Beach and Mitchell, 1978; Russo and Doshier, 1983). According to Payne (1982), this framework is appealing because it assumes that the decision maker is rational and the observed use of a suboptimal decision-making strategy is a result of balancing the costs and benefits. Additionally, since costs and benefits of various decision strategies differ across situations, the cost/benefit approach

provides a useful framework for examining contingent decision behavior.

Beach and Mitchell (1978) developed a contingency model for the selection of decision strategies based on the cost/benefit framework. The model assumes that the perceived cost of using a strategy increases as the degree of analytic complexity of a strategy increases. However, the perceived probability of a strategy leading to a correct decision also increases. According to the model, strategy selection is contingent upon 1) the characteristics of the decision problem (its unfamiliarity, ambiguity of goals, complexity, and instability of task); 2) the characteristics of the decision environment (importance of the decision, the irreversibility of the decision, the degree to which the decision maker is personally accountable for the results of the decision, and the time and resource constraints); and 3) characteristics of the decision maker (knowledge of decision strategies, ability, and motivation)

Greater unfamiliarity, ambiguity of goals, complexity and instability of the decision problem decrease the probability of making a correct decision and indicate the need to use a more analytical strategy to increase the perceived probability of making a correct decision. Greater significance of the problem, irreversibility, and decision maker accountability increase the perceived benefits of a correct decision and

indicate a need to use a more analytical strategy. Additionally, the more knowledgeable, intelligent, cognitively complex, and motivated the decision maker is, the more likely an analytical strategy is used in a given situation. However, the use of a more analytical strategy also is associated with increasing the time and effort spent in making a decision. The decision strategy used in making a decision is a result of balancing the costs and benefits.

A number of studies, using the Beach and Mitchell model as a framework, found some support for the model explanation of contingent decision behavior. Christensen and Szalanski (1978), using business students as subjects in a profit estimation task, demonstrated that as the amount paid for making a correct decision increased, subjects used more information and spent more time making the decision. McAllister, Mitchell, and Beach (1979), conducted three experiments using business students as subjects making bank loan decisions, found that when the decision was more significant, when the decision was irreversible, and when the decision maker was accountable for the decision, subjects selected more analytical strategies and spent more time making the decision than when the opposite condition existed. Waller and Mitchell (1984), using business students as subjects making management decisions, found that as the uncertainty and the significance of the decision increased, subjects selected

a more analytical strategy to make the decision. However, Smith, Mitchell, and Beach (1982), using business students making investment analyses, found that increased problem complexity led to the use of simpler strategies and the significance of the decision (manipulated as the amount of payoff) had no impact on the selection of decision strategies. It was postulated that the failure to find an effect for the significance of the decision on the use of decision strategy may have been due to a weak manipulation of the variable (Billings and Scherer, 1988).

In summary, a majority of the past studies found support for the hypotheses generated from the Beach and Mitchell model. In this research, the Beach and Mitchell Model based on a cost/benefit framework, was used to generate research hypotheses concerning the effects of situational involvement and task complexity on the use of decision-making strategies.

As applied to this study, it was hypothesized that significant main effects would be found, as well as a significant interaction effect between the situational involvement of physicians and task complexity, regarding the use of decision strategies. A high level of situational involvement was hypothesized to motivate physicians to consider all relevant information and to use more analytical decision strategies (i.e., compensatory processes) across levels of task complexity, because the perceived benefits in

making a correct decision outweighed the perceived costs or effort. However, when the situational involvement was low and when the task complexity was high, physicians were expected to use a simpler, less analytical strategy in decision making (i.e., noncompensatory processes), because perceived costs or effort outweighed the perceived benefits.

Research Objectives

The objectives in this research were the following:

1. Examine the cognitive processes underlying physician drug choice using the combination of a process-tracing technique with an analysis of final judgment.
2. Determine the extent to which physician decision-making processes vary across levels of task complexity.
3. Determine the extent to which physician decision-making processes vary across levels of physician situational involvement with the task.
4. Determine the predictive accuracy of applying the utility values obtained from a linear compensatory model to predict drug choice across levels of situational involvement and task complexity.
5. Determine the extent of congruence between the relative importance of drug attributes derived from the process-tracing technique with those derived from an analysis of final judgment.

6. Determine if the relative importance of drug attributes in influencing drug choice varies across levels of task complexity and physician situational involvement.

Research Hypotheses

The following hypotheses were tested in this study.

Hypothesis I.

The situational involvement of physicians has a significant effect on the amount of time spent acquiring information per alternative. High-involvement physicians were expected to spend a larger amount of time acquiring information per alternative than low-involvement physicians.

Hypothesis II.

The complexity of the task has a significant effect on the amount of time spent acquiring information per alternative. Physicians were expected to spend a larger amount of time acquiring information per alternative in the low-complexity task than in the high-complexity task.

Hypothesis III.

The situational involvement and complexity of the task have a significant interaction effect on the amount of time spent acquiring information per alternative. The difference in the amount of time spent acquiring information per alternative between the low and high-

complexity conditions was expected to be significantly larger in the low-involvement physician group than in the high-involvement physician group.

Hypothesis IV.

The situational involvement of physicians has a significant effect on the amount of time spent on each piece of information acquired. High-involvement physicians were expected to spend a larger amount of time on each piece of information acquired than low-involvement physicians.

Hypothesis V.

The complexity of the task has a significant effect on the amount of time spent on each piece of information acquired. Physicians were expected to spend a larger amount of time on each piece of information in the low-complexity task than in the high-complexity task.

Hypothesis VI.

The situational involvement and complexity of the task have a significant interaction effect on the amount of time spent on each piece of information. The difference in the amount of time spent on each piece of information between the low and high-complexity conditions was expected to be significantly larger in the low-

involvement physician group than in the high-involvement physician group.

Hypothesis VII.

The situational involvement of physicians has a significant effect on the number of information acquisitions per alternative. High-involvement physicians were expected to search a higher number of items of information per alternative than low-involvement physicians.

Hypothesis VIII.

The complexity of the task has a significant effect on the number of information acquisitions per alternative. Physicians were expected to search a higher number of pieces of information per alternative in a low-complexity task than in a high-complexity task.

Hypothesis IX.

The situational involvement of physicians and task complexity have a significant interaction effect on the number of information acquisitions per alternative. The difference in the number of information acquisitions per alternative between the low and high-complexity conditions was expected to be significantly larger in the low-involvement physician group than in the high-involvement physician group.

Hypothesis X.

The situational involvement of physicians has a significant effect on the proportion of information searched. High-involvement physicians were expected to search a larger proportion of available information than low-involvement physicians.

Hypothesis XI.

The complexity of the task has a significant effect on the proportion of information searched. Physicians were expected to search a larger proportion of available information in a low-complexity task than in a high-complexity task.

Hypothesis XII.

The situational involvement of physicians and task complexity have a significant interaction effect on the proportion of information searched. The difference in the proportion of information searched between the low and high-complexity conditions was expected to be significantly larger in the low-involvement physician group than in the high-involvement physician group.

Hypothesis XIII.

The situational involvement of physicians has a significant effect on the variability in proportion of information searched across alternatives. High-involvement physicians were expected to have a lower

variability in the proportion of information searched across alternatives than low-involvement physicians.

Hypothesis XIV.

The complexity of the task has a significant effect on the variability in proportion of information searched across alternatives. Physicians were expected to have a lower variability in proportion of information searched in the low-complexity task than in the high-complexity task.

Hypothesis XV.

The situational involvement of physicians and complexity of the task have a significant interaction effect on the variability in proportion of information searched across alternatives. The difference in the variability of proportion of information searched between the low and high-complexity conditions was expected to be significantly larger in the low-involvement group than in the high-involvement group.

Hypothesis XVI.

The situational involvement has a significant effect on the variability in proportion of information searched across attributes. The high-involvement physicians were expected to have a lower variability in proportion of information searched across attributes than the low-involvement physicians.

Hypothesis XVII.

The complexity of the task has a significant effect on the variability in proportion of information searched across attributes. Physicians were expected to have a lower variability in proportion of information searched in the low-complexity task than in the high-complexity task.

Hypothesis XVIII.

The situational involvement of physicians and complexity of the task have a significant interaction effect on the variability in proportion of information searched across attributes. The difference in the variability of proportion of information searched between the low and high-complexity conditions was expected to be significantly larger in the low-involvement group than in the high-involvement group.

Hypothesis XIX.

The situational involvement has a significant effect on the concentration of search. The high-involvement physicians were expected to have a lower value in the concentration of search than the low-involvement physicians.

Hypothesis XX.

The complexity of the task has a significant effect on the concentration of search. Physicians were expected to

have a lower value in the concentration of search in the low-complexity task than in the high-complexity task.

Hypothesis XXI.

The situational involvement of physicians and complexity of the task have a significant interaction effect on the concentration of search. The difference in the concentration of search between the low and high-complexity conditions was expected to be significantly larger in the low-involvement group than in the high-involvement group.

Hypothesis XXII.

A higher proportion of subjects in the high-involvement group used compensatory decision processes than in the low-involvement group across levels of task complexity.

Hypothesis XXIII.

A significant number of subjects shifted from using compensatory decision-making processes in the low-complexity condition to using noncompensatory decision-making processes in the high-complexity condition across levels of situational involvement.

Hypothesis XXIV.

The degree of fit of a linear compensatory model is higher in the high-involvement than in the low-involvement group.

Hypothesis XXV.

The prediction of choice based on a linear compensatory model is more accurate in the high-involvement group than in the low-involvement group across levels of task complexity.

Hypothesis XXVI.

The prediction of choice based on a linear compensatory model is more accurate in the low-complexity task than in the high-complexity task across levels of situational involvement.

Exploratory Question I.

Do situational involvement and task complexity affect the direction of information search?

Exploratory Question II.

Do situational involvement and task complexity affect the proportion of time subjects spend acquiring information on each of the six drug attributes?

Exploratory Question III.

Does situational involvement affect choice outcomes across levels of task complexity?

Exploratory Question IV.

What is the relative importance of drug attributes in influencing physician's likelihood of prescribing a set of drug profiles?

Exploratory Question V.

Is there an association between the relative importance of drug attributes obtained from conjoint analysis, the ranked order of attributes searched, ranked order of proportion of search of attributes, and ranked order of proportion of time spent on each attribute across levels of situational involvement and task complexity?

Exploratory Question VI.

Is there an association between the ranked order of attributes searched in the low complexity task and the ranked order of search in the high complexity task across levels of situational involvement?

Exploratory Question VII.

Is there an association between the ranked order of proportion of attributes searched in the low complexity task and the ranked order of proportion of attribute search in the high complexity task across levels of situational involvement?

Definitions

Additive Model: A linear compensatory decision model in which an individual examines all relevant information across alternatives and an overall evaluation is formed independently and additively on each alternative.

Additive Difference Model: A linear compensatory model in which two alternatives are compared on each attribute, a difference is determined, and the results are summed additively across attributes to reach a decision.

Compensatory Process: The decision-making process in which all relevant drug attributes are considered, tradeoffs among attribute values are made, and an overall evaluation is formed independently on each alternative. The alternative with the highest overall evaluation is chosen.

Conjunctive Model: A noncompensatory model in which an individual establishes a minimum cutoff level for each attribute. An alternative that does not exceed the cutoff levels on all attributes is rejected.

Decision Strategy: The set of procedures that the decision maker engages in when attempting to select among alternative courses of action; and a decision rule that dictates how the results of the engaged-in procedures will be used to make actual decisions.

Disjunctive Model: A noncompensatory model in which an individual establishes a cutoff standard for each attribute.

An alternative that passes a standard for any attribute is chosen.

Drug Attribute: A characteristic, quality, consequence, or outcome possessed by or associated with a drug.

Elimination By Aspect Model: A noncompensatory model in which an individual eliminates alternatives from consideration based on a cutoff value on the most important attribute, the second most important attribute, and so on, until one alternative remains.

Enduring Involvement: the strength of the preexisting relationship between an individual and the situation in which behavior will occur.

Involvement: A unobservable state of motivation, arousal, or interest.

Lexicographic Model: A noncompensatory model in which an individual compares alternatives with respect to the most important attribute. An alternative that is superior on this attribute is chosen. If more than one alternative is preferred on the first most important attribute, the second most important attribute is then considered, and so on.

Noncompensatory Process: The decision-making process in which a subset of the available information is considered. There are no tradeoffs among attribute values. The unfavorable level on one attribute may not be compensated for by a favorable level on other attributes.

Process Tracing: A method that traces the decision process by collecting data while individuals engage in the decision.

Response Involvement: the complexity or extensiveness of cognitive and behavioral processes characterizing the overall consumer decision process.

Situational Involvement: the ability of a situation to elicit concern from individuals for their behavior in that situation.

Task Complexity: Characteristics of the task that affect information processing demands of individuals such as the number of alternatives in the choice set, the number of attributes per alternative, and the amount of time available for making a decision.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter presents a review of the drug prescribing literature and the variables which affect drug prescribing. The theoretical models that have been used to explain drug prescribing will be discussed. In addition, decision-making processes, methods used to study decision making, and variables affecting the use of various decision-making strategies will be reviewed. A cost/benefit framework that is used to generate research hypotheses and empirical studies supporting the model will be covered. Finally, the use of simulated patient cases in research will be discussed.

Factors Influencing Physician Drug Prescribing

A substantial amount of empirical research has been conducted concerning the factors which influence physician drug prescribing. Factors discussed here include: education, drug advertising and sources of drug information, colleagues, pharmacists, patient's characteristics, physician's characteristics, and drug attributes.

Education: Education helps provide physicians with therapeutic knowledge and the ability to practice medicine during their professional career. However, medical schools

differ in their educational programs and medical training. Joyce, et al. (1968) studied prescribing rates of 93 general practitioners in England and reported that "higher educational qualifications" were related to a lower rate of prescribing of all kinds of drugs. Stolley, et al. (1972) conducted a study regarding quality of prescribing among primary care physicians in private practice and found that rational prescribers tended to have more post-graduate education, but fewer years of medical experience. Benson (1983) studied factors associated with antipsychotic drug prescribing and found psychiatrists who were board certified were less likely to prescribe psychotropic drugs. In addition, Garner (1971) reported that physicians who graduated from different medical schools had different prescribing rates.

However, Lee, et al. (1965) reported that physicians who graduated from different medical schools were not significantly different in their drug prescribing. The Ministry of Health in the United Kingdom (1964) also reported that graduates of different medical school have the same prescribing habits.

In sum, the effect of medical school or education on physician prescribing behavior has not been well established due to the inconsistent findings reported in the literature. Hemminki (1975a), in a review of the literature on factors influencing drug prescribing, noted that relatively few

studies were conducted on the effects of education on drug prescribing. Nevertheless, there is some support that higher educational qualifications of physicians are related to higher quality drug prescribing.

Drug Advertising and Sources of Drug Information: Most drug advertising and promotion are in the form of journal advertising, direct mail, drug samples, and drug company representatives. These advertisements have been referred to as "commercial sources of influence" on drug prescribing (Avorn, Chen, and Hartley, 1982; Herman and Christopher, 1976).

Smith (1977), in his review of the effect of journal advertising on drug prescribing, reported that there was unsubstantiated evidence that drug firms, through journal advertising, influence physicians to prescribe drugs inappropriately. Journal advertisements might influence drug prescribing in combination with other factors; thus, making it difficult to study the effect of drug advertising separately.

Mackowiak and Gagnon (1985) studied the effects of detailing visits to physicians and medical journal advertising on the primary and secondary demand of diuretics and benzodiazepines. The number of new prescriptions for a product was used as a measure of advertising effectiveness. The data were analyzed using ARIMA (Auto Regression Integrated

Moving Average) time series analysis. The study found no correlation between changes in detailing or journal advertising expenditures and primary or secondary demand. However, this study had limitations concerning the indicator used to measure advertising effectiveness. Even though the ultimate function of the advertising is to increase sales, the intermediate variables; that is, physicians' beliefs and attitudes concerning the advertised drugs should also be measured in order to better determine advertising effectiveness.

Avorn, Chen, and Hartley (1982) compared scientific and commercial sources of influence of drug prescribing in the Boston area. The researchers examined the prescribing behavior of physicians with respect to two groups of drugs: cerebral vasodilators and propoxyphene derivatives. These two drug groups have been heavily promoted as very effective drugs by drug firms. Nevertheless, these messages appeared to be different from the message published in the scientific literature, in which their effectiveness was presented as questionable or inferior to other drugs. The results indicated that over half of the interviewed physicians perceived journal advertising (68%) and detailmen (54%) to be "minimally important" in influencing their prescribing when compared with scientific sources such as professional journals and published clinical studies. However, the attitudes of the

physicians toward the two groups of drugs were inconsistent with the information published in scientific sources. Approximately half of the physicians who perceived that they were not influenced by advertising also believed that these two drugs were very effective, as advertised by drug firms.

These findings indicated that physicians were influenced by "commercial sources of influence" despite their unawareness of those influences. Commercial sources of drug information may be biased in the message they provide (Avorn, Chen, and Hartley, 1982). Stolley, et al. (1972) reported that the better prescribers are those physicians who depend more on scientific sources for drug information than on drug advertising.

Sources of drug information also affects the adoption of new drugs. Miller (1973, 1974) divided the drug adoption process into five stages as: awareness, interest, evaluation, trial, and adoption. Each stage of the adoption process was reported to be associated with different potential sources of drug information. In the awareness stage, drug company representatives appeared to be the most important source of drug information; while, in the interest stage, detailmen, journal advertising, journal articles, colleagues, and the Physicians' Desk Reference (PDR) were the main sources of drug information. In the evaluation stage, colleagues were the most important source of drug information. In the trial

stage, the PDR was the most important source of information on drug dosage, contraindications, frequency of drug administration, etc.

Peay and Peay (1984) interviewed 124 private practice physicians in Australia concerning preferences for sources of information about new drugs. Commercial sources of information were used more often (71%) than professional sources (42%) for providing first information about a new drug. On the other hand, the finding was reversed when physicians considered prescribing the drug. Professional sources were cited more often (68%) than commercial sources (41%) for providing information used in prescribing.

Additionally, the preferred sources of information vary with the perceived risk associated with the disease or drug (Bauer and Wortzel, 1966; Williamson, 1975). As the perceived risk associated with the drug increases, physicians are more likely to use professional sources and less likely to use commercial sources of drug information (Williamson, 1975).

Colleagues: Coleman, Katz and Menzel (1966) reported that physicians turned to their colleagues for advice and consultation when there were uncertainty and perceived risks related to drug use. They also tended to follow their peers' advice more in the treatment of chronic disease than in the treatment of acute disease (Coleman, Katz, and Menzel, 1959).

Five types of physician interconnections were identified by Coleman, et al. (1966) as: common hospital appointments, shared offices, advice networks, discussion networks, and friendship networks. These professional networks were found to affect the way physicians adopt new drugs. Physicians with more social interaction, who were more integrated into the professional network, and who practiced as a group tended to adopt new drugs earlier than physicians who worked independently in solo practice.

Christensen and Wertheimer (1979) studied the adoption of new drugs by conducting interviews with 29 physicians in a health maintenance organization (HMO). The study found that physicians used literature-based sources such as medical newsletters, journal articles, etc. for general drug information and colleagues for information on new drugs. The source of first information concerning a new drug varied with the type of drug involved. Colleagues were found to be the most influential source in affecting the first prescribing of the new drug. However, some of the findings from this study were inconsistent with the results reported earlier by Coleman, et al. (1966). This study found that physicians who were highly integrated into social and professional networks did not adopt new drugs earlier than their peers. Therefore, the researchers concluded that the extent to which colleagues influenced the adoption of new drugs was dependent upon the

type of practice setting, type of new drug, type of physician specialty, and time period of study.

Pharmacists: Earlier studies on drug prescribing had reported that pharmacists had very little effect on physician prescribing behaviors (Gaffin, et al., 1958; Caplow and Raymond, 1954; Hawkins, 1959; Winick, 1961). Smith, Sorby, and Sharp (1975), in a survey of 1227 physicians in the State of Washington, found that physicians rarely used pharmacists as sources of drug information. Professional journals and texts were cited most often as sources of drug information.

Nevertheless, recent studies have reported the increasing roles of pharmacists in influencing physicians' prescribing decisions. For example, Alexander, et al. (1983) conducted a study in a Veterans Administration medical center to evaluate an educational program on pharmacology initiated by clinical pharmacists. The program included weekly lectures to medical students, psychiatric residents, and staff psychiatrists on the clinical use of psychotropic drugs. After twelve weeks, the uses of psychotropic drugs were found to be more appropriate and closer to the recommendations cited in the literature when compared with the period before the study.

Several researchers also found that an educational program provided by a clinical pharmacist decreased the use and cost of drugs (Self, et al., 1984; Thompson, et al.,

1986). Carter, et al. (1984) found the prescriptions from family practice residency training offices with clinical pharmacists were rated more favorably by an expert panel than the prescriptions from offices without clinical pharmacists.

Patient's Characteristics: When a patient consults with a physician about an illness, (s)he usually brings with him or her the expectation that something can be done to improve his/her condition. Although a prescription drug is an important means to treat patients, it is not the only option available for physicians. Hemminki (1975) conducted a study of general practitioners' proposed medical treatment concerning specific patient cases. She found that most of the patient cases presented to physicians were treated with drugs when other forms of therapy were more appropriate. The results indicated the principal role of drug therapy in medical treatment. Hemminki (1975) concluded that drug treatment was relied upon too frequently by the physicians.

Wartman, et al. (1981) assessed the effects of the prescription on the doctor-patient interaction at a prepaid group practice. The study found about 40% of all physician visits resulted in one or more prescriptions. Patients who did not receive prescriptions were found to be more satisfied with physician visits than patients who received prescriptions. The authors suggested that prescriptions may

be used as substitutions for "meaningful" interaction between physicians and patients.

Physician perception of patient expectation of the drug therapy may influence physicians to prescribe drugs instead of recommending other forms of drug therapy. Stimson (1975) reported that the physicians perceived 80% of the patients expected a prescription drug, whereas, only 50% of patients expected drugs to be prescribed to them.

In addition to patient expectations, patient income, gender and age may also affect physician prescribing behaviors. Coleman, et al. (1966) reported that physicians with a relatively high proportion of higher income patients prescribe more recently marketed and more expensive drugs than physicians with a relatively high proportion of lower income patients. Hartzema and Christensen (1983) studied the prescribing patterns of 80 family practitioners in a HMO and found that patient panel size and age composition accounted for 45.7% of the variation in the prescribing rate. In addition, female patients were found to prefer to see female physicians and older physicians tended to have more older patients than did younger physicians. Therefore, this helps explain why older physicians had higher prescribing rates. Older patients generally have more chronic diseases and require more drugs than younger patients.

Lapp, et al. (1983-84) assessed the effects of patient age, sex, and demand for prescriptions on physicians' drug prescribing using six videotaped hypothetical patients. When symptoms were held constant, the study found no significant differences in the number of prescriptions given to male and female patients. However, older patients were found to receive a significantly higher number of drugs than younger patients. Patients' demand for prescriptions did not result in an increased number of drugs prescribed.

However, Schwartz, Soumerai, and Avorn (1989) assessed physician motivation for "nonscientific" prescribing of cerebral or peripheral vasodilators, propoxyphene, or cephalexin. Of the 110 reasons cited by 72 physicians, patient demand was found to be the most common reason (41%). The other reasons cited were: use of drugs provided placebo effect (24%) and physician's own clinical experiences indicated the use of drug was effective (26%).

In addition, the seriousness of disease and patient condition affected physician prescribing behaviors. Miller (1974) reported that physicians depend more on professional sources of drug information when treating patients with difficult conditions in which drug efficacy is not clearly known. Menzel and Katz (1955-56) found that colleagues were a more important source of drug information when treating chronic conditions than treating acute conditions. Bauer and

Wortzel (1966) reported that as the severity of the disease increased, the use of professional sources of drug information increased over the use of commercial sources of drug information.

Benson (1983) studied the relative importance of physician, patient, and practice setting characteristics on antipsychotic drug prescribing using a sample of 61 North Carolina physicians and 1003 patients. The antipsychotic drug prescribing process is conceptualized as a three stage, sequential decision-making process: 1) whether to prescribe any psychotropic drug; 2) whether to prescribe a neuroleptic drug or other type of drug; and 3) what dose to prescribe. Patient characteristics (sociodemographics and clinical factors) were found to be the most important variables across the three decision stages. Clinical factors such as diagnosis and level of impairment were highly significant in the first two stages, while sociodemographic characteristics such as age was the most important factor in the third stage (drug dosage determination). The effects of practice setting characteristics on the prescribing decision were relatively low. Physician characteristics (education, sociodemographic, and attitudes) vary in importance across decision stages. Physician attitudes were significant in the first stage. Educational factors were highly significant during the first

and third stage, while physician sociodemographic factors had little effect across the three stages of the decision process.

Physician's Characteristics: Stolley, et al. (1972) in the study of the relationship between physician characteristics and the quality of prescribing reported that the better prescribers tended to be younger with less medical experience. They maintained larger, hurried practices with more ancillary personnel. They also tended to consult more with their colleagues and placed a higher value on their profession. They informed patients more about drugs and treatments. The more appropriate prescribers were more satisfied with their formal medical training and more critical of pharmaceutical industry advertising. They relied more on journal articles for drug information, sought more data on contraindications, and were more dissatisfied with existing sources of drug information.

Hayer (1982) also reported similar findings; namely, that younger physicians prescribed drugs more rationally than older physicians. Peterson, et al. (1956) found that the relationship between good performances in medical school and good performance in medical practice diminished among physicians over 35 years old.

With respect to physician specialty, Garner (1971), through prescription analysis, found that specialists were

more likely to determine the specific cause of a disease and prescribed drugs more specific to the disease than general practitioners.

Knapp and Oletjen (1972) reported that physician specialty and the severity of disease were related to the relative weighing of benefits and risks given to hypothetical drugs used in the treatment of hypertension. For milder cases of hypertension, internists weighed benefits of a drug more heavily than the risks of the drug, while the general practitioners were more concerned with the risks than benefits. For more severe hypertension cases, the relationship was reversed. Internists weighed the risks of a drug more heavily than the benefits, while the general practitioners were more concerned with the benefits than the risks.

Melville (1980) conducted a prescribing behavior study of 124 general practitioners and found the relationship between physician prescribing behavior and job-satisfaction. Prescribing drugs which were likely to cause adverse reactions or which were considered inappropriate by medical consensus was associated with low job-satisfaction among physicians. Physicians with low job-satisfaction were also more likely to allow ancillary personnel to write prescriptions for potent and harmful drugs.

Hadsall, et al. (1982) examined the effects of physician characteristics on the diagnosis of emotional problems, and the prescribing rate of selected psychotropic and nonpsychotropic drugs among 32 physicians and 10,585 patient visits. When patient characteristics were controlled, the study did not find a statistically significant relationship between board certification, practice size, physician age and the rate of diagnosing emotional problems. However, board certification, physician age, physician tendency to prescribe drug therapy as indicated by a multiple drug prescribing index, and the perception that patients expect drug therapy were significantly related to the prescribing of non-psychotropic drugs. In contrast, the prescribing of psychotropic drugs was less predictable by the study variables. The propensity to prescribe drug therapy was the only variable significantly related to the prescribing rate of psychotropic drugs. About 61% and 30% of the variance in prescribing non-psychotropic drugs and psychotropic drugs, respectively, was explained by the study variables.

Drug Attributes: Miller (1974), in his review of physician prescribing habits, proposed that drug attributes influenced the prescribing of new drugs, as well as, established drugs. Drug attributes that were hypothesized to affect the adoption of a new drug included: cost, consistency

of therapeutic response, risks associated with prescribing the drug, complexity of drug's effect, available dosage forms, communicability of new drugs or the ability of new drugs to be communicated through promotion or word-of-mouth, the degree to which a new drug is superior to existing drugs, the reputation of drug manufacturer, the social reward associated with a drug, and the reaction of colleagues. Drug attributes that were hypothesized to influence the prescribing of established drugs included: initial cost and continuing cost of a drug, the social reward associated with a drug, consistency of therapeutic response, length of drug's name, and the reputation of drug manufacturer (Miller, 1973, 1974).

Caplow and Raymond's study (1954) supports Miller's notion. They found that "superior therapeutic effect" accounted for 56 percent of drug adoptions, drug side effects accounted for 15 percent, and ease of administration accounted for 14 percent of new drug adoptions. Bauer (1961) also found that there was a significant relationship between preference for a drug company and preference for a given drug.

Several studies have identified drug cost as a relatively unimportant drug attribute in influencing physician prescribing decisions. Lowery, et al. (1972), in a survey of 220 physicians, found that many physicians had a limited knowledge of drug costs. Zelnio and Gagnon (1979), in a literature review of the impact of drug cost information on

physician prescribing patterns, stated that physicians did not incorporate drug cost into the prescribing decision to the extent necessary to achieve a cost savings.

Lilja (1976) studied the relative importance of three drug attributes: efficacy, side effects, and cost of the drug. He found that drug efficacy was the most important drug attribute influencing prescribing. Side effects and cost were ranked second or third in importance, depending upon the type of drug being prescribed.

Zelnio (1982), in a study of the relative importance of eight drug attributes, using a paired comparisons technique, reported that the most important drug attributes were drug efficacy, side effects, and contraindications. The lesser important drug attributes were those of dosage form availability, drug cost, source of drug information, frequency of administration, and manufacturer's reputation. He also stated that these drug attributes represented the most important factors affecting physicians' prescribing behavior identified to date. However, this study had some limitations. The researcher did not study a specific drug class under a specific patient condition. Therefore, the findings might not be generalizable to all classes of drugs across all types of patients.

Chinburapa, et al. (1987) studied the relative importance of drug attributes among health maintenance organization (HMO)

and fee-for-service (FFS) physicians concerning beta-blocker drugs used to treat hypertension. The drug attributes studied included: efficacy, side effects, cost, patient compliance, dosage schedule, manufacturer, and source of drug information. The study found both HMO and FFS physicians indicated the same four drug attributes to be especially important. In descending order of importance, these were: patient compliance; efficacy; dosage schedule; and side effects. Additionally, both groups ranked source of drug information as the fifth most important attribute. Only on the two most important attributes did the groups differ in their rankings. The HMO physicians ranked manufacturer as less important than cost, while FFS physicians ranked manufacturer as more important than cost.

Chinburapa and Larson (1988) used a conjoint analysis to determine the relative importance of effectiveness, side effects, cost, dosage schedule, and acceptance by peers in influencing physician prescribing intention of hypothetical drugs used to treat hypertension. Using aggregate level analysis, side effects were found to be the most important attribute, followed by effectiveness, dosage schedule, cost, and acceptance by peers.

Denig, et al. (1988) studied the relative importance of efficacy, mild and serious side effects, compliance, and cost of drugs among 169 general practitioners in the Netherlands.

The study found the relative importance of drug attributes differed significantly between the two diseases. Serious side effects were the most important factor when choosing a drug for irritable bowel syndrome (IBS), followed by efficacy, costs, mild side effects, and compliance. For the drug treatment of renal colic, efficacy was the most important factor followed by serious side effects, mild side effects, and costs. The importance attached to side effects and costs was significantly higher when choosing a drug for IBS than for renal colic. On the other hand, drug efficacy was significantly more important when choosing a drug for renal colic than for the IBS.

In summary, the relative importance of drug attributes in influencing drug prescribing seems to differ depending upon type of drugs and diseases studied. However, cost of drugs was found to be relatively low in importance across studies.

Theoretical Models of Drug Prescribing

Several researchers have proposed models that attempt to explain the decision-making process that leads a physician to prescribe a particular drug over another. Some of the models related external factors to physician drug prescribing, while others incorporated or considered the cognitive processes underlying physician prescribing decisions.

Hemminki (1975), through a literature review, developed a model of factors which affect drug prescribing. The major variables in the model are: (1) the pressure from research and drug firms, (2) the demands and expectations of patients, pressure groups and society, and (3) control and regulations from government, health authorities, and insurance systems. Research and drug firms are indicated in the model as closely related variables which mutually affect the demands from pressure groups and society. These three variables: research, drug firms, and the demand from pressure groups and society, directly influence drug prescribing of physicians through education, scientific journals, and advertising. The extent of this influence varies with the physician's personal characteristics, working situations, and his therapeutic opportunities. Colleagues are considered as another important source of influence who are also affected by each of the above variables. Additional variables that exert influence on physician's drug prescribing include: patient's personal characteristics, demand, and expectations; federal, state, and local control groups; professional norms; and other situational factors in the practice environment. Although the model provided a useful conceptual framework, it ignores the cognitive component of physician prescribing decision processes.

A model for the adoption of new drugs has been proposed by Miller (1974). This model was adapted from the model for the adoption of innovations developed by Rogers and Shoemaker (1971). The model consists of three major parts: 1) antecedents; 2) process; and 3) results. The antecedents are variables that exist in the situation before the introduction of an innovation (Roger, 1962). Antecedents include the individual physician's identity and perception of the situation, each of which affects the drug adoption process.

The adoption process in the second part involves five sequential stages as: awareness, interest, evaluation, trial, and adoption. In the first stage, a physician becomes aware of a new drug mostly through detailing and journal advertising. If interested in the new drug, more drug information is sought from journal articles, drug company representatives, the Physician's Desk References (PDR), and colleagues. In the evaluation stage, the physician considers using the new drug. He begins to evaluate the new drug and seeks information from his colleagues, journal articles, and medical meetings. In the trial stage, the physician will obtain data on drug dosage, dosage forms, and drug contraindications mostly from the PDR, journal advertising, drug company literature, and drug samples. The results of the trial stage will be used to decide whether to adopt the new drug.

Knapp and Oltjen (1972), in an experimental study of benefit-to-risk ratio in drug selection among general practitioners and internists, proposed a cognitive model of decision making based on an "expectancy-value" model. According to the model, physician's drug choice is a function of four variables: 1) the expectancy of the occurrence of benefits if the drug were prescribed; 2) the magnitude of the benefits; 3) the expectancy of the occurrence of drug side effects; and 4) the magnitude of the side effects. In the study, the relative weights given to the four factors were assessed under different levels of severity of hypothetical cases of essential hypertension. The results indicated the relationship between the relative importance of the four factors varied with the severity of disease and the physician's specialty. For a milder case of hypertension, internists weighed benefits of a drug more heavily than risks. General practitioners, however, were more concerned with risks than benefits. For more severe cases of hypertension, the relationship was reversed. Other background variables such as physician status, age, practice site, and prescribing rate were not significantly related to the physician's perceptions of benefit-to-risk ratio of drug.

Lilja (1976) proposed a model of physician's drug choice process. According to the model, physicians select established drugs through a habitual process and adopt a new

drug through a nonhabitual choice process. Three drug attributes: efficacy, side effects, and cost were assumed to be the most important variables affecting the physician's attitude toward drugs. In the study, 180 Swedish physicians were asked about their attitude toward 10 antidiabetic drugs used to treat diabetes mellitus, and 10 antibiotic drugs used to treat pneumonia. The physicians' judgment regarding drug efficacy, side effects, and cost of each drug were also obtained. Using multiple regression analysis, drug efficacy was found to be the most important attribute for both types of drugs. Side effects and cost was the second most important criterion in choosing antidiabetic drugs and antibiotic drugs, respectively. The three drug attributes accounted for 53.8% and 30.3% of the total variation for antidiabetic and antibiotic drugs, respectively. In addition, there were no significant relationships between background variables and physician prescribing decisions.

The Fishbein Behavioral Intention Model and its derivatives have been utilized by a few researchers as a conceptual framework in explaining physician drug prescribing. The model assumes that "most behavior of interest ... is under volitional control and that in a given situation, a person holds or forms a specific belief that influences his subsequent behavior" (Ajzen and Fishbein, 1973). According to the theory, physician prescribing intention serves as an

immediate determinant of actual prescribing behavior. Prescribing intention, in turn, is a function of the weighted sum of (1) subjective beliefs that a particular drug possesses or is associated with salient drug attributes and the evaluation of those attributes (attitudinal component) and; (2) the normative beliefs that specific individuals or groups think he should or should not prescribe the drug and his motivation to comply with those referents (subjective norm component).

The Fishbein model normally requires that certain assumptions are met. First, the near perfect correlation between behavioral intention and actual behavior are only obtained when behavioral intention is measured in reference to "a specific act in a specific situation" (Fishbein, et al., 1970). In addition, the time interval between the measurement of intention and behavior should be small in order to obtain high correlation between the two variables.

Harrell and Bennett (1974) utilized the Fishbein Behavioral Intention Model to study physician prescribing behavior of five oral antidiabetic drugs. A sample of 93 physicians was studied through a survey. The drug attributes included in the study were: efficacy, duration of action, serious side effects, hypoglycemic effects, cardiovascular effects, and weight effects. The model was found to significantly predict prescribing intention across all drugs

studied ($p < 0.001$). An average of 26 percent of the variation in prescribing intention was explained by the model. The subjective norm component was not found to contribute significantly to the model for four of five drugs. In addition, the relationship between actual prescribing behavior and prescribing intention was significant across drugs.

Epstein, Read, and Winickoff (1984) used the Fishbein model to study physician prescribing behavior for anti-inflammatory drugs in Veterans Administration Clinics. The physician's beliefs regarding three drug attributes: efficacy, side effects and cost, and the relative importance of six drug attributes: efficacy, side effects, likelihood of compliance, placebo effects, cost, and the patient's perception of the physician were measured. The physicians' beliefs were not found to be significantly related to prescribing behavior. However, the researchers concluded that the results may be due to a small sample size ($n=30$) and a limited number of drug attribute beliefs that were measured. Nevertheless, the study found the evaluation of physicians concerning the importance of cost and placebo effects correlated significantly with prescribing behavior ($p < 0.05$).

Chinburapa, et al. (1987) utilized the Fishbein Behavioral Intention Model as a conceptual framework in explaining prescribing intention of health maintenance organization (HMO) and fee-for-service (FFS) physicians

concerning four beta-blockers used to treat hypertension. A sample of 73 HMO and 43 FFS physicians in the Phoenix and Tucson metropolitan areas was surveyed. No significant differences were found between the two groups of physicians concerning the Fishbein variables: prescribing intention, importance of drug attributes, attribute beliefs, and subjective norms. The model was found to explain a significant portion of the variance in prescribing intentions of the HMO (41.4%) and FFS (53.9%) physicians. In contrast to the earlier findings by Harrell and Bennett (1974) regarding the unimportant role of subjective norm, the study found subjective norm to be relatively more important than attitude in influencing the prescribing intention of both HMO and FFS physicians.

Denig, et al. (1988) used a derivative of the Fishbein Behavioral Intention Model to study physician's drug prescribing for two conditions: irritable bowel syndrome (IBS) and renal colic. The drug choice model proposed by the authors differed from the Fishbein model in that it included the personal experience with drugs as a third component in the model. A sample of 169 physicians in the Netherlands was studied using a personal interview. Attitudes, subjective norms, and personal experiences were found to explain 45% and 60% of the variation in the overall preference for IBS and renal colic drugs, respectively. When the model was used to

predict physician first choice of drug, it was found that 73.6% and 78% of the first choices for IBS and renal colic, respectively, were correctly predicted by the model. However, further analysis of the model using Kappa as a measure of agreement between the model's prediction and drug choice, found that there was a high agreement between the prediction of the model and the first drug choice for the treatment of renal colic only. The Kappas indicated a low agreement in the case of the model prediction for drug treatment for IBS. Further, discriminant analysis using the three factors in the model (attitudes, subjective norms, and experience) was performed to predict drug choice for the two diseases. Discriminant functions were found to be significant only for the drugs used in renal colic. The researcher suggested that whether the first choice of drug can be reliably predicted by the model may depend on the type of disease in question. The drug choice for IBS may be less rational than drug choice for renal colic.

Segal and Hepler (1982, 1985) proposed a cognitive model of drug prescribing based on Vroom's valence and force models (Vroom, 1964). According to the model, a physician drug choice is a function of a physician's beliefs or subjective probability that certain outcomes will occur from various drug choices and the values of the outcomes. The model was first tested using a hypothetical case of mild hypertension patients

(Segal and Hepler, 1982). Six drug-related outcomes were identified through an interview of 12 physicians including psychiatrists, internists, and family practitioners. The outcomes identified were: control of disease, patient compliance, side effects, cost, patient's satisfaction with treatment, and colleagues' criticism. Following, another sample of 50 family practice residents were asked about the beliefs regarding the probability that each of the six outcomes will occur from various drug choices and the value of each outcome. The beliefs and outcome values obtained were then used to predict physician's drug choice. The model was found to correctly predict 72% of prescribing decisions (significant at $p < 0.01$).

Further, Segal and Hepler (1985) tested the model using actual cases of hypertension and maturity-onset diabetes mellitus. Forty physicians were included in the sample. The results from this study were consistent with the earlier study. The drug choice model correctly predicted prescribing intention in 81% of hypertension cases and in 87% of the diabetes cases. Actual prescribing was correctly predicted in 76% of hypertension cases and in 70% of the diabetes cases (significant at $p < 0.01$). Segal and Hepler (1985) concluded that the cognitive model of drug prescribing is a useful model for predicting physician's drug choice.

Decision-making Processes

In the past decade, a substantive amount of research in decision making has focused attention on understanding the cognitive processes underlying judgment and choice (Payne, 1976; Payne, Braunstein, and Carroll, 1978; Slovic, Fischhoff, and Lichtenstein, 1977; Svenson, 1979). The basic framework underlying most research on judgment and choice is the information processing theory developed in the field of cognitive psychology. According to the information processing theory (Newell and Simon, 1972), the human decision maker acts as an information processor, having mechanisms for information input and output, capabilities for interpreting and processing information, and memories for storing and retrieving information. The individual decision maker acquires information from the external environment and/or from memory. The information acquired serves as input to an internal representation. The cognitive representation, in turn, serve as input to judgment and choice. The processing of information is considered a sequential process and is limited in attention, duration, and capacity. Consequently, the individual decision maker appears to utilize various heuristics or decision-making strategies in order to keep the processing demand of the task within the bounds of the limited cognitive capacity (Bettman, 1979; Payne, 1980).

A number of strategies or rules describing the processes individuals used to make decisions have been identified in the literature. In general, the decision-making processes differ in two ways: whether the decision process is compensatory or noncompensatory and whether the processing of information is organized around alternatives or attributes (Payne, 1982). Compensatory processes such as additive and additive difference models consider all relevant attribute information and tradeoff attribute values; that is, a low value on one attribute can be compensated for by a high value on another attribute. In contrast, noncompensatory processes, such as conjunctive, disjunctive, lexicographic, and elimination by aspects, do not involve tradeoffs among attribute values and only consider a subset of available information in making decisions concerning multiattribute alternatives (Einhorn, 1970, Bettman, 1979; Svenson, 1979). The attribute-based processing involves a comparison of attributes across alternatives, while the alternative-based processing evaluates an alternative holistically across attributes.

The decision-making strategies also differ in the cognitive effort required to use the strategies and in their ability to lead to the optimal decision. Compensatory decision-making processes are considered to be more complex, require greater cognitive effort, and are more difficult to apply than noncompensatory processes (Einhorn, 1971).

However, compensatory processes are considered to be more likely to lead to the optimal decision than noncompensatory processes which only examine a subset of available information and are more likely to lead to inconsistency or intransitivity in preferences (Abelson and Levi, 1985; Klayman, 1985; Johnson and Payne, 1985; Tversky, 1969, 1972).

In the following, each of the compensatory and noncompensatory processes is discussed. These include: the additive model, additive-difference model, conjunctive model, disjunctive model, lexicographic model, and elimination by aspects model. Although a few researchers have proposed other decision strategies (Svenson, 1979), the six strategies discussed are the most commonly cited in the decision research literature and are more relevant to the process-tracing technique utilized in this research.

The Additive Model. The additive model is a linear compensatory model in which the evaluation for each alternative can be formally represented as:

$$E = \sum_{i=1}^n w_i s_i$$

where E is the overall evaluation of the alternative, w is the weight associated with an attribute i, s is the evaluation of the attribute i, and n is the number of attributes (Bettman, 1979). An individual, using the additive

model, acquires all attribute information regarding the alternative and forms an evaluation additively and independently on each alternative before proceeding to the next alternative. The alternative with the highest overall evaluation value is chosen. The model assumes that: 1) the attribute and alternative can be searched in any order; 2) there are no ties among alternatives; and 3) all attributes and alternatives are examined because a low value on one attribute can be compensated for by high values on other attributes (Klayman, 1983).

The Additive-Difference Model. The additive-difference model is a linear compensatory model in which the individual compares a pair of alternatives on each attribute. The difference between each attribute is weighed and summed additively across all attributes. The preferred alternative is the one with the highest weighed sum of value differences across attributes. The preferred alternative is then compared to the third alternative. The process continues until all alternatives are compared. The final choice is the preferred of the final pair of alternatives (Tversky, 1969; Payne, 1976). The assumptions for this model are the same as for the additive model (Klayman, 1983). However, the additive-difference model differs from the additive model in that the additive model involves alternative-based processing, while

the additive-difference model involves an attribute-based processing (Payne, 1976).

The Conjunctive Model. The conjunctive model is an alternative-based, noncompensatory decision process in which an individual decision maker establishes a minimum cutoff level for each attribute. An alternative that does not exceed the cutoff values on all attributes is eliminated from consideration (Einhorn, 1970). According to Wright (1974), the individual puts more weight on negative attribute information when using this model since the low value on one attribute can not be compensated for by the high values on other attributes.

The model is based on Simon's (1955) "satisficing" principle in which the individual seeks to "satisfice" rather than "maximize". According to the model, the individual examines one alternative at a time, across attributes, and terminates the search process when the first acceptable alternative is found (Klayman, 1983).

The Disjunctive Model. The disjunctive model is an alternative-based, noncompensatory decision-making process, in which an individual establishes an acceptable standard for each attribute. If an alternative exceeds a standard for any of the attributes, it is chosen. This model puts more weight on positive information (Wright, 1974) since an alternative

may be chosen based on the high value on one attribute regardless of the values on other attributes (Einhorn, 1970).

The Lexicographic Model. The lexicographic model is an attribute-based, noncompensatory decision-making process. According to the model, an individual decision maker first rank orders attributes based on their importance. The alternatives are then compared on the most important attribute. The alternative possessing the highest value on the most important attribute is chosen regardless of the values on the other attributes. If more than one alternative is preferred on the first most important attribute, the second most attribute is considered, and so on (Coombs, 1964; Einhorn, 1970).

The Elimination by Aspect. The elimination by aspect is an attribute-based, noncompensatory decision-making process (Tversky, 1972). According to the model, an individual decision maker establishes an acceptable level for each attribute. The order in which attributes are evaluated is based proportionally to its weight. The alternatives that do not pass the acceptable level on the first most important attribute are eliminated. The process continues with the second most important attribute, the third attribute, and so on, until one alternative remains. According to Tversky (1972), the elimination by aspect model is not considered a

rational decision process since it does not ensure that the remaining alternatives are better than those which are eliminated.

Methods Used to Study Decision Processes

There are two major approaches that can be used to study and identify the cognitive processes underlying judgment and choice (Billings and Marcus, 1983; Einhorn, Kleinmuntz, and Kleinmuntz, 1979; Payne, Braunstein and Carroll, 1978; Svenson, 1979). One involves a structural analysis of final judgment or outcome of the decision processes such as choice, rankings, or ratings. This method typically employs mathematical or statistical models (e.g., multiple regression, analysis of variance, etc.) to study the relationship between model input such as attributes or cues and output such as choice or judgment. The degree of fit of the algebraic model to the data is used to make inferences about the cognitive processes underlying decisions.

The second approach, referred to as process tracing, stems from the information processing approach to behavior originated by Newell and Simon (1972). This method employs various techniques to trace and collect data during the decision-making process. According to Svenson (1979), "the order in which a decision maker seeks and evaluates the

information of a decision problem is related to the cognitive process leading to the final decision."

In addition to the two major approaches, an analysis of the response time has been used in cognitive psychology to study decision-making processes. In the following, each of the three approaches is discussed.

Structural Analyses of Final Judgments

Structural analyses of the final judgments or input-output analysis refer to methods that utilize decision outputs to study the decision-making processes. This approach employs algebraic or statistical models to describe the relationship between input (attributes, cues) and output (judgment, choice) based on assumptions about how individuals use information to form judgement or decision (Abelson and Levi, 1985).

Generally, alternatives that are used to elicit a judgment or decision from subjects can be categorized into two types. The first type involves actual alternatives that are known to subjects or those subjects have had prior experience with. The other type involves hypothetical alternatives that are described based on several attributes. In both approaches, subjects are presented with the alternatives and are asked to indicate an overall rating or preference for each alternative, the weight attached to each attribute, and for known alternatives, the beliefs or evaluations for each

attribute. The scale values for attributes are put into mathematical equations based on hypothesized models to determine the goodness of fit or the relationship with the subjects overall rating or preference for alternatives.

In studying the processing of information, the hypothetical alternatives are preferred to actual alternatives. In the former case, subjects are presented with information and are asked to use the information to form a judgment, while in the latter case, subjects judgement or evaluation about alternatives may have already been formed. In using the actual and known alternatives to elicit a judgment, subjects may retrieve the previously formed evaluation from the memory; thus, the processing of information may not occur (Bettman, 1979).

There are limitations associated with the use of algebraic models to study the decision processes. This method uses the degree of fit of algebraic models to infer the decision-making processes and does not directly observe or collect information about the actual processes used by decision makers. According to Svenson (1979), algebraic models provide surface descriptions of the processes rather than a detailed information concerning stages in decision processes. Additionally, the use of degree of fit of an algebraic model to infer the cognitive process is considered a "paramorphic" representation; that is, a high degree of fit

does not necessary mean that individuals actually used the process that the model has specified. Different models may be equally successful in describing the process yet be suggestive of different underlying cognitive processes (Hoffman, 1960, Einhorn, 1970).

Researchers utilizing linear models to study decision processes have found the linear model to provide a good fit to the data (Slovic and Lichtenstein, 1971). Moreover, the linear model always does as well as any nonlinear model in describing the data (Dawes and Corrigan, 1974; Goldberg, 1968). Dawes and Corrigan (1974) reviewed the contexts in which linear models performed well. These included: 1) the independent variables have monotonic relationships to the criterion; 2) there is error in the measurement of the input and output variables; and 3) deviations from optimal weighing of the variables do not make much practical difference. Dawes and Corrigan (1974) further noted that these characteristics were found in most decision situations and thus contributed to a good performance of linear models in judgment.

Thus, the high degree of fit of linear models to the data can be seen more as a function of the characteristics of the decision contexts and the insensitivity of linear models than an actual characteristic of the decision process (Dawes and Corrigan, 1974; Einhorn, 1970; Slovic, Fischhoff, and Lichtenstein, 1977). As a result, other researchers have

suggested that cognitive processes cannot be sufficiently understood by solely studying input-output relationships and other research methods needed to be included (Ford, et al., 1989; Payne, Braunstein, and Carroll, 1978; Pitz and Sachs, 1984; Svenson, 1979).

Process-Tracing Techniques

Process-tracing techniques have been introduced as an alternative method to study the decision-making processes (Payne, Braunstein, and Carroll, 1978). Process-tracing techniques are data collection methods that trace the information acquisition and yield the data on predecisional behavior to identify what information is attended to and how the information is being processed before the decision is made. Process-tracing techniques generally include: 1) verbal protocol analysis, and 2) the analysis of information acquisition behavior using eye movement recording (Russo, 1978), information display board (Payne, 1976), or mouse-based information acquisition system (Johnson et al. 1989).

Verbal Protocols: Verbal protocols are obtained by asking the individuals to "think aloud" or verbalize their thoughts while performing the decision task. According to Newell and Simon (1972), a verbal protocol is "a record of the subject's ongoing behavior, and an utterance at time t is

taken to indicate knowledge or operation at time t ". The statements in the protocol are normally divided into simple assertions and are analyzed to infer and test the decision process used by subjects.

Verbal protocols in process-tracing analysis should be distinguished from introspection (Payne, Braunstein, Carroll, 1978). Verbal protocol analysis involves subjects that are "naive" about the theoretical constructs under the study. On the other hand, introspection involves highly trained subjects or experts in the generation of introspective data. Additionally, concurrent verbal protocol should be distinguished from retrospective protocol. Concurrent verbal protocol collects the information during performance of the task, while retrospective protocol collects the information after the decision task. According to Payne, et al. (1978), verbal protocols used in process-tracing should be collected concurrently, rather than retrospectively. Retrospective protocol may not provide reliable inferences to the decision-making processes since it allows subjects the time to apply his own knowledge and justify or rationalize the responses (Svenson, 1979).

Verbal protocol analysis has the advantage of providing the detailed analysis of decision strategy used by subjects. However, collecting and analyzing verbal protocol is time-consuming. Thus, only a small sample size has been used

(Bettman, 1979). Verbal protocols are also difficult to analyze formally and objectively (Russo, 1978). The obtrusive nature of collecting concurrent verbal protocols may also affect the cognitive processes underlying decisions since collecting the protocols require an additional response by the subject (Bettman, 1979; Russo, 1978). Subjects who were asked to verbalize may also attempt to present their decision-making to the experimenter in a socially desirable manner (Biehal and Chakravarti, 1989). However, other researchers indicated that the collection of verbal protocol does not affect or interfere with the decision-making process (Payne, Braunstein, Carroll, 1978; Payne, 1980; Smead, Wilcox, and Wilkes, 1981).

Biehal and Chakravarti (1989), in a study of the effects of collecting concurrent verbal protocols on information processing, found that verbalization affected the extent of brand-processing and problem-framing. However, verbalization did not have significant effects on processing level and span and information use. Moreover, there were no significant differences in the frequency distributions of choice outcomes between verbalizers and nonverbalizers. The authors suggested that the collection of verbal protocols may not always be nonreactive and attempts should be made to minimize or control the reactive effects.

Further, there is question concerning the ability of subjects to verbally report their mental operations in

generating the responses. Nisbett and Wilson (1977), in a literature review on verbal reports of mental processes, concluded that verbal reports are not very useful as indicators of cognitive processes. However, most of the research reviewed by Nisbett and Wilson (1977) was retrospective in nature. Thus, it may limit the generalizability to concurrent verbal protocols used in process-tracing studies. In general, verbal protocols are useful and informative when the protocols are collected concurrently with decision task, when the decision making is conscious, and when information processing is not automatized or relies on stored rules in the memory (Ericsson and Simon, 1980; Johnson and Puto, 1987).

Analysis of Information Acquisition: The process-tracing technique using this method involves presenting the decision task to the subjects in a form of alternative-by-attribute matrix (Payne, et al., 1978; Jacoby, et al., 1978). Each alternative is described using various attributes. The alternatives are listed across the top of the matrix, while attributes are listed down the left-handed side of the matrix, or vice versa. The values of the different alternatives on attributes are hidden. Subjects are required to examine or acquire the information from the matrix prior to making the decision. The data concerning the amount of information

acquired, the content of information acquired, the order and duration of search are collected. These measures are used to infer the decision-making processes used by the subjects.

An analysis of information acquisition behavior requires certain assumptions. First, it is assumed that the information acquired is cognitively processed by the subjects. Second, a longer period of attention to a piece of information is assumed to be accompanied by a more complex cognitive process than a shorter attention (Svenson, 1979).

Brucks and Schurz (1990) also stated several assumptions associated with the structure of choice task employed in an analysis of information acquisition. These assumptions are: alternatives in a choice set are comparable or can be described on the same attributes; number of alternatives and attributes describing alternatives are known to the decision maker prior to the start of the choice task; and attribute values are fixed and are assumed to be the only form of information available to subjects.

Several methods have been used to monitor information acquisition. These included: eye movement recording, information display board, and the Mouselab system.

Eye Movement Recordings: This method involves the use of sensing apparatus to record sequences of eye fixations as subjects examine the alternatives. In order to obtain

accurate measures, subjects' heads must be immobilized to prevent large head movements. Moreover, the display of the stimuli needed to be separated by a considerable distance in order to prevent the subjects from using peripheral processing. According to Russo (1978), eye movement recordings provide the most detailed information of the process-tracing methods and are useful for recording the processes that occur rapidly. However, there are several disadvantages associated with the method. These include the complexity and cost of the equipment, cost of training personnel, and time required to collect and analyze the data (Bettman, 1979; Payne, Braunstein, and Carroll, 1978; Johnson, et al., 1989; Just and Carpenter, 1984). Moreover, the recording of eye movements may be inaccurate if the number of attributes and alternatives are large (Svenson, 1979).

Information Display Boards: An information display board used by Payne (1976) contained a matrix of envelopes attached to a sheet of cardboard. Each envelope consisted of cards displaying the value of an attribute for a particular alternative. To examine the value of an attribute for a given alternative, the subject pulled the card out, turned it over, read the information, and placed it back into the envelope. The order in which the subject examined the cards was recorded.

The information display boards are easy to use, inexpensive, and can be applied in a wide range of settings (Russo, 1978). However, the disadvantages of the information display boards include the obtrusive nature of the task and the effort required to acquire the information both of which may affect the acquisition behavior (Arch, Bettman, and Kakkar, 1978; Bettman, 1979). Additionally, the information display boards examine only goal-directed acquisition of information. Russo (1978), in a review of information display board studies, reported that the reacquisition rate for the information display boards was low (7% of acquisitions) compared to eye movement recordings (56% of acquisitions). Thus, there is a possibility that a low density of observations provided by the information display boards may yield inaccurate conclusions regarding the decision-making strategy.

Other limitations of the information display boards include: the use of a well-defined structure decision task in a matrix format rather than an ill-structured task; the lack of control on internal information search, the lack of direct measurement of internal processing; the lack of accidental exposure to the information, and the lack of variation in the cost of information search and sources of information (Brucks, 1985).

However, the validity of information display boards has been examined in a number of studies (Holbrook and Maier, 1978; Sheluga, Jaccard, and Jacoby, 1979; Lehmann and Moore, 1980). The validity of the method was determined by comparing information acquisition behavior of the subjects with the hypothesis derived from theory and/or empirical findings. For example, Sheluga, et al. (1979) reported a positive relationship between the importance of an attribute and the extent and sequence of search of the attribute. Jacoby, et al. (1978) found that when brand names of cereals were available, subjects searched less information and focused the search on brand name and price information. When brand names were not available, subjects searched more information. Lehmann and Moore (1980) used the information boards to test the hypothesis regarding the nature of information acquisition behavior over time. The findings indicated that the search decreased when subjects became more familiar with the product, and when the brand name was available. Lenmann and Moore (1980) concluded that the findings supported the validity of the information display boards.

The Mouselab System: Johnson, et al. (1989) developed a microcomputer-based system called Mouselab for monitoring information acquisition behavior. The method was developed to minimize efforts required to acquire information from the

information display boards. The Mouselab system utilized computer graphics to display information and a "mouse" to access the information. According to Johnson et al. (1989), "the methodology comes close to the recording of eye movements in terms of speed and ease of acquisitions, while minimizing instrumentation cost and difficulty of use for both subject and experimenter."

The advantages of using a "mouse" as a pointing device included: ease of learning, rapid movement, and low error rate compared to other devices. Additionally, the effort required to acquire information is relatively small (Johnson, et al., 1989). The disadvantages of the Mouselab system are similar to those associated with the use of information display boards such as the lack of direct measurement on internal processing and the imposition of a matrix format and a well-defined structure on the decision task.

However, previous research indicated that the use of the Mouselab system did not change or affect subject's decision-making strategies (Payne, Bettman, Johnson, 1988). In addition, the results obtained using other process-tracing techniques were replicated by subjects using the Mouselab system (Johnson, Meyer, Ghose, 1988; Johnson, Payne, Bettman, 1988; Schkade and Johnson, 1989; Payne, Bettman, Johnson, 1988).

An Analysis of Response Time

Another method used to study the cognitive processes underlying decision making is an analysis of response time. Response time is defined as "the amount of time between the presentation of a stimulus to an individual and his or her response to that stimulus." (Gardner, Mitchell, and Russo, 1978).

The basic principle of the method is that the response time is directly related to the amount of processing efforts used in performing the task. A cognitive process can be divided into a series of independent subprocesses. Each subprocess requires a constant processing time. By manipulating the characteristics of the problem and comparing the mean response time for different experimental conditions, the nature of a cognitive process associated with the task can be determined (Bettman, 1979; Russo, 1978, Svenson, 1979).

The response time analysis is very useful for studying the brief processes of less than a few seconds in duration such as recall time or memory search. It is less effective for studying longer tasks such as purchase decision because the longer the task, the higher the chance that factors not manipulated by the experimenter may affect response time (Bettman, 1979; Russo, 1978).

The response time analysis has certain limitations. First, subjects may trade-off speed and accuracy when

performing the task. This trade-off may threaten the validity of the results in studying the cognitive processes since subjects may not perform at the same accuracy level across experimental tasks. This phenomenon can be minimized by instructing subjects to take the time necessary to minimize error rates (Bettman, 1979; Johnson and Russo, 1978). Second, the collecting of response times is an obtrusive method. Subjects may alter the responses since they are aware that their response times are being measured (Russo, 1978).

In summary, several methods can be used to study cognitive processes underlying judgment and choice. These include: structural analysis of final judgments, process-tracing techniques, and analysis of response times. Each method has advantages and disadvantages. Researchers have suggested that multimethod approaches be used since these methods can provide complementary analysis (Bettman, 1979; Payne, Braunstein, Carroll, 1978; Einhorn, Kleinmuntz, Kleinmuntz, 1979; Russo, 1978). However, when it is not possible to use a multimethod approach, the choice of methods depends on theoretical considerations, the availability of apparatus, and the relative difficulty involved in analyzing data collected by each method (Payne, Braunstein, and Carroll, 1978).

Variables Affecting Decision Processes

In this section, empirical studies that examined the effects of variables affecting the use of different decision-making processes will be reviewed. These variables can be broadly categorized as task characteristics, environmental characteristics, and individual characteristics (Ford et al. 1989).

Task Characteristics

The effects of task characteristics on decision-making processes have received a great deal of attention by decision researchers (Ford et al. 1989). Task characteristics that have been examined in the literature include: task complexity, information display format, response mode, and attribute values.

Task Complexity: According to Payne (1982), three characteristics of the task that are likely to affect information processing demand of individuals include the number of alternatives in a choice set, the number of attributes used to describe an alternative, and the amount of time available to make a decision.

Einhorn (1971) used structural analysis of final judgments to examine the effects of type of decision task and number of attributes on the use of linear, conjunctive, and disjunctive models. Type of decision tasks included job

preference and graduate student admission. Hypothetical profiles were used. Subjects were 39 students and 30 faculty members for job preference and graduate student admission task, respectively. The study found a high degree of fit of the three decision models across both type of decisions. In the job preference task, the conjunctive model fit the data better than the linear or disjunctive model, while in the graduate student admission study, the linear and conjunctive model fit the data equally well. Task complexity was not found to affect the type of models used; however, the degree of fit of the models decreased as task complexity increased. Einhorn suggested that the poorer fit of the models in a high task complexity condition may indicate that subjects used a combination of models to simplify the task cognitively.

Wright (1974) used structural analysis of final judgments to examine the effects of time pressure and distraction on decision process. Subjects were 210 students evaluating hypothetical automobiles. The algebraic models with relatively high weights on negative information (conjunctive processes) were found to provide the best fit to a significantly higher number of subjects under high time pressure and moderate distraction conditions. Additionally, fewer attributes were found to be used under these conditions.

Wright and Weitz (1977) used structural analysis of final judgements to examine the effects of time horizon and time

pressure on product evaluation strategy. Subjects were 180 women evaluating hypothetical birth control devices. Time horizon and time pressure manipulation were found to affect the linearity and complexity of the evaluation strategies used by subjects. When the time pressure was high and when commitment and outcomes were distant in time, subjects tended to use simpler evaluation strategy. When greater commitment was required and when outcomes of the decision were expected sooner rather than later, subjects tended to put more weight on negative information.

Pras and Summers (1975) also used a structural analysis of final judgments to examine the effects of number of attributes and "acceptability" of alternatives on the use of additive, conjunctive, and lexicographic decision models. Subjects were 40 students indicating their evaluation of automobiles. The study found the conjunctive model fit the data better than the additive and lexicographic model when all alternatives were included. When only acceptable alternatives were included, the linear additive model performed better than the other two models. In contrast to Einhorn's findings, this study found the degree of fit of the three models increased as the number of attributes increased. The discrepancy between the two findings may be attributed to the nature of the attributes included in the study. Pras and Summers (1975) reported that including a higher number of relevant attributes

led to an increase in predictive power of the model. Einhorn's study did not indicated how attributes included in the study were selected and whether those attributes were determinant attributes.

Payne (1976) used information display boards and verbal protocol analysis to study the effects of number of attributes and number of alternatives on decision-making strategies. Twelve subjects indicated their choice concerning hypothetical apartments. The results indicated that proportion of information searched increased and variability of information searched decreased as the number of alternatives increased. These findings indicated that subjects shifted from using compensatory processes to noncompensatory processes when the task became more complex. In addition, direction of search was found to be organized more by attributes than by alternatives as the number of alternatives increased. Number of attributes was found to affect percentage of information searched but had no effect on variability of information searched. Payne (1976) concluded that number of attributes did not affect the use of decision strategy.

Payne and Braunstein (1978) used an analysis of information acquisition and response times to examine the effects of number of alternatives on decision processes. Twenty-five subjects indicated their preferences for gambles. The results were consistent with Payne's findings (1976). As

the number of alternatives increased, the proportion of information searched decreased, the variability of search increased, the mean search time decreased, and the direction of search was organized more by attributes than by alternatives.

Lussier and Olshavsky (1979) used verbal protocol analysis to examine the effects of number of attributes and number of alternatives on decision processes concerning portable typewriters. Twenty-seven students were included. The study found that when the number of alternatives were small, subjects used compensatory processes. When the number of alternatives were increased, subjects used noncompensatory strategy to eliminate some alternatives from the choice set and then used compensatory strategy to evaluate the remaining alternatives. Number of attributes was not found to affect the decision-making strategy.

Crow, Olshavsky, and Summers (1980) used verbal protocol analysis to study the effects of number of alternatives on decision processes. Fourteen industrial buyers indicated their choice of hypothetical vendors for electrical components. In contrast to earlier findings, number of alternatives was not found to affect decision processes. Subjects tended to use two-stage decision processes in which the conjunctive processes were used to eliminate vendors and the lexicographic processes were used to select the final

vendor across tasks. The lack of significant findings for the effect of number of alternatives in this study may be attributed to a limited range in the level of task complexity manipulated. The number of alternatives varied in the study were 7 and 15 alternatives, both of which reflected a high level of task complexity. In contrast, previous studies reported a change in decision strategy when the number of alternatives was increased beyond two or three alternatives.

Shields (1980) used information display boards to examine the effects of task complexity and decision phase on the process used in rating performance. Twelve executives were involved. Task complexity was manipulated by varying the number of responsibility units and number of parameters per unit in a performance report. Task complexity was found to affect variability and direction of search. As the number of responsibility units increased, the variability of search increased. Direction of search was alternative-based when there were few units in a report. Number of parameters per unit and decision phase did not significantly affect the search process. In contrast to the research hypothesis, subjects were not found to shift from using nonlinear strategy to linear strategy as the task progressed. The variability of information searched was not found to be significantly different across decision phases. The researchers concluded that the lack of support for the use of phased-strategy may be

attributed to the method used to divide the search processes into decision phases. The method used in the study may not coincide with the actual shifting of decision-making processes by respondents.

Billings and Marcus (1983) evaluated the validity of two process-tracing measures (the variability and direction of search on an information display board) and three measures from structural analysis of judgments (regression indices, ANOVA measures of interaction, and curvilinearity). The validity was evaluated by the extent to which the measures converge with one another and their sensitivity to a manipulation of task complexity. Forty-eight students indicated their choice and preferences for hypothetical apartments. Task complexity in the process-tracing task was manipulated by varying the number of alternatives. In the rating or structural analysis task, the time available to make a decision was manipulated.

The variability of search and ANOVA measures of interaction and curvilinearity were found to be more sensitive to the manipulation of task complexity than regression indices. Variability of search and measures of interaction and curvilinearity showed an increase in the use of noncompensatory processes under high task complexity, while regression indices did not indicate any significant effect. The measures from search task and rating task did not

converge. Billing and Marcus (1983) concluded that search measures obtained from information display boards and ANOVA measures were valid measures of noncompensatory decision-making strategy; however, the measures lacked convergent validity because they may represent different components of the decision process or because they required different types of responses.

Johnson and Meyer (1984) used verbal protocol and logit model analysis to examine the effects of number of alternatives on attribute importance weights and degree of fit of compensatory choice models. Nine and ninety-one subjects participated in the protocol analysis and logit analysis, respectively. Subjects indicated their choice and preferences for hypothetical apartments. Verbal protocol analysis indicated that as the number of alternatives increased, the use of noncompensatory processes increased. Subjects tended to focus on fewer number of attributes as task complexity increased. In addition, the logit analysis indicated changes in the relative importance of attributes as task complexity increased. However, the study did not find decreases in the degree of fit of the linear compensatory models as the number of alternatives increased. This was because subjects tended to uniformly use "rent" as a screening attribute when task complexity increased. Thus, the decrease in the degree of fit of the linear model due to the increased use of

noncompensatory processes may have been neutralized by increased homogeneity in the decision-making processes used by subjects (Johnson and Meyer, 1984).

Biggs, et al. (1985) used information display boards and verbal protocols to examine the effect of task complexity and similarity of alternatives on decision processes. Eleven bank loan officers were asked to make loan decisions. Task complexity was manipulated by varying the number of attributes and number of alternatives. As task complexity increased, the percentage of information search decreased, the variability of search increased, and more subjects used noncompensatory strategies. As similarity of alternatives increased, percentage of information search increased and the variability of search decreased. Additionally, when task complexity was held constant, more subjects used compensatory strategies as the similarity of alternatives increased.

Onken, Hastie, and Revelle (1985) used verbal protocol and analysis of response time to examine the effect of task complexity on decision-making strategies. Subjects were 99 students indicating their preferences for hypothetical apartments. Task complexity was found to have a significant effect on decision time although the relationship was not consistent across individuals. When task complexity increased, some subjects used simplified strategy. The researchers concluded that the observed individual differences

in decision times as task complexity varied may reflect individual differences in motivation and/or ability to process information.

Johnson, Meyer, and Ghose (1989) used computer simulation and the Mouselab system in a series of experiments to examine the effects of number of alternatives and the intercorrelation among attributes on the predictive accuracy of compensatory models. The computer simulation results indicated the degree of fit of compensatory models decreased when there were negative correlations among attributes. The compensatory model fit noncompensatory processes less well than compensatory processes. Moreover, the negative effect on predictive accuracy was more pronounced when attributes were negatively correlated.

An analysis of information using the Mouselab system indicated that as the number of alternatives increased, the attribute-based processing increased and amount of information search decreased. Subjects tended to shift from compensatory to noncompensatory strategies as task complexity increased. However, the intercorrelation among attributes was not found to have significant effects on decision-making strategies.

In summary, a majority of empirical studies that examined the effects of task complexity indicated that increased task complexity resulted in subjects shifting from compensatory strategies to noncompensatory strategies to simplify the task.

As task complexity increased, the proportion of information searched decreased and the variability of information searched increased. Ford et al. (1989) in a review of process-tracing studies concluded that the results concerning the effects of task complexity on decision-making strategies were the most robust findings in the process-tracing literature. The effects have been found using different types of subjects (students, consumers, professionals), different types of decision task (gambling, consumer products, etc.) and different methodology (structural analyses of final judgments, process-tracing techniques, and response time analysis).

Information Display Format: The format in which the information was displayed was found to affect the information processing strategy used by subjects in a number of studies. The findings were consistent with the "concreteness" principle suggested by Slovic (1972).

"Concreteness represents the general notion that a judge or decision maker tends to use only the information that is explicitly displayed in the stimulus object and will use it only in the form in which it is displayed. Information that has to be stored in memory, inferred from the explicit display, or transformed tends to be discounted or ignored."

Bettman and Kakkar (1977) used information display boards to examine the effects of display format on information acquisition strategy. Subjects were 150 housewives evaluating actual breakfast cereals. Information display format was

manipulated by presenting the information in an alternative form, an attribute form, and a matrix form. Display format was found to affect information acquisition strategy. In the alternative format, alternative-based processing was used more often, while in the attribute format, more attribute-based processing was used. In the matrix format, alternative-based processing was used more often than attribute-based processing. This may be due to the use of actual products in the study. Subjects' experience with the products may lead him/her to use more alternative-based or brand processing since in the real market environment, products were predominantly organized by brand (Bettman and Kakkar, 1977).

Herstein (1981) used verbal protocol and information display board to study the effects of information display and political stand of candidate on the voting decisions. Subjects were 20 students. Information display format was found to affect the sequence of information searched, number of comparisons, and number of overall evaluative statements made by subjects. Additionally, political stand of candidate affected the amount of information searched.

Painton and Gentry (1985) used different versions of information display boards to study subjects' information search strategy. Subjects were 40 students making decisions concerning pocket camera. Subjects were found to use more attribute-based processing when acquiring information from the

traditional information display boards in which product attributes were provided. However, subjects used more alternative-based processing when acquiring information interactively from the computer in which attributes were not provided and subjects were required to specify attributes used. The researchers concluded that the format of information presentation affected the way subjects used information.

Johnson, Payne, and Bettman (1988) used the Mouselab system to examine the effects of information format on processing strategy. Subjects were 91 students indicating their rating and bidding for gambles. Information format was manipulated by varying the format of probability information in the gamble. Probability was display either in the decimal or hard fraction conditions. Decimal format was hypothesized to be easier to process than fraction format. Information display format significantly affected decision time, percentage of time used to examine probability information, and processing strategy. In the fraction conditions, there was an increase in the decision time and percentage of time examining probability information, and decrease in alternative-based processing. Johnson et al. (1988) suggested that the manipulation of information display format may affect the cognitive effort required to use various decision-making processes. Thus, subjects changed their decision-making

strategies in response to changes in information display format in order to minimize cognitive effort.

Response Mode: Type of response modes required by researchers have been found to affect form of processing and the use of compensatory and noncompensatory processes. Generally, two type of response modes are required. The first involves a judgment task, in which alternatives are successively presented to subjects. The subjects are required to indicate a judgment for each alternative as values on a rating scale, or as the amount of money one would pay for the alternative. The other response mode involves presenting two or more alternatives to subjects simultaneously and asking the subjects to choose the most preferred alternative.

In a series of experiments with gambling decisions, Lichtenstein and Slovic (1971, 1973) and Lindman (1971) reported the reversal of preference for gambles as a function of response mode. When choosing among gambles, subjects preferred the gamble with the higher probability of winning but a smaller amount of payoff. In contrast, when bidding for gambles, the subjects preferred the gamble with the larger amount of money to be won but a lower probability of winning.

Lichtenstein and Slovic (1971, 1973) explained that the preference reversal occurs because a different processing strategy is used in a different response mode. In the choice

task, a dimensional processing is used, in which each dimension of one gamble is compared to the same dimension in another gamble. In the bidding task, subjects use alternative-based processing, in which one piece of information is used as an anchor or a starting point for judgment and then adjustments are made to the anchor based on additional information about the alternative. In the choice task, the probability of winning is the most salient dimension, while in the bidding task, the amount to be won is the most salient information.

Payne (1982) suggested an explanation of response mode effect on processing strategy using a distinction between similarity and dissimilarity judgment developed by Tversky (1977). According to Payne (1982), choice is related more to examining features that are distinct to alternatives, while features held in common are ignored; thus leading to attribute-based processing. In contrast, a judgment involves the use of all information which leads to alternative-based processing.

Tversky, et al. (1988) proposed a "compatibility principle" that can be used to explain preference reversal due to response mode effect. According to the principle, the weight of an input component is enhanced by the compatibility with the output. Amount of payoffs is more salient in the

bidding mode (judgment) than in the choice mode because both payoffs and bidding response are in the same units (dollars).

Rosen and Rosenkoetter (1976) used an eye fixation analysis to examine the effect of response mode on information processing strategies across a range of stimuli that differed in the amount of attribute interdependency. Six subjects indicated judgement and choice of gambles, vacations, or gifts. The findings indicated that the effect of response mode on processing strategy is moderated by the degree of attribute interdependency. The choice task resulted in more dimensional processing strategy than did a judgment task only when the attributes of stimuli were neither interdependent nor dissimilar (vacations). Interdependent attribute stimuli (gambles) resulted in alternative-based processing, while dissimilar attribute stimuli (gifts) led to dimensional processing for both judgment and choice.

Billing and Scherer (1988) used information display boards to study the effects of response mode and decision importance on decision-making strategies. Subjects (n=104) made a choice or judgment on candidates for residence hall advisor. Response mode was found to have significant effects on the process measures. The judgment task was associated with a greater amount of information searched, a lower variability of search, and more alternative-based processing.

Schkade and Johnson (1989) used the Mouselab system to examine cognitive processes underlying preference reversal. The results supported earlier research that choice and bidding tasks were associated with different decision processes. In choice task, subjects paid more attention to probability information and made a greater number of comparisons among alternatives than in the bidding task. In the bidding task, subjects spent a higher proportion of time to payoffs information and a higher amount of time in generating the response than the choice task. Schkade and Johnson interpreted the findings as consistent with the compatibility principle proposed by Tversky (1988).

Attribute Values. The value of attributes defining an alternative in a choice set affects the perceived similarity of alternatives. Bigg, et al. (1985) manipulated the similarity of loan profiles by varying the attribute values describing profiles. It was found that as similarity of alternatives increased, percentage of information search increased and the variability of search decreased. Additionally, when task complexity was held constant, more subjects used compensatory strategies as the similarity of alternatives increased.

Payne (1982) suggested an explanation for the effects of similarity of alternatives on decision strategies based on the

hypothesis developed by Shugan (1980). According to Shugan (1980), cost of thinking associated with the use of different decision-making strategies is related to the perceptual similarity between alternatives. As the similarity between alternatives increases, the cost of thinking decreases. Thus, the more similar the alternatives, the more likely a compensatory strategy will be used because the cost or effort associated with using a strategy decreases (Payne, 1982).

Schmalhofer et al. (1986) used information display boards to study the effect of similarity of alternatives on information processing strategy. Subjects were 28 students indicating their choice between pairs of newsmagazines. The number of attributes with similar values was used as an indicator of similarity. The results were consistent with previous research. It was found that the amount of information examined differed among choice pairs. As the similarity of choice pairs increased, the amount of processed information increased.

Payne, Bettman, and Johnson (1988) used a Mouselab system to study the effects of variance of probability values and time pressure on decision strategy concerning gambles. Subjects were 16 undergraduate students. High variance of probability values and high time pressure were found to be associated with a lower amount of information acquired, a lower amount of time spent on each piece of information, a

higher amount of time spent on the most important attribute, a higher variability in information searched across alternatives and attributes, and a higher amount of attribute-based processing. The findings supported the hypothesis that subjects were adaptive and changed their decision strategies in response to changes in structure of alternatives and choice environments.

Environmental Characteristics

Relatively few studies have examined, manipulated, or measured the effects of environmental factors on decision-making processes (Ford et al. 1989). An environmental characteristic that has been examined in the literature is the importance of the decision.

Klayman (1985) used information display boards to study the effects of decision importance, task complexity, information display format, mental capacity, and sex on the use of decision-making strategies among 12-year-old children. Decision importance was manipulated by using three different decision tasks (buying a bicycle, choosing a summer camp, and selecting a "lunch" special). The findings indicated three-way interactions between mental capacity, decision importance, and task complexity concerning the proportion of information searched. Among the high ability children, there was an interaction between decision importance and task complexity.

When there were few alternatives, the amount of information searched was equally high for important and unimportant decisions. When there were many alternatives, important decisions received a higher proportion of information searched than unimportant decisions. However, these effects were not found in the low ability children.

Williams, DeNisi, and Blencoe (1985) used an analysis of information acquisition to examine the effects of task importance and response mode (rating vs choice) on amount of information searched. Subjects were 120 undergraduate students evaluating hypothetical employee performance. Task importance was manipulated by varying the purpose of performance appraisal (promotional vs remedial training). The study found a significant interaction effect between appraisal purpose and response mode. When the appraisal purpose was promotional (high importance), subjects searched for a greater amount of information under choice condition than under rating condition.

Billings and Scherer (1988) examined the effects of response mode and decision importance on the use of decision strategies. The importance of decision was manipulated by varying the instructions given to subjects prior to the experiment. The study found an interaction effect between response mode and decision importance on the amount of information searched. The amount of information searched

between subjects in the high and low importance condition was not significantly different when subjects were asked to give judgment. However, subjects in the high importance condition searched a greater amount of information than subjects in the low importance condition under the choice task. Additionally, there was a significant interaction effect between decision importance and task trials concerning the pattern of search. Under the low importance condition, subjects used less alternative-based processing in the later trials. Under high importance, there was no significant difference in the pattern of search over task trials. Subjects were found to use more alternative-based processing under the high importance than low importance condition.

In summary, empirical studies found a significant effect of the importance of the decision on decision-making processes. However, the effect appeared to be moderated by a number of factors such as task complexity, response mode, and cognitive ability.

Individual Characteristics

Individual characteristics that have been found to affect the decision-making processes include knowledge or experience, cognitive ability, perceived risk, involvement, demographic characteristics, and others.

Knowledge and Experience: Knowledge and experience are the most frequently examined individual characteristics (Ford et al., 1989). Park (1976) used structural analysis of final judgments to examine the effect of prior familiarity and product complexity on the use of decision-making strategies. Subjects were 294 students indicating their evaluation for various consumer products. Prior familiarity was measured as the extent to which subjects had established evaluative criteria for a product. Product complexity was measured as the number of criteria used in product evaluation. Decision models examined were: unweighted linear compensatory model; weighted linear compensatory model; conjunctive model; and disjunctive model. The study found the significant main effects of prior familiarity and product complexity in terms of predictive accuracy of decision models. The unweighted linear model was found to be more predictive for low familiarity consumers, while the weighted linear model was more predictive for high and moderate familiarity consumers. High product complexity was associated with higher predictive accuracy than low product complexity across decision models. The conjunctive and disjunctive models were found to be less predictive than unweighted and weighted linear models across groups.

Bettman and Park (1980) used verbal protocol analysis to study the effects of prior knowledge and experience and phase

of the choice process on decision-making processes. Subjects were 99 housewives indicating their choice for a microwave oven. Prior knowledge was measured as to whether subjects had search experience, usage experience, and ownership status. A subject with no search experience, usage experience, and ownership status was defined as low familiarity. A subject with search experience and/or usage experience was defined as a moderate level of familiarity. A subject with all three types of experience was defined as high familiarity.

The study found moderate knowledge subjects did more processing and searched more for available information than subjects with low or high prior knowledge. Subjects with more prior knowledge and experience used more brand processing, while subjects with less experience used more attribute processing. The effects of prior knowledge on decision processes may be explained by ability and motivation to process information (Bettman and Kakkar, 1980). Subjects with low prior knowledge may not have the ability to process the information, while subjects with high knowledge possessed the ability but may lack the motivation to do so or may have previously processed information stored in the memory, hence, did not need to do any further information processing. In contrast, the moderate knowledge subjects possessed both ability and motivation to process the information.

Additionally, subjects were found to use more attribute processing in the early phase and more brand processing in the later phase of the decision process. Subjects also tended to compare alternatives to standards in order to eliminate some alternatives in the middle phase of the choice processes. Tradeoffs among attribute values and comparison of alternatives were found in the later phase of the decision processes.

Jacoby, Chestnut, and Fisher (1978) used information display boards to examine the relationship between product importance, perceived risk, past purchasing experience, brand loyalty and information acquisition behavior. Subjects were 60 students indicating their choice of cereals. The study found that the mean proportion of information searched was only 2%. Amount of information searched was found to be positively related to product importance, and past purchasing experience. In contrast, brand loyalty was found to be negatively related to amount of information searched. Perceived risk was not found to relate significantly to amount of information searched.

Moore and Lehmann (1980) used information display boards to examine the relationship between individual difference variables and amount of information searched. A sample of 120 subjects indicating their choice of health bread during a six-week period. A multiple regression analysis indicated that

knowledge and experience was the most highly related variable to amount of information searched. As knowledge and experience increased, the amount of information searched decreased.

Hoyer and Jacoby (1982) used an analysis of information acquisition to examine the relationship between past experience, attitude toward sex and contraception, and amount of information searched. Subjects were 61 students indicating their choice of hypothetical birth control methods. In contrast to earlier findings, past experience and attitude measures were not found to be significantly related to amount of information searched. The study found the medical authority to be the most preferred source of information. The most frequently acquired types of information were health risks, effect on later conception, and effectiveness.

Brucks (1985) used an analysis of information acquisition to examine the effects of prior knowledge and usage situations on information search. Prior knowledge was conceptually categorized into subjective and objective knowledge. Subjective knowledge refers to what individuals think they know, while objective knowledge refers to what individuals actually know.

In the experiment, subjects acquired information about sewing machines from a computer data base. The results indicated an interaction effect between objective knowledge

and usage situation concerning the variability and appropriateness of information search. In the complex usage situation, objective knowledge was positively related to number of attributes examined and variability of search and negatively related to the amount of inappropriate search. These effects were not found in the simple usage situations. The relationship between objective knowledge and number of attributes examined was stronger in the complex situation than in the simple situation. In contrast, subjective knowledge was not significantly related to number of attributes examined but was found to relate to the use of dealer opinions. The results of the study provided some evidence supporting the distinction between objective and subjective knowledge.

Sujan (1985) used verbal protocol analysis to examine the effects of knowledge and type of product information - match/mismatch of information to category knowledge base - on evaluation strategies. Subjects were 126 students indicating their evaluation of cameras. Objective knowledge was measured using a 15-question multiple choice scale. The study found evaluation processing strategy to be related to prior knowledge and the match/mismatch of information to category knowledge base. When the given information matched category-based knowledge, knowledgeable subjects used category-based processing in which subjects spent less time forming the impression and evaluation, generated more thoughts related to

the product category and fewer thoughts related to product attributes. When the given information was discrepant from category knowledge, knowledgeable consumers used more analytical processing and spent more time forming an evaluation of the products. Novice subjects were found to use category-based processing more than knowledgeable subjects regardless of whether the given information match or mismatch category-based knowledge.

In sum, previous research reported inconsistent findings concerning the effects of prior knowledge on information acquisition and decision processes. Some studies reported a negative relationship between knowledge and information searched, while others reported a positive relationship or no relationship. The results may be due to differences in the operational definition of knowledge (objective versus subjective knowledge), and how information search is defined and measured. Brucks (1985) reported that subjective knowledge affected the information processing differently than objective knowledge.

The other explanation for the inconsistent findings deals with the nature of the relationship between knowledge and information search. Some researchers have found the inverted-U relationship, in which a positive relationship between knowledge and information search was found at low-to-moderate level of knowledge, and a negative relationship was found at

moderate-to-high level of knowledge (Bettman and Park, 1980; Johnson and Russo, 1984). However, Brucks (1985) did not find the inverted-U relationship between knowledge and information search in her study. Brucks (1985) stated that knowledge facilitates an acquisition and processing of new information, while simultaneously, makes it more efficient to screen out irrelevant or unimportant information. Thus, the relationship between knowledge and amount of information search may be positive, negative, or inverted-U, depending on whether the facilitating function or the efficiency function of knowledge is a stronger one in a particular situation.

Cognitive Ability: In addition to knowledge and experience, cognitive ability and skills were found to affect information acquisition and decision processes. Tan and Dolich (1980) utilized structural analysis of final judgments to examine the moderating effects of cognitive complexity and prior familiarity on decision processes. Cognitive complexity was defined as "the extent to which a person uses dimensions in a differentiated manner." Familiarity was measured as "the proportion of brands in a product class that one knew something about." Decision models examined in the study included linear compensatory models and lexicographic model. Subjects were 96 students indicating their preferences for

three product classes (automobiles, apartments, and toilet soaps).

The study found a significant main effect of cognitive complexity for two of three products studied. The predictive accuracy of decision models was found to be higher among cognitively complex subjects than cognitively simple subjects for automobiles and apartments. For the less important toilet soaps, there was no difference in predictive accuracy of decision models among high and low cognitive complex subjects. Prior knowledge did not have a significant effect on the predictive accuracy of the models. Additionally, linear compensatory models were associated with higher predictive accuracy than lexicographic model across groups.

Capon and Davis (1984) used information display boards to examine the relationship between cognitive ability and information processing strategies. Subjects were 60 female church members indicating their choice of steam irons and microwave ovens. Subjects were categorized into three groups according to the way they processed and acquired information ranging from complex processing (large number of alternatives examined and attribute processing) to simple processing (few alternatives examined and alternative processing). Performance on cognitive tasks was used to as a measure of cognitive ability. The study found performance on systematic

combination tasks to relate significantly to subject's information processing strategy.

Jacoby, et al. (1984) used information display boards to examine the relationship between performance level of security analysts and information processing strategy. Subjects were 17 security analysts indicating the "best buy" from a set of eight common stocks. The performance level was measured as the amount of increase in price per share for each analyst. The study found the relationship between performance level and amount and content of information searched. The better performance analysts searched approximately the same amount of information across task trials, while the lower performance analysts searched less information over trials. The better performance analysts were more likely to engage in more systematic processing of information as indicated by the tendency to consistently search for the same piece of information across alternatives. The better performers were also less likely to access information that did not provide predictive or explanatory value.

Perceived Risk: The effects of perceived risk on decision processes has been examined in three studies. Jacoby, Fisher, and Chestnut (1978) measured perceived risk in terms of likelihood that a new brand of cereal would be harmful to health or low in nutrition. Perceived risk was not

found to be significantly related to amount of information searched.

Moore and Lehmann (1980) measured perceived risk of buying bread by whether the bread was bought only for personal consumption. Buying for personal consumption was considered to lessen perceived risk associated with making a poor decision. The study found buying for personal consumption to be negatively associated with amount of information searched.

Capon and Burke (1980) used information display boards to examine the effect of perceived risk, information availability, and socioeconomic status on information acquisition behavior. Perceived risk was varied by using three different product classes. Microwave oven, toaster oven, and steam iron were used to represent high, medium, and low perceived risk, respectively. The study found perceived risk and information availability affected total amount of information searched but had no effect on content and sequence of search. High perceived risk and high information availability led to a greater amount of information searched.

Involvement: Involvement is considered to be a major determinant of an individual's motivation to process information (Andrews, 1988; Celsi and Olson, 1988; Rothchild, 1984). Houston and Rothchild (1978) differentiated between

three types of involvement: enduring involvement, situational involvement, and response involvement.

Enduring involvement was defined as "the strength of the preexisting relationships between an individual and the situation in which behavior will occur." (Houston and Rothchild, 1978). Enduring involvement is considered to be a stable characteristic of individuals that is independent of situation and is related to prior experience and the individual's values or goals.

Situational involvement was defined as "the ability of a situation to elicit from individuals concern for their behavior in that situation." Situational involvement is seen as situation specific and closely related to the concept of perceived risk (Block and Richins, 1983; Houston and Rothchild, 1978; Laurent and Kapferer, 1985).

Response involvement was defined as "the complexity or extensiveness of cognitive and behavioral processes characterizing the overall consumer decision process." Response involvement is a function of enduring and situational involvement (Houston and Rothchild, 1978; Celsi and Olson, 1988).

Richins and Bloch (1986) examined the behaviors associated with acquiring and disseminating information concerning automobiles. The study found behaviors associated with enduring involvement to be stable over time, while

behaviors associated with situational involvement declined as the situation inducing the involvement changed.

Celsi and Olson (1988) examined the effects of enduring and situational involvement on attention and comprehension phases of information processing of the product advertisement. A sample of 136 subjects was exposed to the ad about tennis equipment. Situational involvement was manipulated by telling subjects in the experimental group that they would have a chance of winning a lottery to obtain their choice of advertised product. Both enduring and situational involvement were found to have a significant main effect on attention and comprehension processes. Subjects in the high situational involvement condition spent more time processing the ad, produced a higher total number of thoughts, had a higher proportion of product-related thoughts, and a higher proportion of product-related inferences than did subjects in the control group.

Tyebjee (1979) examined the level of conflict and involvement on choice time. Subjects were 48 students indicating a choice between a pair of beers. Level of conflict is a function of the relative preference for each alternative. Product involvement was measured as weekly consumption, perceived product differentiation, and self-report knowledgeability. The study found that as level of conflict increased, the time taken to make a choice increased.

Product involvement was not found to relate to choice time. However, Tyebjee (1979) concluded that the lack of involvement effect may be due to inadequate measures of product involvement.

Gensch and Javalgi (1987) used structural analysis of final judgments to examine the effects of involvement on decision-making processes. A random sample of 500 farmers indicated their preferences for retail outlets. Decision models examined were logit compensatory model and maximum likelihood hierarchical model (noncompensatory model). High-involved decision maker was defined as any farmer who took an advanced course concerning soil fertility, sought information from less than four retail outlets, and/or applied their own fertilizer.

The findings supported the research hypothesis that low-involved individuals used a hierarchical noncompensatory decision process, while high-involved individuals used a linear compensatory decision process. The maximum likelihood hierarchical model (MLH) was found to have a higher predictive accuracy than the logit model for the low-involved farmers, while the logit model had a higher predictive accuracy for the high-involved farmers.

In addition, the importance of attributes in affecting decisions differ between high- and low-involved subjects. High-involved subjects tended to give more weight to service

attributes, while low-involved subjects regarded reputation, size, and price as more important. Low-involved subjects made their choice by using fewer attributes than high-involved subjects.

Demographic Variables: Demographic variables that have been examined in the literature were socioeconomic status, gender, age, etc. Capon and Burke (1980) found a significant interaction effect between perceived risk and socioeconomic status on total amount of information searched. High socioeconomic subjects searched a higher amount of information than low socioeconomic subjects when choosing a high perceived risk product. High socioeconomic subjects also used more high level processing strategies (search for at least one item of information across alternatives) than low socioeconomic subjects. Low socioeconomic subjects searched less information in general and tended to ignore some alternatives completely when acquiring information. Capon and Burke (1984) suggested that lower socioeconomic status may be associated with lower processing ability.

Klayman (1985) found a significant interaction effect between gender and mental capacity concerning the proportion of information searched. Boys and girls in the low ability group searched the same proportion of information. However, in the high ability group, girls searched a greater proportion

of information than boys. Klayman suggested that further research is needed to investigate the gender differences hypothesis.

Schaninger and Sciglimpaglia (1981) used information display boards to examine the effects of demographics and cognitive personality trait on information acquisition behavior. A sample of 120 housewives made purchase decisions regarding four product classes (coffee, creamer, lemonades, and dryers). Housewives who were younger, earlier in the family life cycle, more educated, of higher social class, and nonhomeowners searched a greater amount of information. In addition, housewives who were more tolerant of ambiguity, having clarifier cognitive style, and higher self-esteem searched a greater amount of information concerning attributes and alternatives across four decisions.

Other Individual Characteristics: Other individual characteristics that have been examined in the literature included affective state and level of stress. Isen and Means (1983) used verbal protocol analysis to examine the effect of a positive feeling state on decision-making strategy. Subjects were 26 students indicating their choice for hypothetical automobiles. Subjects in the positive feeling state were given feedback concerning their success in performing a prior task of perceptual-motor skills. Subjects

in the positive feeling state condition spent less time making a decision, searched fewer attributes, and were less likely to reacquire the same piece of information than subjects in the control condition.

None of the subjects was found to use linear compensatory strategy in decision making. Subjects in the positive feeling condition were more likely to use the elimination by aspects strategy by eliminating some alternatives which did not meet the cutoff level on important attributes.

Keinan (1987) used an analysis of information acquisition to examine the effect of stress on the scanning and consideration of relevant alternatives phase of the decision-making process. Subjects were 101 students performing a multiple-choice analogies test. Stress was manipulated by telling subjects in the experimental groups that electric shocks may be administered. Subjects in the experimental groups were more likely to answer the tests before all alternative answers had been considered and to scan alternatives nonsystematically than did subjects in the control group. In addition, the patterns of alternative scanning were found to be related to the quality of answers given to decision problems. A complete scanning of alternatives was more likely to lead to a correct solution than an incomplete scanning of alternatives.

A Cost/Benefit Framework

A cost/benefit framework provides an explanation of why the use of various decision-making processes varies across decision situations. The framework suggests that the choice of a decision strategy is a function of a compromise between perceived costs and perceived benefits (Beach and Mitchell, 1982; Einhorn and Hogarth, 1981; Payne, 1982; Russo and Doshier, 1983). Perceived costs include effort and time spent in acquiring information and making decisions. Perceived benefits of a strategy refers to the ability of a strategy to select the correct decision, and its justifiability (Payne, 1982).

According to Payne (1982), this framework is appealing because it assumes that the decision maker is rational and the observed use of a suboptimal decision-making strategy is a result of balancing the costs and benefits. Additionally, since costs and benefits of various decision strategies differ across situations, the cost/benefit approach provides an effective framework for examining contingent decision behavior due to characteristics of task, decision environment, and individual decision makers.

Russo and Doshier (1983) also proposed that strategy selection is a "deliberate" process and strategies are selected based on trade-offs between efforts and errors. In a series of experiments using eye fixation analysis, Russo

and Doshier (1983) found that subjects used mainly a dimensional (attribute) processing strategy in choosing between two alternatives when the task environment was neutral and either dimensional or holistic processing strategy was equally appropriate. Dimensional processing is easier to use than alternative processing; thus, the observed use of dimensional processing demonstrated subjects' desire to reduce cognitive effort.

However, when the task environment was more appropriate for holistic processing in terms of yielding a more accurate response (i.e. the dimensions of alternatives were dependent), holistic and dimensional strategy were equally used by subjects. The results indicated that some subjects trade-off between effort and error in the selection of processing strategy.

Beach and Mitchell (1978) developed the most comprehensive model based on a cost/benefit framework (Payne, 1982). Beach and Mitchell (1978) identified categories of decision strategies ranging from the use of a complex computer program, linear compensatory processes, noncompensatory processes, to nonanalytic processes such as flipping a coin or repeating a previous choice. The contingency model for the selection of decision strategies assumes that the perceived cost of using a strategy increases as the degree of analytic complexity of a strategy increases. However, the perceived

probability of a strategy leading to a correct decision increases as the degree of analytic complexity of a strategy increases.

According to the model, strategy selection is contingent upon 1) task characteristics; 2) decision environment characteristics; and 3) decision maker characteristics. Task characteristics are those characteristics that are inherent in the decision problem. Task characteristics include unfamiliarity, ambiguity, complexity, and instability of the task. Task familiarity is defined by the degree to which the decision maker has had experience with the decision problem. Task ambiguity is defined by the degree to which the decision maker is clear about the goals, and the elements of the task. Task complexity is defined by the number of alternatives and/or attributes in the decision problem and the degree to which the outcome of the decision influences future decisions. Task instability is defined by the degree to which the criteria, goals, and structure of the decision problem changes.

Decision environment characteristics are characteristics that describe the decision environment. Environmental characteristics include the importance of the decision, the irreversibility of the decision, and the degree to which the decision maker is accountable for the decision (accountability), and time or resource constraints.

Decision maker characteristics include the knowledge the decision maker has about the decision strategies and the probability that each strategy would lead to a correct decision, the ability to use the strategies, and the motivation to spend time and effort making a decision.

Greater unfamiliarity, ambiguity of goals, complexity, and instability of the decision problem decrease the probability of making a correct decision and indicate a need to use a more analytical strategy to increase the perceived probability of making a correct decision. Greater significance of the decision problem, irreversibility of the decision, and the accountability of the decision maker for the decision increase the perceived benefits of a correct decision and indicate a need to use a more analytical strategy.

Additionally, the more knowledgeable, intelligent, cognitively complex, and motivated the decision maker is, the more likely an analytical strategy is used in a given situation. However, the use of a more analytical strategy is associated with increasing time and effort spent in making the decision. The decision strategy used in a given situation is a result of trade-offs between the costs and benefits.

Empirical Studies of Beach and Mitchell's Model

A number of studies have tested hypotheses derived from Beach and Mitchell's model and found support for the model's

explanation of contingent decision behavior. Christensen-Szalanski (1978) conducted a series of experiments to examine the model's assumption that strategy selection is a function of perceived costs and perceived benefits. Subjects were 12 business students performing the profit estimation task. Benefit was manipulated by varying the percentage points given to a correct decision. Each subject was shown a list of eight strategies which varied in the degree of complexity and the use of available information and was asked to choose a strategy to be used in the estimation task. The study found that as the benefits of making a correct decision increased, subjects spent more time making the decision, were more confident in the answers, and used more complex strategies to solve the problem.

Christensen-Szalanski (1978) concluded that one should not assume that the problem solvers or the decision makers consciously make all the computations implied by the model; however, the decision makers do consider the benefits and costs incurred in performing various decision tasks.

McAllister, Mitchell, and Beach (1979) conducted a series of experiments to test the effects of significance, irreversibility, and accountability on the selection of decision-making strategies. Subjects were business students who were given a list of decision strategies and were asked to select a strategy to solve various business problems. The

hypothetical decision cases were described as either significant or insignificant via the impact on the financial status of the company; the decision maker was either accountable or not accountable for the decision; and the decision was either reversible or irreversible at a later point in time.

The results indicated a significant main effect for each independent variable. When the decision was more significant, when the decision was irreversible, and when the decision maker was accountable for the decision, subjects selected more analytical strategies and spent more time making the decision.

Smith, Mitchell, and Beach (1982) also used Beach and Mitchell's model as a conceptual framework. The study examined the effects of time constraint, task complexity, and importance of the decision on the selection of a decision strategy. Subjects were 64 business students making investment analyses. Task complexity was varied by requiring subjects to either compute five or two measures for investment analyses. Significance of task was manipulated by varying the amount of payoffs for a correct decision. Time constraints was manipulated by varying the time allowed to perform the task.

High time constraint was found to decrease subjects' confidence in the ability to implement the strategy for the complex strategies. However, time constraint was not found to

affect the confidence level for the simple decision strategies. Subjects who selected a more complex strategy were more confident in their ability to implement the strategy than subjects who selected a less complex strategy.

Subjects were found to select a less complex decision strategy when the task was more complex. However, the significance of the decision was not found to significantly affect the selection of decision strategies; although the effects were in the hypothesized direction. The researchers concluded that the lack of effects of importance of the decision may be due to a weak manipulation of the variable because the amount of difference in payoffs between the two conditions may not have been sufficiently large.

Waller and Mitchell (1984) , using the Beach and Mitchell model as a framework, examined the effects of state uncertainty and significance of the decision on the selection of decision strategies. Subjects were 64 accounting students assuming a role of manager in making a decision concerning whether to investigate a cost variance problem. Subjects were given a list of five decision strategies and were asked to select one strategy to solve the problem.

Significance was manipulated by varying the significance of the decision to the firms in term of financial impact, the significance in compensation for the manager, and the significance in future personal consequences to the manager.

Uncertainty was manipulated by varying the description of the production process as either 90% or 50% in control.

The results indicated that subjects selected more complex decision strategies as state uncertainty increased, when the decision had a significant financial impact, when the manager compensation was dependent on the company's profit, and when the manager assumed personal consequences of the decision. The researchers concluded that the results of the study provided empirical support for the Beach and Mitchell model explanation of contingent decision behavior.

The Use of Simulated Cases in Research

Research in clinical decision-making using information processing (process tracing) and structural analysis of final judgments paradigms have used simulated patient cases to examine medical decision making (Elstein, et al., 1983). A simulated patient case or a standardized case enables the researchers to experimentally control for the type and amount of information in the decision environment and to study the effects of selected independent variables on physician judgment and choice processes. On the other hand, the use of actual patient cases makes it difficult to control for a large number of attributes and information that may be present or to compare results across physicians (Wigton, 1988).

Elstein, et al., (1983) indicated two limitations concerning the external validity associated with the use of simulated patient cases or written case presentation in medical decision-making research. First, hypothetical cases can only include certain variables; thus other important variables that may be crucial to the decision problem may be ignored. Examples of commonly ignored variables are time constraint and patient's appearance. Second, the use of hypothetical cases may affect the responses given because physicians know they are being observed in the study.

However, studies have found high correlations between judgments concerning simulated cases and actual judgments (Kirwan, et al., 1983; Kuyvenhoven, et al., 1984; Rovner, et al., 1986). For example, Kuyvenhoven et al., (1984) compared the simulation performance with prescription and referral data concerning actual patients. The amount of certain drugs prescribed (analgesics, antirheumatics, hypnotics, sedatives, tranquilizers, neuroleptics, and antidepressant drugs) and the number of referrals to specialists were used as indicators of a risk of unnecessary harm to patients.

A sample of 19 general practitioners was studied. The general practitioners who had a high correlation between the prescribing data and the referral data were included. In the simulation, experts determined "a risk of unnecessary harm to the patient" caused by physician's therapeutic procedures.

The study found a high correlation between prescription and referral data with the ratings of the risk of unnecessary harm to the patient in the written simulation. The results of the study can be used to demonstrate that performance and judgment in simulation cases are related to performance and judgment in actual cases.

CHAPTER 3

METHODOLOGY

This research was conducted to determine the effects of situational involvement and task complexity on the information acquisition and decision-making process used by physicians. A process-tracing technique was used to collect process measures such as the amount of time spent per item of information acquired, the proportion of information acquired, the variability in proportion of information searched across alternatives, the variability in proportion of information searched across attributes, and direction of search. In addition, an analysis of final judgment (i.e. conjoint analysis) was used to test the accuracy of applying the part-worths obtained from a linear compensatory model to predict drug choices made under various conditions of situational involvement and task complexity.

Subjects

A sample of practicing physicians in the departments of family practice, internal medicine, and obstetrics and gynecology was recruited from the University Medical Center, University of Arizona. These specialty groups were selected because they are likely to treat patients with uncomplicated urinary tract infection; which was the hypothetical case used

in the study. Physicians were sent a letter explaining the purpose of the study and requesting participation. A week later, physicians were contacted via phone by the investigator to solicit participation. Prospective subjects were offered fifty dollars to participate. A total of forty eight subjects was included in the study.

Development of Experimental Stimuli

The development of experimental stimuli was divided into two parts. The first part involved the development of a hypothetical patient description or case scenario. In the second part, sets of drug alternatives used in conjoint analysis and process tracing were developed.

Development of a Case Scenario: In order to achieve the objectives of the study, a disease state was needed that: 1) has clear-cut drug therapy; 2) is self-limiting; and 3) is associated with the use of drug alternatives that warrant a physician's justification in the context of drug use review and evaluation. These conditions were required for a successful manipulation of situational involvement. The first two criteria were required to minimize ceiling effects of the manipulation. It was assumed that if a disease state that is severe, ambiguous, and/or has no clear-cut drug therapy was used, the level of existing involvement with the decision may be too high to allow for the manipulation to further increase

the level of situational involvement. The third criterion was needed to reflect reality and increase the believability of the involvement manipulation.

An acute uncomplicated urinary tract infection and its treatment (anti-infective drugs) met the criteria and were used as the disease state and the drug class for developing the experimental stimuli. The hypothetical patient description used in the study was developed by adapting case studies available in the medical literature (Fruchtman, Newman, 1979; Parrish, 1983).

Development of Sets of Drug Profiles: Three sets of drug profiles were needed. One set was required for a conjoint analysis, and the remaining sets for an analysis of information acquisition behavior (i.e., process tracing).

Five drug attributes describing drug profiles were identified through previous research as relevant and important in influencing physician prescribing (Carlson, 1987; Chinburapa, et al., 1987; Chinburapa and Larson, 1988; Segal and Hepler, 1982,1985; Zelnio, 1982). These drug attributes were: efficacy, side effects, cost, dosage schedule, and duration of treatment. Two side effects were included, for a total of six drug attributes. Each drug attribute was assigned three levels. The levels of drug attributes were selected through a review of clinical studies and medical

textbooks to reflect the range of existing characteristics of anti-infective drugs used to treat acute uncomplicated urinary tract infection (Bauernfeind, Naber, and Sauerwein, 1987; Gomez-Lus and Calvo, 1987; Kunin, 1987; Slack, Greenwood, 1987; Williams, 1987).

A set of 18 hypothetical drug profiles used in conjoint analysis was developed using a fractional factorial design from a possible 3^6 (729) possible combinations (Addelman, 1962; Plackett and Burman, 1946). The type of fractional factorial design used was a symmetric orthogonal array or the additive main-effect model in which each level of the drug attributes appears an equal number of times. In addition, a necessary and sufficient condition for any two attributes to be uncorrelated is that each level of one attribute appears with each level of another attribute an equal number of times (Green, 1974). Previous research indicated that the orthogonal array design performed as well as the full factorial design in terms of part-worth estimation (Carmone, et al., 1978). The orthogonal array used to construct the profiles was based on Addelman's basic plan 4 (1962). The randomization procedure was used to randomly assign six drug attributes and their levels to the corresponding plan columns and the numbers 1,2,3 representing the levels of each attribute. The set of 18 profile combinations and their randomly assigned order of attributes and levels are shown in

Tables 3.1-3.2. An example of hypothetical drug profiles is shown in Table 3.3.

The remaining two sets of drug profiles used for an analysis of information acquisition behavior were developed using the following criteria: 1) the levels of the drug attributes in a particular profile were not consistently favorable or unfavorable across all drug attributes; and 2) no drug alternative in a choice set dominated all other alternatives across all attributes. These criteria were needed to increase the likelihood that the differences between the use of different decision-making processes would be detected if such differences existed (Einhorn, 1970, 1971; Park, 1976). The 9 profiles were developed based on an orthogonal array of 27 profiles (Plackett, Burman, 1946). The profiles that did not meet the above criteria were eliminated and/or modified until nine profiles remained. Three profiles were randomly chosen for the set of one decision task, and the remaining six profiles were used in the other set.

Conjoint Analysis

This study utilized conjoint analysis to determine the predictive validity of applying the linear compensatory model in predicting physician drug choice under different levels of situational involvement and task complexity. Conjoint analysis is an analytical research tool that utilizes a

Table 3.1. Drug Attributes and Their Levels Used to Construct Drug Profiles

Attributes	Levels
I. Cost per Treatment	1. \$25 2. \$10 3. \$5
II. Incidence of GI upset	1. 14% of patients 2. 2% of patients 3. 7% of patients
III. Daily Dosage Schedule	1. four a day 2. twice a day 3. once a day
IV. Duration of Treatment	1. 7 days 2. 1 day 3. 3 days
V. Bacteriological Cure Rate	1. 93% of patients 2. 78% of patients 3. 63% of patients
VI. Incidence of Vaginitis	1. 14% of patients 2. 2% of patients 3. 7% of patients

Table 3.2. Orthogonal Main Effects Design for 3^6 Profile Set

Profile Combination	Drug Attributes					
	I	II	III	IV	V	VI
1	1	1	1	1	1	1
2	1	2	2	3	2	2
3	1	3	3	2	3	3
4	2	1	2	2	2	3
5	2	2	3	1	3	1
6	2	3	1	3	1	2
7	3	1	3	3	2	1
8	3	2	1	2	3	2
9	3	3	2	1	1	3
10	1	1	3	2	1	2
11	1	2	1	1	2	3
12	1	3	2	3	3	1
13	2	1	1	3	3	3
14	2	2	2	2	1	1
15	2	3	3	1	2	2
16	3	1	2	1	3	2
17	3	2	3	3	1	3
18	3	3	1	2	2	1

Table 3.3 An Example of Hypothetical Anti-Infective Drug Profile

Drug PS	
Cost Per Treatment :	\$25
Incidence of GI Upset:	14% of patients
Dosage Schedule:	four times a day
Duration of Treatment:	7 days
Cure Rate:	93% of patients
Incidence of Vaginitis:	14% of patients

decompositional approach to study individual preferences or judgments. Generally, the subjects are shown a set of hypothetical product profiles which are constructed from a predetermined combination of product attributes. The subjects are then asked to give an overall judgment (ranking, or rating) regarding those hypothetical profiles. The subject's overall judgment is decomposed to determine the part-worths, or utilities for the various levels of each product attribute and to determine the relative importance of the product attributes in influencing overall judgment. Consequently, the part-worths obtained are used to predict the choice made by the subjects. The accuracy with which the model predicts the actual choice is used to indicate the predictive validity of the conjoint model.

In this study, the utilities for each attribute level or the part-worths were estimated using the LINMAP (LINNear programming techniques for Multidimensional Analysis of Preference) for microcomputer (Srinivasan and Shocker, 1973a, b). LINMAP is a nonmetric parameter estimation method that uses ordinal preference judgments (i.e., rankings) as input. LINMAP differs from the other approaches of parameter estimation in that it uses linear programming techniques. The use of linear programming enables LINMAP to obtain global optimum parameter estimates (Green and Srinivasan, 1978). LINMAP is considered to be the only globally optimal nonmetric

procedure for analyzing preference judgment (Shocker and Srinivasan, 1979).

Process-Tracing Method

The process-tracing technique employed in this research was the analysis of information acquisition behavior. The analysis of information acquisition behavior is based on a method that collects data concerning the amount of information acquired, content of information acquired, sequence of information searched, and duration of search prior to making a decision.

This study utilized the Mouselab software system to monitor information acquisitions (Johnson, et al., 1989). The system is operated using an IBM or IBM-compatible personal computer and uses computer graphics to display a set of alternatives in a form of alternative-by-attribute matrix. On a display screen, the alternatives are listed across the top of the matrix, while various attributes are listed down the left-hand side of the matrix. Each column of information in the matrix represents an alternative while each row represents an attribute across all alternatives presented. Each cell of the matrix contains the value of an attribute for the alternative that forms the cell. The values for alternatives and attributes in the matrix are hidden behind the blank boxes. To access and examine the information in each box

prior to making a choice, the subject needs to move a cursor into the box by using a hand-controlled pointing device called a "mouse". The box then opens and displays the value. The box will remain open until the cursor is moved out of the box. Only one box can be opened at a time. The Mouselab software records the order in which boxes are opened, the amount of time and frequency that each box is opened, total decision time, and the chosen alternative. Response times are recorded to an accuracy of 1/60th of a second. Figure 3.1 shows an example of a display of an attribute value using the Mouselab system. Figures 3.2-3.3 show the two sets of drug alternatives used for the analysis of information acquisitions with all the boxes opened.

According to Payne, Bettman, and Johnson (1988):

"The Mouselab methodology comes close to the recording of eye movements in terms of speed and ease of acquisitions, while minimizing instrumentation costs and difficulty for both subject and experimenter. ...the time to acquire information using the Mouselab system is limited mainly by the time it takes to think where to point, rather than by the time it takes to move the mouse".

The Mouselab software system was considered useful and practical as a process-tracing technique because it is easy to learn. This leads to decreased time and effort to acquire information and decreased reactivity on the part of subjects (Johnson, et al., 1989). Previous research using the Mouselab system as a process-tracing method indicated that the use of

Figure 3.1. An Example of a Stimulus Display Using the Mouselab Program

	Drug A	Drug B	Drug C
Cost per Day	<input type="text"/>	<input type="text"/>	<input type="text"/>
GI Upset Incidence	<input type="text" value="14%"/>	<input type="text"/>	<input type="text"/>
Dosage Schedule	<input type="text"/>	<input type="text"/>	<input type="text"/>
Duration (days)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cure Rate	<input type="text"/>	<input type="text"/>	<input type="text"/>
Vaginitis Incidence	<input type="text"/>	<input type="text"/>	<input type="text"/>
Choose one:	<input type="text" value="Drug A"/>	<input type="text" value="Drug B"/>	<input type="text" value="Drug C"/>

Figure 3.2. A Choice Set of Three Drug Alternatives

	Drug A	Drug B	Drug C
Cost per Day	\$5	\$10	\$25
GI Upset Incidence	14%	7%	7%
Dosage Schedule	1/day	2/day	2/day
Duration (days)	3	1	7
Cure Rate	63%	78%	93%
Vaginitis Incidence	2%	7%	2%
Choose one:	Drug A	Drug B	Drug C

Figure 3.3. A Choice Set of Six Drug Alternatives

	Drug A	DRUG B	DRUG C	DRUG D	DRUG E	DRUG F
Cost per Day	\$10	\$5	\$25	\$5	\$25	\$5
GI Upset Incidence	2%	7%	7%	14%	2%	14%
Dosage Schedule	1/day	2/day	1/day	1/day	4/day	1/day
Duration (days)	3	1	1	3	1	1
Cure Rate	93%	78%	93%	63%	63%	93%
Vaginitis Incidence	14%	14%	7%	7%	7%	14%
Choose One	Drug A	Drug B	Drug C	Drug D	Drug E	Drug F

the Mouselab system itself did not change subject's decision strategies (Payne, Bettman, and Johnson, 1988). In addition, the results obtained from studies using other process-tracing techniques (e.g., verbal protocols and information display boards) were replicated by subjects using the Mouselab system (Johnson, Meyer, and Ghose, 1988; Johnson, Payne, and Bettman, 1988; Schkade and Johnson, 1989; Payne, Bettman, and Johnson, 1988). Thus, the Mouselab System was considered appropriate as a process-tracing technique in this study.

Experimental Procedure

The subjects were tested individually. Each experimental session was held in the subject's office at the practice site. Each subject was given an honorarium of \$50 for participating in the study. Subjects were told that the purpose of the experiment was to better understand how physicians make prescribing decisions. Subjects were randomly assigned to experimental and control groups and were given written instructions that guided the subjects through the entire experiment (Appendix A-G).

Subjects in both groups were given a written case scenario of a patient with an acute uncomplicated urinary tract infection. In reference to the scenario, subjects answered questions measuring the level of enduring involvement with the decision task. Following, subjects were given

instructions on the operation of the Mouselab program and a sample decision task. The sample task allowed subjects to become familiar with the program prior to performing the actual decision tasks. The sample decision task concerned choosing an apartment to rent from a set of four apartment alternatives. The alternatives were described on five attributes. These attributes were: rent, distance from work, room size, noise level, and parking facility. The apartment alternatives and their attribute levels were developed based on the study by Payne (1976). Subjects could repeat the sample decision task as many time as they wished.

After the practice session, subjects in both groups were required to perform the two choice tasks using the Mouselab program. To minimize order effects, the order of the two choice tasks were randomized across subjects. Additionally, the differential carry over effects were minimized by having subjects performed the wash-out task unrelated to drug prescribing prior to performing the second choice task.

Following the choice tasks, subjects performed the ranking task. Subjects were shown a set of 18 hypothetical drug profiles described individually on 3" x 5" cards and were asked to first sort the cards into three groups: "high chance of prescribing", "fair chance of prescribing" and "low chance of prescribing" the drug to the described patient. After sorting, subjects were asked to rank the cards in each

group from the highest chance to the lowest chance of being prescribed to the hypothetical patient.

As a manipulation check, subjects answered post-experimental questions measuring the levels of situational involvement with the decision task. Background information such as type of specialty, number of years in practice, self-rating of expertise in the treatment of urinary tract infection, and age were also obtained.

Independent Variables

The two independent variables in the study were situational involvement of physicians and task complexity. The levels of situational involvement were manipulated by having physicians in the experimental group assume that their decisions will be reviewed and evaluated by their peers and that they will be required to justify their choice of drug with an infectious-disease specialist (See Appendix D).

Subjects in the control group were shown only the case scenario prior to making a choice. No mention was made regarding the above assumption.

Task complexity was experimentally manipulated by varying the number of drug alternatives in a choice set. Subjects in each group were required to make one choice with three alternatives and a second choice with six alternatives. The order of the choice task was randomized across subjects. The

levels were chosen based on previous research that found significant difference between the two levels on the use of decision-making process (Johnson, Meyer, Ghose, 1989; Payne, Braunstein, 1978).

Research Design

The experimental research design used in the study was a two-treatment (2x2) mixed model factorial design (Keppel, 1982). The two main effects were the situational involvement and task complexity. The between-subjects factor was the level of situational involvement of physicians in the experimental and control group (i.e. high versus low situational involvement). The within-subjects factor was the level of task complexity (i.e., three versus six alternatives). The research design is illustrated in Figure 3.4.

Dependent Variables

The dependent measures obtained during the decision task using the Mouselab software system were the following: average time spent acquiring information per drug alternative, average time spent per item of information acquired, number of information acquisitions, the proportion of information searched, variability in proportion searched across alternatives, variability in proportion searched across

Figure 3.4. A Two-Treatment (2 x 2) Mixed-Model Factorial Design

Repeat Process Measures

Treatment Group	Task Complexity	
	Low	High
Experimental		
Control		

Treatment Group:

Experimental = Subjects received situational involvement manipulation

Control = Subjects did not receive situational involvement manipulation

Task Complexity:

Low = Subjects chose one drug from a set of three drug alternatives

High = Subjects chose one drug from a set of six drug alternatives

attributes; concentration of search, direction of search, and proportion of time spent on each drug attribute.

In the analysis of process measures, brief exposures of information that occur when the computer cursor accidentally opens one box on its way to another were excluded. According to Schkade and Johnson (1989), brief exposures of less than 150 milliseconds duration are considered too short to produce a meaningful mental representation. Therefore, in this study, all information acquisitions of less than 150 milliseconds duration were excluded from the analysis.

In addition, an analysis of information acquisition that was used in this study allowed subjects to have access to the same piece of information as many times as they wished. Thus, the process measures of variability of information search across alternatives and variability of search across attributes were calculated based on both first time acquisition of information and reacquisition of the same piece of information.

According to Payne (1976) and Klayman (1983), the proportion of information searched is determined by dividing the amount of first time acquisitions of information by the total available. Variability in proportion searched across alternatives is the standard deviation of the proportion of information searched per alternative across available alternatives in a choice set. Variability in proportion

searched across attributes is the standard deviation of the proportion of information searched per attribute across available attributes in a choice set. Variability of search across alternatives and attributes was calculated twice. The first measure was based only on the first time acquisition of information, while the second measure was based on all acquisitions of information.

Concentration of search (P) is the measure of processing strategy and was defined by Johnson et al. (1989) as:

$$P = (CA \times NA / TA) - 1$$

where CA is the number of information acquisitions of the chosen alternative, NA is the number of alternatives in a choice set, and TA is the total number of acquisitions across alternatives. Positive values of P indicate that information search is concentrated on the chosen alternative, while a value of zero indicates that a subject searches each alternative equally. A higher positive value of P results from the use of relatively more noncompensatory process to eliminate some alternatives from consideration prior to making a choice (Johnson, et al., 1989), while a lesser value indicates the use of relatively more compensatory process to examine each alternative equally across alternatives.

Direction of search is the measure of the relative use of alternative-based versus attribute-based processing. The index is determined by examining the alternative and attribute

associated with nth and n+1th item of information searched. If the n+1th piece of information searched is of the same alternative as the nth item, it is considered as an interattribute transition (alternative-based processing). If the n+1th piece of information searched is of the same attribute as the nth item, but involved a different alternative, it is considered as an intraattribute transition (attribute-based processing). If the n+1th item of information searched is within neither the same alternative nor the same attribute on the nth item of information, it is considered a shift in the sequence of information searched. The index of direction of search is determined as:

$$(\text{Inter} - \text{Intra}) / (\text{Inter} + \text{Intra}),$$

where "Intra" is the number of intraattribute transitions, and "Inter" is the number of interattribute transitions. The value ranges from -1 to +1. A sequence of search that consists only of interattribute transitions and shift transitions has a value of +1. A sequence of search that consists of only intraattribute transitions and shift transitions has a value of -1. Thus, a more negative value indicates the use of relatively more attribute-based processing, and a more positive value indicates the use of relatively more alternative-based processing. The concentration and direction of search were determined based on

both the first acquisition of a piece of information and reacquisition of that piece of information.

In addition to process-tracing measures, subjects' search patterns recorded by the Mouselab program were classified according to the proportion of information searched and direction of search. The search pattern was categorized as: compensatory processes when subjects searched all, or almost all, of the available information; noncompensatory processes when subjects searched a subset of available information. Additionally, the search pattern was classified as attribute-based, alternative-based, or mixed. Attribute-based processing is implied when subjects acquire information on drug attributes across alternatives, while alternative-based processing involves the subject examining one alternative across attributes before proceeding to the next alternative.

In addition, search patterns were examined for the use of mixed models or sequential decision-making process in which subjects used noncompensatory process to eliminate unacceptable alternatives and then used compensatory processes or noncompensatory processes to compare a few or a subset of alternatives. A form for classification of individual search pattern is displayed in the Appendix H.

Two graduate students in the College of Pharmacy, both of whom were unaware of the purpose of the study, acted as independent judges in the classification of the individual

search patterns. The judges were trained by the investigator. During the training session, judges were given a description of various types of decision-making processes, a classification form, and were instructed on the classification of the search patterns. Following the training session, judges were given a few examples of search patterns to practice with feedback from the investigator.

Although search patterns can be classified into specific models such as additive-model or elimination by aspect model, the main emphasis of the study was to distinguish between the more general classes of compensatory and noncompensatory processes. The more general classification is considered to be more pertinent to the purpose of the study. Furthermore, researchers have found that human decision making is complex and tends to involve the use of various combinations of decision strategies rather than the use of a single model alone (Bigg, 1985; Payne, 1976, 1982; Klayman, 1983).

In this study, the use of mixed models or sequential decision strategies was classified as noncompensatory process since any decision strategy which is not compensatory may introduce bias into the decision process (Hogarth, 1980). For example, the use of noncompensatory processes such as elimination-by-aspect to eliminate undesirable alternatives from a choice set prior to using compensatory processes to choose an alternative does not assure that the "best"

alternative remains in the choice set. Furthermore, subjects may not consider all important relevant attributes in the early stages.

Measurement of Involvement: Zaichkowsky's (1985) Personal Involvement Inventory (PII) was modified and used to measure physician's enduring involvement with the decision tasks. The involvement scale contains 15 items. Each item was labeled with 7-point bi-polar adjectives, such as important/unimportant, significant/insignificant, essential/nonessential, etc. (See Appendix B). Each item was scored from 1 to 7, in which a score of one (1) indicated a low level of enduring involvement, and a score of seven (7) indicated a high level of enduring involvement. A score of four (4) indicated neutral. The score for the fifteen items was then summed and divided by the number of items (15) to obtain the score of enduring involvement.

Manipulation Check: Situational involvement was assessed by asking subjects to indicate the extent of agreement/disagreement with two Likert-scaled statements. Each statement was on a 6-point scale ranged from "strongly disagree" to "strongly agree". Each item was scored from 1 to 6, in which a score of one (1) indicates a low level of agreement, and a score of 6 indicates a high level of agreement. The two items were averaged to form a manipulation check score. The items are presented in Appendix G.

Statistical Analysis

The data were analyzed by several statistical methods using the SYSTAT 4.0 (1988), a statistical software package for personal microcomputer. All statistical tests were conducted at the 0.05 level of significance.

To ascertain whether the experimental manipulation affected the level of situational involvement, a Student's t-test was conducted to test the significance of the difference in the mean scores of situational involvement between subjects in the experimental and control group.

Additionally, Student's t-tests and chi-square analyses were conducted to determine whether the two treatment groups were comparable in levels of enduring involvement and selected background variables such as type of specialty, number of years in practice, self-rating of expertise in the treatment of urinary tract infection, age, and gender.

A two-by-two mixed model Latin square analysis of variance (ANOVA) with one-between-subjects (situational involvement) and one-within subjects factor (task complexity) was used to examine differences in average time spent acquiring information per alternative, average time spent per item of information acquired, number of information acquisitions per alternative, proportion of information searched, variability in proportion searched across alternatives, variability in proportion searched across

attributes, concentration of search, direction of search, and proportion of time spent on each drug attribute. The Latin square analysis was used to deal with the presence of practice or order effects that occurred with within-subjects treatment condition (Keppel, 1982). In the presence of significant interaction effects, the analysis of simple effects was conducted. These analyses were used to test hypothesis I-XXI, and examine exploratory questions I and II.

A test of the difference between proportions was used to test: the differences between the experimental and control groups in the proportion of subjects who used compensatory decision processes across levels of task complexity; and the difference between the proportion of time the part-worth obtained from the conjoint additive model correctly predicted drug choice across different levels of situational involvement. The analyses were used to test hypotheses XXII and XXV.

The McNemar test for two related samples was used to test: the significance of changes in the number of subjects who shifted from using compensatory decision processes to noncompensatory decision processes when faced with a more complex task across levels of situational involvement (Siegel, 1956); and the significance of changes in the percentage of correct predictions between the low- and the high-complexity

task. The analyses were used to test hypotheses XXIII and XXVI.

The percentage of all pairs of alternatives (predicted versus observed preference ranking) that were not consistent with the linear model predictions was calculated from the conjoint LINMAP. The measure was used to indicate the degree of fit of the linear model. A two-tailed t-test was used to test the significance of the mean difference between percentage of pairs which violate the linear model prediction between the low- and the high-involvement group. The analysis was used to test hypothesis XXIV.

Chi-square analyses were used to test the significance of the differences in: the frequency distribution of drug choices between experimental and control groups across levels of task complexity; the frequency distribution of attributes regarded as most important between the experimental and control group. The analyses were used to examine exploratory questions III, and IV.

Spearman's rank correlation coefficient was used to determine: the association between the ranked order of the importance of drug attributes determined from the utility values derived from conjoint analysis, the order of attribute searched, the ranked order of proportion of search of each attribute, and the ranked order of proportion of time spent acquiring information on each attribute; the association

between the order of attribute searched in the low-complexity task and the order of attribute searched in the high-complexity task; and the association between the ranked order of proportion of information search of attributes in the low-complexity task and the ranked order of proportion of search of attributes in the high-complexity task. The analyses were used to examine exploratory questions V, VI, and VII.

A two-by-two (2x2) Latin square analysis of variance was conducted to determine significant differences in average Spearman's rank correlation coefficients between the ranked order of importance of drug attributes based on conjoint analysis, the ranked order of attribute searched, the ranked order of proportion of search of drug attributes, and the ranked order of proportion of time spent searching each attribute. In the presence of significant interaction effects, the analysis of simple effects was conducted. This analysis was used to further examine exploratory question IV.

Assumptions

The major assumption of the study concerned the use of information acquisition behavior to infer about the decision-making processes. It was assumed that physicians processed the information acquired and that the order in which physicians acquired the information was related to the cognitive processes leading to the decision. Another

assumption was that the physicians gave accurate responses to the questionnaire items.

Limitations

One limitation of the study concerns the use of volunteer physicians from the study site. This is a threat to external validity. The results may not be generalizable to other types of health care settings or the physician population as a whole. In addition, collecting and analyzing the data using the process-tracing technique is more time consuming than analyzing only the final judgment traditionally conducted in previous studies. The depth of the data collected in this study limits the number of subjects investigated which may limit the generalizability of the results.

Another limitation concerns the use of a hypothetical case scenario and a well-structured decision task in which all available alternatives and relevant drug attributes were shown. The results may not be generalizable to actual patients or actual environments in which decisions are less structured. However, the process-tracing technique used in the study provides objective and useful information regarding physician information acquisition behavior prior to making prescribing decisions.

Pilot Study

Prior to conducting a pilot study, two clinical pharmacists reviewed the case scenario and description of drug profiles for face validity. Their suggestions were used to revise the wording of the case scenario, and the range of levels of drug attributes to more fully reflect reality of the clinical situations.

After revisions, a preliminary study was conducted to test the clarity of instruction booklet and research instruments, and to assess the ease of use of the Mouselab program. A convenient sample of six colleagues and acquaintances was used. Four subjects were tested at the College of Pharmacy. Two subjects were tested at their residence. The experimental procedure was the same as outlined for the main study. At the end of the experiment, successive changes were made to the research instrument and instruction booklet in response to subject's comments or the investigator's observations.

After a preliminary study, a pilot study was conducted to further evaluate and pretest the instruction booklet, case scenario, description of drug profiles, research instruments, the experimental procedure, and the manipulation of situational involvement. The effect size obtained in the pilot study was used to estimate a sample size needed for the main study.

Nine medical residents from the University Medical Center, the University of Arizona were used as subjects. Each subject was given twenty dollars to participate in the study. Data collection and statistical analyses were the same as outlined for the main study. In addition, subjects were asked to "think aloud" or verbalize their thoughts while performing the two decision tasks. The verbal protocol was tape recorded.

Pilot Study Results

The data for one subject was lost due to failure of the Mouselab program to collect process measures after the subject spent more than twelve minutes on the decision task. As a result, eight subjects were included in the study. The demographic profile of eight subjects is presented in Table 3.4.

Table 3.5 presents means of enduring involvement scores and manipulation check for experimental and control groups. Subjects in the experimental and control group were not found to differ significantly in the mean enduring involvement scores. The internal consistency of the items was calculated using the Cronbach's alpha. The Cronbach's alpha was 0.915 indicating a high inter-item reliability of the enduring involvement items.

Table 3.4 Demographic profile of Pilot Study Sample

Gender

Males	8	Females	0
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Age

20-29	3
30-39	5

Years in practice

Mean = 2.75
 S.D. = 2.315
 Range = 1-8

Type of Specialty

Family practice	2
Internal medicine	6

Self-rating of expertise^a

Mean = 5.00
 S.D. = 0.756
 Range = 4-6

^a mean on an item scored on 1-7 scale where 7 indicates a high level of expertise

Table 3.5 Descriptive Statistics for Enduring Involvement Scores and Manipulation Check by Treatment Group

	Experiment (n=4)	Control (n=4)	Total Sample (n=8)
Enduring Involvement^{a,c}			
Mean	5.600	5.233	5.417
S.D.	0.628	1.089	0.846
Manipulation Check^{b,c}			
Mean	4.400	4.650	4.525
S.D.	0.712	0.806	0.717

^a means of 15 semantic differential items scored on a 1-7 scale where 7 indicates a higher level of enduring involvement

^b means of 5 semantic differential items scored on a 1-7 scale where 7 indicates a higher level of situational involvement

^c difference between means of experimental and control group, enduring involvement ($t=0.583$, $df=6$, $p>0.1$), manipulation check ($t=0.465$, $df=6$, $p>0.1$)

As a manipulation check, a two-tailed t-test was conducted to test significant differences in the mean scores of situational involvement between the experimental and control group. Subjects in the experimental and control group did not significantly differ in the mean scores of situational involvement. The results indicated a need to modify items used in the manipulation check to more directly reflect the nature of the manipulation.

A 2x2 mixed model Latin square analysis of variance was conducted to examine the effects of involvement and task complexity on process-tracing measures (Keppel, 1982). The between-subjects factor was level of situational involvement. The within-subjects factor was level of task complexity.

The process measures obtained in the pilot study included the average time spent acquiring information per alternative, the average time spent per item of information acquired, number of acquisitions per alternative, proportion of information searched, standard deviation of the proportion of information searched across alternatives based on first acquisition of information, standard deviation of the proportion of information searched across alternatives based on all acquisitions of information, standard deviation of the proportion of information searched across attributes based on first acquisition of information, standard deviation of the proportion of information searched across attributes based on

all acquisitions of information and the concentration of search.

The means of the process measures classified by situational involvement and task complexity and results of analysis of variance are shown in Tables 3.6-3.23.

The main effects of situational involvement were not statistically significant for any of the aforementioned process measures. Task complexity significantly affected time spent acquiring information per alternative and number of acquisitions per alternative. In addition, the interaction effect between involvement and task complexity was statistically significant for concentration of search measure. An analysis of simple effects indicated that the mean differences in the concentration of search between the low- and the high-complexity task was larger in the control group than in the experimental group (Table 3.22)

Not all differences in the means of process measures by involvement and task complexity were in the hypothesized direction. Process measures that differed in the hypothesized direction for situational involvement and task complexity were: time spent acquiring information per alternative, time spent per item of information acquired, number of acquisitions per alternative, and concentration of search. Subjects in the experimental group spent more time acquiring information per alternative, spent more time per item of information acquired,

Table 3.6. Mean (Standard Deviation) Time (seconds) Spent Acquiring Information per Alternative by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=4)	28.572 (16.292)	12.381 (5.815)	20.462 (14.233)
Control (n=4)	18.963 (4.387)	11.464 (4.836)	15.214 (5.860)
Overall (n=8)	23.753 (12.163)	11.923 (4.976)	17.838 (10.859)

Table 3.7. Analysis of Variance Source Table for Time Spent Acquiring Information per Alternative: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	109.849	1	109.849	2.560	0.185
Order	162.005	1	162.005	3.776	0.124
Invo x Order	505.079	1	505.079	11.771	0.027
S. w. groups	171.629	4	42.907		
<u>Within-Subjects Effects</u>					
Complexity	559.092	1	559.092	53.740	0.002
Invo x Comp	74.758	1	74.758	7.186	0.055
Practice	103.620	1	103.620	9.960	0.034
Invo x Pract	41.683	1	41.683	4.007	0.116
Residual	41.614	4	10.404		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 3.8. Mean (Standard Deviation) Time (second) Spent per Item of Information Acquired by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=4)	1.342 (0.287)	1.039 (0.352)	1.190 (0.339)
Control (n=4)	1.035 (0.157)	0.963 (0.264)	0.999 (0.205)
Overall (n=8)	1.188 (0.270)	1.001 (0.291)	1.095 (0.288)

Table 3.9. Analysis of Variance Source Table for Time Spent per Item of Information Acquired: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.146	1	0.146	0.994	0.375
Order	0.010	1	0.010	0.065	0.811
Invo x Order	0.036	1	0.036	0.242	0.649
S. w. groups	0.587	4	0.147		
<u>Within-Subjects Effects</u>					
Complexity	0.140	1	0.140	4.877	0.092
Invo x Comp	0.053	1	0.053	1.856	0.245
Practice	0.155	1	0.155	5.398	0.081
Invo x Pract	0.000	1	0.000	0.001	0.976
Residual	0.115	4	0.029		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 3.10. Mean (Standard Deviation) Number of Information Acquisition per Alternative by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=4)	20.750 (9.378)	13.500 (8.763)	17.125 (9.253)
Control (n=4)	19.083 (6.783)	12.333 (5.598)	15.708 (6.794)
Overall (n=8)	19.916 (7.629)	12.917 (6.836)	16.416 (7.876)

Table 3.11 Analysis of Variance Source Table for Number of Information Acquisition per Alternative: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	8.033	1	8.033	0.151	0.717
Order	132.267	1	132.267	2.492	0.190
Invo x Order	288.975	1	208.975	5.444	0.080
S. w. groups	212.342	4	53.085		
<u>Within-Subjects Effects</u>					
Complexity	195.979	1	195.979	8.785	0.041
Invo x Comp	0.251	1	0.251	0.011	0.921
Practice	0.696	1	0.696	0.031	0.868
Invo x Pract	2.775	1	2.775	0.124	0.742
Residual	89.229	4	22.307		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 3.12. Mean (Standard Deviation) Proportion of Information Acquired by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=4)	0.903 (0.131)	0.799 (0.159)	0.851 (0.146)
Control (n=4)	1.000 (0.000)	0.861 (0.142)	0.931 (0.119)
Overall (n=8)	0.951 (0.100)	0.830 (0.143)	0.891 (0.135)

Table 3.13. Analysis of Variance Source Table for Proportion of Information Acquired: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.026	1	0.026	1.551	0.281
Order	0.030	1	0.030	1.835	0.247
Invo x Order	0.053	1	0.053	3.195	0.148
S. w. groups	0.066	4	0.016		
<u>Within-Subjects Effects</u>					
Complexity	0.059	1	0.059	6.217	0.067
Invo x Comp	0.001	1	0.001	0.127	0.739
Practice	0.000	1	0.000	0.045	0.842
Invo x Pract	0.001	1	0.001	0.127	0.739
Residual	0.038	4	0.009		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 3.14. Mean (Standard Deviation) Variability of Search Across Alternatives Based on First Acquisition by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=4)	0.072 (0.092)	0.148 (0.102)	0.110 (0.099)
Control (n=4)	0 (0)	0.147 (0.141)	0.074 (0.121)
Overall (n=8)	0.036 (0.071)	0.148 (0.114)	0.092 (0.109)

Table 3.15. Analysis of Variance Source Table for Variability of Search Across Alternatives Based on First Acquisition: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.005	1	0.005	0.577	0.490
Order	0.014	1	0.014	1.533	0.283
Invo x Order	0.025	1	0.025	2.702	0.176
S. w. groups	0.037	4	0.009		
<u>Within-Subjects Effects</u>					
Complexity	0.050	1	0.050	5.061	0.088
Invo x Comp	0.005	1	0.005	0.504	0.517
Practice	0.001	1	0.001	0.061	0.817
Invo x Pract	0.000	1	0.000	0.021	0.891
Residual	0.039	4	0.010		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 3.16. Mean (Standard Deviation) Variability of Search Across Alternatives Based on All Acquisitions by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=4)	1.662 (0.607)	0.915 (0.585)	1.288 (0.681)
Control (n=4)	0.975 (0.447)	1.102 (0.545)	1.038 (0.467)
Overall (n=8)	1.318 (0.615)	1.009 (0.533)	1.163 (0.579)

Table 3.17. Analysis of Variance Source Table for Variability of Search Across Alternatives Based on All Acquisitions: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.250	1	0.250	5.299	0.083
Order	0.073	1	0.073	1.542	0.282
Invo x Order	2.446	1	2.446	51.947	0.002
S. w. groups	0.188	4	0.047		
<u>Within-Subjects Effects</u>					
Complexity	0.383	1	0.383	1.875	0.243
Invo x Comp	0.765	1	0.765	3.742	0.125
Practice	0.095	1	0.095	0.463	0.534
Invo x Pract	0.005	1	0.005	0.023	0.886
Residual	0.818	4	0.204		

Invo=Involvement; Comp=Complexity; Subj. w. groups=Subjects within groups; L.S. Residual = Latin Square Residual

Table 3.18 Mean (Standard Deviation) Variability of Search Across Attributes Based on First Acquisition by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=4)	0.157 (0.215)	0.184 (0.125)	0.171 (0.163)
Control (n=4)	0 (0)	0.176 (0.122)	0.088 (0.123)
Overall (n=8)	0.078 (0.164)	0.180 (0.114)	0.129 (0.146)

Table 3.19. Analysis of Variance Source Table for Variability of Search Across Attributes Based on First Acquisition: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.027	1	0.027	2.007	0.230
Order	0.074	1	0.074	5.474	0.079
Invo x Order	0.039	1	0.039	2.924	0.162
S. w. groups	0.054	4	0.013		
<u>Within-Subjects Effects</u>					
Complexity	0.041	1	0.041	3.438	0.137
Invo x Comp	0.022	1	0.022	1.863	0.244
Practice	0.002	1	0.002	0.149	0.719
Invo x Pract	0.013	1	0.013	1.111	0.351
Residual	0.048	4	0.012		

Invo=Involvement; Comp=Complexity; Subj. w. groups=Subjects within groups; L.S. Residual = Latin Square Residual

Table 3.20. Mean (Standard Deviation) Variability of Search Across Attributes Based on All Acquisitions by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=4)	1.442 (0.381)	0.790 (0.285)	1.116 (0.467)
Control (n=4)	0.718 (0.504)	0.603 (0.168)	0.660 (0.353)
Overall (n=8)	1.080 (0.566)	0.696 (0.239)	0.888 (0.464)

Table 3.21. Analysis of Variance Source Table for Variability of Search Across Attributes Based on All Acquisitions: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.832	1	0.832	6.207	0.070
Order	0.082	1	0.082	0.591	0.485
Invo x Order	0.002	1	0.002	0.013	0.914
S. w. groups	0.552	4	0.138		
<u>Within-Subjects Effects</u>					
Complexity	0.589	1	0.589	5.935	0.072
Invo x Comp	0.288	1	0.288	2.900	0.164
Practice	0.491	1	0.491	4.951	0.090
Invo x Pract	0.001	1	0.001	0.006	0.943
Residual	0.397	4	0.099		

Invo=Involvement; Comp=Complexity; Subj. w. groups=Subjects within groups; L.S. Residual = Latin Square Residual

Table 3.22. Mean (Standard Deviation) Concentration of Search by Situational Involvement and Task Complexity: Pilot Study

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=4)	0.485 (0.245)	0.344 (0.456)	0.414 (0.347)
Control (n=4)	0.208 (0.175)	0.702 (0.660)	0.455 (0.519)
Overall (n=8)	0.346 (0.246)	0.523 (0.559)	0.435 (0.427)

Table 3.23. Analysis of Variance Source Table for Concentration of Search: Pilot Study

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.007	1	0.007	0.052	0.831
Order	0.022	1	0.022	0.172	0.700
Invo x Order	0.583	1	0.583	4.567	0.099
S. w. groups	0.511	4	0.128		
<u>Within-Subjects Effects</u>					
Complexity	0.125	1	0.125	2.869	0.166
Invo x Comp	0.403	1	0.403	9.258	0.038
Practice	0.134	1	0.134	3.067	0.155
Invo x Pract	0.781	1	0.781	17.943	0.013
Residual	0.174	4	0.044		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

acquired a higher number of pieces of information per alternative, and had a less value in the concentration of search than did subjects in the control group.

When faced with three alternatives, subjects spent more time acquiring information per alternative, spent more time per item of information, acquired a higher number of pieces of information per alternative, and had a less value in the concentration of search than when faced with six alternatives.

Process measures that differed in the hypothesized direction for task complexity only were: proportion of information searched, variability in the proportion of information searched across alternatives based on first time acquisition of information, and variability in the proportion of information searched across attributes based on first time acquisitions of information. When faced with three alternatives, subjects searched a greater proportion of information and had a lower variability in the proportion of search across alternatives and across attributes than when faced with six alternatives. The mean differences of proportion of information searched, variability in the proportion of information searched across alternatives based on first time acquisition, and variability in the proportion of information across attributes based on first time acquisition were not in the hypothesized direction for the effects of situational involvement. Subjects in the

experimental group searched a lesser proportion of information, had a higher variability in the proportion of information searched based on first time acquisition of information across alternatives and across attributes than did subjects in the control group.

Process measures that were not in the hypothesized direction for both situational involvement and task complexity were: variability in the proportion of information searched across alternatives and variability in the proportion of information searched across attributes based on all acquisitions of information. Subjects in the experimental group had a greater variability in the proportion of information searched across alternatives and across attributes based on all acquisitions of information. Additionally, when faced with three alternatives, subjects had a greater variability in the proportion of information searched across alternatives and across attributes based on all acquisitions of information than when faced with six alternatives.

The interaction between task complexity and task order or differential carry-over effects were examined by plotting the process measures as a function of task order and examining the trend in the data (Keppel, 1982). A considerable departure from the parallel functions was observed for time spent acquiring information per alternative, number of acquisitions per alternative, variability in the proportion of information

searched across alternatives based on first time acquisition of information and variability of information searched across attributes base on first time acquisition of information. The differences in these four process measures between the low-complexity and high-complexity task tended to be larger in the first task order than in the second task order. The presence of carry-over effects indicated a need to include a distraction or a washout task between the two decision tasks to eliminate or minimize carry-over effects.

Further, the order effects for certain process measures differed between subjects in the two treatment groups. The interaction between involvement and task order was close to significant or significant for average time spent acquiring information per alternative and concentration of search.

Due to conflicting results in the mean differences for various process measures, the sample size for the main study was calculated based on the effect size of the process measures differing in the hypothesized direction for both involvement and task complexity. These process measures were time spent acquiring information per alternative, time spent per item of information acquired, number of information acquisitions per alternative, and concentration of search. The sample size estimate for each measure is displayed in Table 3.24.

Table 3.24. Sample Size Estimates Based on Results of the Pilot Study

Process Measure	Involvement		Task Complexity		Interaction	
	Effect Size	Sample Size	Effect Size	Sample Size	Effect Size	Sample Size
tacqalt	0.401	56	1.833	8	0.665	24
tperacq	0.249	132	0.550	32	0.339	72
acqalt	0.097	836	0.741	20	0.026	11224
consrch	0.057	2400	0.423	48	0.760	20

Note. tacqalt= time spent acquiring information per alternative; tperacq= time spent per item of information acquired; acqalt= number of information acquisitions per alternative; consrch = concentration of search

The sample size that was required to detect significant main effects and interaction effects for all four measures ranged from 2-2806 subjects per cell. However, the sample size that was considered achievable in the study was set at 24 subjects per cell. This sample size was sufficient to detect all four significant effects for task complexity, and two out of four significant interaction effects between involvement and task complexity. Thus, a total of 48 subjects was included for the main study.

In addition, conjoint analysis was conducted on ranking data of 18 hypothetical drug profiles. The utilities for each drug attribute level were estimated using the LINMAP (LINEar programming techniques for Multidimensional Analysis of Preference) for microcomputer. The relative importance of drug attributes was found to differ between the experimental and control group. For the experimental group (high involvement), cure rate was found to be most important (38.22%), followed by cost per treatment (25.07%), incidence of vaginitis (11.15%), incidence of GI upset (10.30%), duration of treatment (8.18%), and dosage schedule (7.09%). For the control group (low involvement), cure rate was the most important attribute (40.23%), followed by incidence of GI upset (15.15%), duration of treatment (13.80%), incidence of vaginitis (10.97%), cost per treatment (10.14%), and dosage schedule (9.71%). It should be noted that cost per treatment

was second in importance for the experimental group and fourth in importance for the control group. The findings indicated that subjects in the experimental group attached a higher importance value to cost than did subjects in the control group.

Actions Resulting from the Pilot Study

As a result of the pilot study, several changes are made to the main study. First, a wash-out task has been included between the two choice tasks due to the presence of interaction effects between task complexity and task order or carry-over effects. The wash-out task used in the study included asking subjects to indicate their agreement/disagreement with sixteen Likert statements dealing with controversial ethical and political medical issues unrelated to the prescribing tasks. The items used in the wash out task are presented in the Appendix E.

Secondly, a manipulation of situational involvement has been modified to strengthen the effect of the manipulation. A phrase "...evaluate the quality of anti-infective drug prescribing in terms of its clinical and economic appropriateness" has been included to prevent subjects from thinking about costs as a main criteria for evaluation. Further, the sentence "In the discussion, you will need to explain your reasons for choosing or rejecting a particular

drug alternative" has been added. This was done to encourage subjects to examine alternatives more equally instead of only concentrating the search on the chosen alternative. The revised manipulation of situational involvement is shown in Appendix D.

Finally, the previous manipulation check scales measuring the perceived severity of making poor prescribing decisions have been replaced with new items that are more directly related to the manipulation. The previous items have been excluded because they elicited socially desirable responses from subjects and did not discriminate between the two treatment groups. The revised items are shown in Appendix G.

CHAPTER 4

RESULTS

This research utilized a combination of a process-tracing techniques and an analysis of final judgement to examine the effects of situational involvement and task complexity on the information acquisition and decision-making process underlying drug prescribing. In this chapter, the results of the study will be presented.

Sample

Fifty-one subjects agreed to participate in the study. All subjects were recruited from the University Medical Center, the University of Arizona. Three subjects were excluded from the analysis; one subject refused to complete the decision tasks, and two cases were eliminated due to subject's errors in acquiring information from the Mouselab program. As a result, a total of 48 subjects were included in the analysis.

The demographic profile of each treatment group is presented in Table 4.1. In each group, a higher number of males than females participated in the study. The distribution of gender, age, and type of specialty were not significantly different between the two treatment groups. Additionally, physicians in the two groups did not

Table 4.1 Sample Demographic Profile by Treatment Group

Characteristic	Experiment (n=24)	Control (n=24)	Total Sample (n=48)
Gender ^a			
Male	19	20	39
Female	5	4	9
Age ^a			
30-39	10	9	19
40-49	8	10	18
50-59	5	3	8
60-69	1	2	3
Type of Specialty ^a			
Family Practice	7	5	12
Internal Medicine	11	8	19
OB-GYN	1	5	6
Other	5	6	11
Years In Practice ^b			
Mean	13.625	11.792	12.708
S.D.	9.107	10.787	9.919

^a difference between frequency distributions of experimental and control group; gender ($\chi^2 = 0.30$, $df=1$, $p>0.10$), age ($\chi^2 = 2.34$, $df=3$, $p>0.10$), specialty ($\chi^2 = 5.29$, $df=3$, $p>0.10$)

^b difference between means of experimental and control group; $t=0.64$, $df=46$, $p>0.10$

significantly differ in the average number of years in practice.

The means and standard deviations of self-rating of expertise in the treatment of urinary tract infection and pre-existing (enduring) levels of involvement are shown in Table 4.2. Physicians in the two groups were not significantly different with respect to the two variables.

Reliability of Involvement Measures

Enduring involvement was measured using fifteen items. Each item was on a seven-point semantic differential scale. The scores on fifteen items were averaged to form a measure. The inter-item reliability was calculated using Cronbach's Alpha. The Cronbach's alpha was 0.927, indicating a high internal consistency reliability of the items.

Manipulation Check

The two Likert-scale statements were used as a manipulation check to ascertain subjects' adoption of the manipulation. Each item was on a six-point scale. The scores on two items were averaged to form a measure. The Pearson correlation between the two items was 0.769 which is satisfactory.

The means and standard deviations of the manipulation check measures are presented in Table 4.3. A two-tailed t-test indicated significant differences between the two group

Table 4.2 Descriptive Statistics for Self-Rating Expertise and Enduring Involvement Scores by Treatment Group

	Experiment (n=24)	Control (n=24)	Total Sample (n=48)
Expertise Rating ^{a,b}			
Mean	5.208	5.208	5.208
S.D.	1.103	1.101	1.051
Enduring Involvement ^{a,c}			
Mean	5.472	5.733	5.603
S.D.	0.688	0.706	0.702

^a difference between means of experimental and control group; expertise ($t=0$, $df=46$, $p=1$), enduring involvement ($t=1.29$, $df=46$, $p>0.1$)

^b mean on a 1-7 scale where 7 indicates a higher level of expertise

^c means of 15 semantic differential items scored on a 1-7 scale where 7 indicates a higher level of enduring involvement

Table 4.3 Manipulation Check Scores by Treatment Group

	Experiment (n=24)	Control (n=24)	Total Sample (n=48)
Manipulation Check ^{a,b}			
Mean	5.813	3.438	4.625
S.D.	2.444	1.597	2.369

^a means of 2 Likert items scored on a 1-6 scale where 6 indicates a higher level of agreement

^b difference between means of experimental and control group; $t=3.99$, $df=46$, $p<0.001$

means ($p < 0.001$). Subjects in the experimental groups had a significantly higher level of agreement with the two Likert-items than did subjects in the control group. The results indicated that subjects in the experimental group adopted the manipulation stated in the case scenario.

Tests of Hypotheses

All research hypotheses stated in Chapter I were tested at the $\alpha = 0.05$ significance level.

Hypotheses I,II,III

Hypotheses I,II, and III concerned the effects of situational involvement and task complexity on the amount of time spent acquiring information per drug alternative. Hypothesis I stated that the situational involvement has a significant effect on the amount of time spent acquiring information per alternative. Physicians in the experimental group were expected to spend a larger amount of time acquiring information per alternative than physicians in the control group.

Hypothesis II stated that task complexity has a significant effect on the amount of time spent acquiring information per alternative. Physicians were expected to spend a larger amount of time acquiring information per

alternative in the three-alternative task than in the six-alternative task.

Hypothesis III stated that the situational involvement and complexity of the task have a significant interaction effect on the amount of time spent acquiring information per alternative. The difference in the amount of time spent acquiring information per alternative between the low and high-complexity conditions was expected to be significantly larger in the control group than in the experimental group.

The group means and standard deviations of time spent acquiring information per alternative are shown in Table 4.4. The three hypotheses were tested using a two-by-two mixed-model Latin square analysis of variance with the repeated measure on task complexity. The results of the analysis of variance are shown in Table 4.5.

Hypothesis I and Hypothesis III were not supported. The main effect of situational involvement and the interaction effect were not statistically significant. Additionally, it should be noted that the mean difference between the two groups in the amount of time spent acquiring information per alternative was not in the hypothesized direction. Subjects in the experimental group spent less time acquiring information per alternative than did subjects in the control group.

Table 4.4. Mean (Standard Deviation) Time (second) Spent Acquiring Information per Alternative by Situational Involvement and Task Complexity

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=24)	15.857 (7.530)	12.377 (6.750)	14.117 (7.289)
Control (n=24)	18.262 (12.588)	12.392 (6.446)	15.327 (10.329)
Overall (n=48)	17.060 (10.333)	12.384 (6.529)	14.722 (8.913)

Table 4.5. Analysis of Variance Source Table for Time Spent Acquiring Information per Alternative

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	35.129	1	35.129	0.279	0.600
Order	114.276	1	114.276	0.908	0.346
Invo x Order	25.985	1	25.985	0.206	0.652
S. w. groups	5540.204	44	125.914		
<u>Within-Subjects Effects</u>					
Complexity	524.610	1	524.610	18.281	<.001
Invo x Comp	34.294	1	34.294	1.195	0.280
Practice	9.192	1	9.192	0.320	0.574
Invo x Pract	0.105	1	0.105	0.004	0.952
Residual	1262.653	44	28.697		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Hypothesis II was supported. The main effect of task complexity was significant ($p < 0.001$). Subjects spent a significantly higher amount of time acquiring information per alternative when choosing a drug among three alternatives than when choosing a drug among six alternatives. Additionally, the order of the decision task (practice effect) did not significantly affect the amount of time spent acquiring information per alternative.

Hypotheses IV, V, and VI.

Hypotheses IV, V and VI dealt with the effects of situational involvement and task complexity on time spent per item of information acquired. Hypothesis IV stated that the situational involvement has a significant effect on the amount of time spent on each piece of information acquired. Physicians in the experimental group were expected to spend a larger amount of time on each piece of information acquired than physicians in the control group.

Hypothesis V stated that task complexity has a significant effect on the amount of time spent on each piece of information acquired. Physicians were expected to spend a larger amount of time on each piece of information acquired in the three-alternative task than in the six-alternative task.

Hypothesis VI stated that the situational involvement and task complexity have a significant interaction effect on the

amount of time spent on each piece of information acquired. The difference in the amount of time spent on each piece of information between the low and high-complexity conditions was expected to be significantly larger in the control group than in the experimental group.

The group means and standard deviations of time spent per item of information acquired are shown in Table 4.6. The three hypotheses were tested using a two-by-two mixed-model Latin square analysis of variance with the repeated measure on task complexity. The results of the analysis of variance are shown in Table 4.7.

Hypothesis IV and Hypothesis VI were not supported. The main effect of situational involvement and the interaction effect were not statistically significant. Additionally, the mean difference between the two groups in the amount of time spent per piece of information acquired was not in the hypothesized direction. Subjects in the experimental group spent less time per item of information acquired than did subjects in the control groups.

Hypothesis V was supported. The main effect of task complexity was significant ($p < 0.05$). Subjects spent a significantly higher amount of time per item of information acquired when choosing a drug among three alternatives than when choosing a drug among six alternatives.

Table 4.6. Mean (Standard Deviation) Time (second) Spent Per Item of Information Acquired by Situational Involvement and Task Complexity

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=24)	1.331 (0.489)	1.181 (0.474)	1.256 (0.482)
Control (n=24)	1.557 (1.493)	1.151 (0.629)	1.354 (1.152)
Overall (n=48)	1.444 (1.105)	1.166 (0.551)	1.305 (0.880)

Table 4.7. Analysis of Variance Source Table for Time Spent per Item of Information Acquired

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.231	1	0.231	0.220	0.641
Order	1.017	1	1.017	0.972	0.330
Invo x Order	1.509	1	1.509	1.442	0.236
S. w. groups	46.068	44	1.047		
<u>Within-Subjects Effects</u>					
Complexity	1.852	1	1.852	4.352	0.043
Invo x Comp	0.396	1	0.396	0.930	0.340
Practice	3.041	1	3.041	7.148	0.010
Invo x Pract	0.673	1	0.673	1.581	0.215
Residual	18.271	44	0.425		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Additionally, practice effect was found to be statistically significant ($p < 0.01$). Subjects spent a higher amount of time per item of information acquired in the first task (Mean = 1.143 sec., S.D. = 1.159) than in the second task (Mean = 1.127 sec., S.D. = 1.127).

Hypotheses VII, VIII, and IX

Hypotheses VII, VIII, and IX tested the effects of the situational involvement and task complexity on the number of pieces of information acquired per alternative. Hypothesis VII stated that the situational involvement of physicians has a significant effect on the number of information acquisitions per alternative. Physicians in the experimental group were expected to search a higher number of pieces of information per alternative than physicians in the control group.

Hypothesis VIII stated that task complexity has a significant effect on the number of information acquisitions per alternative. Physicians were expected to search a higher number of items of information per alternative in a low-complexity task than in a high-complexity task.

Hypothesis IX stated that the situational involvement of physicians and task complexity have a significant interaction effect on the number of information acquisition per alternative. The difference in the number of information acquisitions per alternative between the low and high-

complexity conditions was expected to be significantly larger in the control group than in the experimental group.

The group means and standard deviations of the number of information acquisitions per alternative are shown in Table 4.8. The three hypotheses were tested using a two-by-two mixed-model Latin square analysis of variance with the repeated measure on task complexity. The results of the analysis of variance are shown in Table 4.9.

Hypothesis VII and Hypothesis IX were not supported. The main effect of situational involvement and the interaction effect were not statistically significant. Furthermore, the mean difference between the two groups in the number of information acquisitions per alternative was not in the hypothesized direction. Subjects in the experimental group searched a lower number of pieces of information per alternative than did subjects in the control groups.

Hypothesis VIII was supported. The main effect of task complexity was statistically significant ($p < 0.05$). Subjects searched a significantly higher number of pieces of information per alternative when choosing a drug among three alternatives than when choosing a drug among six alternatives.

The practice effect was also found to be statistically significant for the number of acquisitions per alternative. Subjects searched a significantly lower number of items of information per alternative in the first task (Mean = 12.00,

Table 4.8. Mean (Standard Deviation) Number of Information Acquisition Per Alternative by Situational Involvement and Task Complexity

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=24)	12.806 (6.651)	10.910 (5.901)	11.858 (6.293)
Control (n=24)	15.097 (10.989)	12.521 (7.552)	13.809 (9.418)
Overall (n=48)	13.951 (9.060)	11.715 (6.754)	12.833 (8.027)

Table 4.9. Analysis of Variance Source Table for Number of Information Acquisition per Alternative

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	91.389	1	91.389	0.782	0.381
Order	1.671	1	1.671	0.014	0.905
Invo x Order	1.585	1	1.585	0.014	0.908
S. w. groups	5141.586	44	116.854		
<u>Within-Subjects Effects</u>					
Complexity	120.002	1	120.002	7.970	0.007
Invo x Comp	2.780	1	2.780	0.185	0.670
Practice	66.663	1	66.663	4.428	0.041
Invo x Pract	33.057	1	33.057	2.196	0.146
Residual	662.472	44	15.056		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

S.D. = 6.775) than in the second task (Mean = 13.667, S.D. = 9.106).

Hypotheses X, XI, and XII

Hypotheses X, XI, and XII concerned the effects of the situational involvement and task complexity on the proportion of information searched. Hypothesis X stated that the situational involvement of physicians has a significant effect on the proportion of information searched. Physicians in the experimental group were expected to search a larger proportion of available information than physicians in the control group.

Hypothesis XI stated that task complexity has a significant effect on the proportion of information searched. Physicians were expected to search a larger proportion of available information in a low-complexity task than in a high-complexity task.

Hypothesis XII stated that the situational involvement and task complexity have a significant interaction effect on the proportion of information searched. The difference in the proportion of information searched between the low and high-complexity conditions was expected to be significantly larger in the control group than in the experimental group.

The group means and standard deviations of proportion of information searched are shown in Table 4.10. The three hypotheses were tested using a two-by-two mixed-model Latin square analysis of variance with the repeated measure on task complexity. The results of the analysis of variance are shown in Table 4.11.

Hypothesis X and XII were not supported. The main effect of situational involvement and the interaction effect were not statistically significant. Moreover, the difference between the two treatment groups in the proportion of information searched was not in the hypothesized direction. Subjects in the experimental group searched a lower proportion of available information than did subjects in the control groups.

Hypothesis XI was supported. The main effect of task complexity was statistically significant ($p < 0.001$). Subjects searched a significantly higher proportion of available information in the low-complexity task than in the high-complexity task. In addition, the order of the decision task did not significantly affect the proportion of information searched.

Hypotheses XIII, XIV, and XV

Hypotheses XIII, XIV, and XV tested the effects of situational involvement and task complexity on the variability in the proportion of information searched across alternatives.

Table 4.10. Mean (Standard Deviation) Proportion of Information Acquired by Situational Involvement and Task Complexity

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=24)	0.921 (0.097)	0.778 (0.167)	0.850 (0.153)
Control (n=24)	0.914 (0.169)	0.848 (0.164)	0.881 (0.168)
Overall (n=48)	0.918 (0.137)	0.813 (0.168)	0.865 (0.161)

Table 4.11. Analysis of Variance Source Table for Proportion of Information Acquired

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.024	1	0.024	0.674	0.416
Order	0.015	1	0.015	0.413	0.524
Invo x Order	0.000	1	0.000	0.002	0.965
S. w. groups	1.585	44	0.036		
<u>Within-Subjects Effects</u>					
Complexity	0.263	1	0.263	21.994	<.001
Invo x Comp	0.036	1	0.036	3.019	0.089
Practice	0.008	1	0.008	0.640	0.428
Invo x Pract	0.004	1	0.004	0.358	0.553
Residual	0.526	44	0.012		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Hypothesis XIII stated that the situational involvement of physicians has a significant effect on the variability in proportion of information searched across alternatives. Physicians in the experimental group were expected to have a lower variability in the proportion of information searched across alternatives than physicians in the control group.

Hypothesis XIV stated that the complexity of the task has a significant effect on the variability in proportion of information searched across alternatives. Physicians were expected to have a lower variability in proportion of information searched in the three-alternative task than in the six-alternative task.

Hypothesis XV stated that the situational involvement of physicians and task complexity have a significant interaction effect on the variability in proportion of information searched across alternatives. The difference in the variability in the proportion of information searched between the low and high-complexity conditions was expected to be significantly larger in the control group than in the experimental group.

Since subjects have access to items of information previously acquired, variability in the proportion of information acquired across alternatives was calculated based on first-time acquisition and all acquisitions of the information. The group means and standard deviations of the

two variability measures are shown in Table 4.12 and Table 4.14.

The three hypotheses were tested using a two-by-two mixed-model Latin square analysis of variance with the repeated measure on task complexity. The results of the analysis of variance for the variability of search across alternatives based on first-time acquisition and all acquisitions of information are shown in Table 4.13, and Table 4.15, respectively.

Hypothesis XIII and XV were not supported with either measure of variability of search across alternatives. The main effect of situational involvement and the interaction effect were not statistically significant. In addition, the difference between the two treatment groups in the variability in the proportion of information searched across alternatives - based on first-time acquisition - was not in the hypothesized direction. Subjects in the experimental group tended to focus their search more on certain alternatives and had a higher variability of search across alternatives than did subjects in the control groups.

Table 4.12. Mean (Standard Deviation) Variability of Search Across Alternatives Based on First Acquisition by Situational Involvement and Task Complexity

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=24)	0.089 (0.107)	0.207 (0.131)	0.148 (0.133)
Control (n=24)	0.072 (0.134)	0.124 (0.102)	0.098 (0.121)
Overall (n=48)	0.080 (0.120)	0.166 (0.124)	0.123 (0.129)

Table 4.13. Analysis of Variance Source Table for Variability of Search Across Alternatives Based on First Acquisition

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.060	1	0.060	3.082	0.086
Order	0.062	1	0.062	3.212	0.080
Invo x Order	0.000	1	0.000	0.020	0.887
S. w. groups	0.853	44	0.019		
<u>Within-Subjects Effects</u>					
Complexity	0.175	1	0.175	19.655	<.001
Invo x Comp	0.027	1	0.027	3.012	0.090
Practice	0.001	1	0.001	0.165	0.687
Invo x Pract	0.007	1	0.007	0.821	0.370
Residual	0.391	44	0.009		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.14. Mean (Standard Deviation) Variability of Search Across Alternatives Based on All Acquisitions by Situational Involvement and Task Complexity

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=24)	0.742 (0.481)	0.951 (0.561)	0.847 (0.527)
Control (n=24)	0.935 (0.896)	0.870 (0.566)	0.902 (0.742)
Overall (n=48)	0.839 (0.718)	0.910 (0.559)	0.875 (0.641)

Table 4.15. Analysis of Variance Source Table for Variability of Search Across Alternatives Based on All Acquisitions

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.074	1	0.074	0.147	0.703
Order	0.002	1	0.002	0.004	0.952
Invo x Order	0.166	1	0.166	0.329	0.569
S. w. groups	22.137	44	0.503		
<u>Within-Subjects Effects</u>					
Complexity	0.123	1	0.123	0.369	0.547
Invo x Comp	0.451	1	0.451	1.355	0.251
Practice	0.928	1	0.928	2.791	0.102
Invo x Pract	0.518	1	0.518	1.556	0.219
Residual	14.636	44	0.333		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

In contrast to the first variability measure, the difference between the two group means for the second variability measure -based on all acquisitions of information - was in the hypothesized direction for the effects of situational involvement. Subjects in the experimental group had a lesser variability in the proportion of information searched across alternatives than did subjects in the control group.

Hypothesis XIV was supported for variability of search measure based on first-time acquisition of information, but was not supported for the variability of search measure based on all acquisitions of information. For the variability of search across alternatives based on first-time acquisition of information, the main effect of task complexity was statistically significant ($p < 0.001$). Subjects searched each alternative more equally and had lesser variability of search across alternatives when choosing a drug among three alternatives than when choosing a drug among six alternatives. For the variability of search across alternatives based on all acquisitions of information, the mean difference was in the hypothesized direction, however, the main effect of task complexity was not statistically significant.

Additionally, there was no significant task order or practice effect for either measure of variability of search across alternatives.

Hypotheses XVI, XVII, and XVIII

Hypotheses XVI, XVII, and XVIII dealt with the effects of situational involvement and task complexity on the variability in the proportion of information searched across attributes. Hypothesis XVI stated that the situational involvement has a significant effect on the variability in the proportion of information searched across attributes. Physicians in the experimental group were expected to have a lower variability in proportion of information searched across attributes than physicians in the control group.

Hypothesis XVII stated that task complexity has a significant effect on the variability in the proportion of information searched across attributes. Physicians were expected to have a lower variability in proportion of information searched in the three-alternative task than in the six-alternative task.

Hypothesis XVIII stated that the situational involvement and task complexity have a significant interaction effect on the variability in the proportion of information searched across attributes. The difference in the variability in the proportion of information searched between the low and high-complexity conditions was expected to be significantly larger in the control group than in the experimental group.

Variability in the proportion of information acquired across attributes was also calculated based on first-time acquisition and all acquisitions of information. The group means and standard deviations of the two measures of variability of search across attributes are shown in Table 4.16 and Table 4.18.

The three hypotheses were tested using a two-by-two mixed-model Latin square analysis of variance with the repeated measure on task complexity. The results of the analysis of variance for the variability of search across attributes based on first-time acquisition and all acquisitions of information are shown in Table 4.17, and Table 4.19, respectively.

Hypothesis XVI and Hypothesis XVIII were not supported for both measures of variability of search across attributes. The main effect of situational involvement and the interaction effect were not statistically significant. The difference between the two treatment groups in the variability in the proportion of information searched across attributes - based on first acquisition and all acquisitions - were not in the hypothesized direction. Subjects in the experimental group tended to focus their search more on certain attributes and had a higher variability of search across attributes than did subjects in the control groups.

Table 4.16. Mean (Standard Deviation) Variability of Search Across Attributes Based on First Acquisition by Situational Involvement and Task Complexity

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=24)	0.120 (0.127)	0.194 (0.128)	0.157 (0.131)
Control (n=24)	0.085 (0.146)	0.168 (0.151)	0.126 (0.153)
Overall (n=48)	0.103 (0.136)	0.181 (0.139)	0.142 (0.143)

Table 4.17. Analysis of Variance Source Table for Variability of Search Across Attributes Based on First Acquisition

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.023	1	0.023	0.783	0.381
Order	0.000	1	0.000	0.009	0.925
Invo x Order	0.004	1	0.004	0.125	0.725
S. w. groups	1.303	44	0.030		
<u>Within-Subjects Effects</u>					
Complexity	0.148	1	0.148	14.615	<.001
Invo x Comp	0.000	1	0.000	0.047	0.829
Practice	0.002	1	0.002	0.150	0.700
Invo x Pract	0.006	1	0.006	0.561	0.458
L.S. Residual	0.445	44	0.010		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.18. Mean (Standard Deviation) Variability of Search Across Attributes Based on All Acquisitions by Situational Involvement and Task Complexity

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=24)	0.700 (0.305)	0.740 (0.299)	0.720 (0.299)
Control (n=24)	0.730 (0.443)	0.698 (0.472)	0.714 (0.453)
Overall (n=48)	0.715 (0.376)	0.719 (0.391)	0.717 (0.382)

Table 4.19. Analysis of Variance Source Table for Variability of Search Across Attributes Based on All Acquisitions of Information

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.001	1	0.001	0.004	0.951
Order	0.050	1	0.050	0.226	0.637
Invo x Order	0.001	1	0.001	0.003	0.955
S. w. groups	9.694	44	0.220		
<u>Within-Subjects Effects</u>					
Complexity	0.000	1	0.000	0.005	0.946
Invo x Comp	0.031	1	0.031	0.379	0.541
Practice	0.262	1	0.262	3.174	0.082
Invo x Pract	0.189	1	0.189	2.291	0.137
Residual	3.629	44	0.082		

Invo=Involvement; Comp=Complexity; Subj. w. groups=Subjects within groups; L.S. Residual=Latin Square Residual

Hypothesis XVII was supported for variability of search across attributes based on first-time acquisition of information, but was not supported for the variability of search based on all acquisitions. The main effect of task complexity was statistically significant ($p < 0.001$) for the variability of search across attributes based on first-time acquisition of information. The main effect of task complexity was not significant for the variability of search across attributes based on all acquisitions of information.

Both measures of variability of search across attributes indicated that subjects looked at each attribute more equally and had less variability of search across attributes in the low-complexity task than in the high-complexity task. Additionally, the order of the decision task did not significantly affect either measure of variability of search across attributes.

Hypotheses XIX, XX, and XXI

Hypotheses XIX, XX, and XXI tested the effects of situational involvement and task complexity on the concentration of search. The concentration of search index indicates the extent to which information search is concentrated on the chosen alternative. A value of zero indicates that a subject searched each alternative equally; a positive value indicates that the search is concentrated on

the chosen alternative. An increase in the concentration of search results from subjects using noncompensatory decision-making processes such as the elimination by aspect (EBA) model to eliminate unacceptable alternatives from the choice set.

Hypothesis XIX stated that the situational involvement has a significant effect on the concentration of search. Physicians in the experimental group were expected to have a lower value in the concentration of search than physicians in the control group.

Hypothesis XX stated that the complexity of the task has a significant effect on the concentration of search. Physicians were expected to have a lower value in the concentration of search in the low-complexity task than in the high-complexity task.

Hypothesis XXI stated that the situational involvement and task complexity have a significant interaction effect on the concentration of search. The difference in the concentration of search between the low and high-complexity conditions was expected to be significantly larger in the control group than in the experimental group.

The group means and standard deviations of the concentration of search are shown in Table 4.20. The three hypotheses were tested using a two-by-two mixed-model Latin square analysis of variance with the repeated measure on task complexity. The results of the analysis of variance are shown in Table 4.21.

Hypothesis XIX and Hypothesis XXI were not supported. The main effect of situational involvement and the interaction effect were not statistically significant. Additionally, the difference between the two treatment groups in the concentration of search was not in the hypothesized direction. Subjects in the experimental group tended to concentrate their search more on the chosen alternative than did subjects in the control group.

Hypothesis XX was supported. The main effect of task complexity was statistically significant ($p < 0.001$). Subjects searched each alternative more equally and had a lower value in the concentration of search index when faced with a three-alternatives task than when faced with a six-alternatives task. In addition, there was no significant task order or practice effect.

Table 4.20. Mean (Standard Deviation) Concentration of Search by Situational Involvement and Task Complexity

Involvement	Task Complexity		Overall
	Three Alternatives	Six Alternatives	
Experimental (n=24)	0.296 (0.262)	0.827 (0.376)	0.562 (0.418)
Control (n=24)	0.254 (0.345)	0.571 (0.448)	0.412 (0.427)
Overall (n=48)	0.275 (0.304)	0.699 (0.429)	0.487 (0.427)

Table 4.21. Analysis of Variance Source Table for Concentration of Search

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.534	1	0.534	3.269	0.077
Order	0.008	1	0.008	0.049	0.826
Invo x Order	0.165	1	0.165	1.010	0.320
S. w. groups	7.183	44	0.163		
<u>Within-Subjects Effects</u>					
Complexity	4.301	1	4.301	39.258	<.001
Invo x Comp	0.276	1	0.276	2.518	0.120
Practice	0.007	1	0.007	0.065	0.801
Invo x Pract	0.002	1	0.002	0.015	0.903
Residual	4.821	44	0.110		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Hypotheses XXII and XXIII

Hypotheses XXII and XXIII concerned the effects of situational involvement and task complexity on the use of decision-making processes. Two independent judges were involved in classifying subjects' search patterns into various types of decision-making processes. Inter-judge agreement was 84.4% percent. The differences between the two judges were resolved through mutual agreement following discussion. The percentage of subjects using each decision strategy in each treatment group is shown in Table 4.22.

As indicated earlier in Chapter III, the general classification of compensatory versus noncompensatory decision-making processes was more relevant to the purpose of the study than the specific model used by subjects. Thus, hypothesis testing was based on the general type of decision-making processes.

Table 4.22. Percentage of Subjects Employing Various Search Pattern by Situational Involvement and Task Complexity

Search Pattern	Experimental		Control	
	3 alt	6 alt	3 alt	6 alt
<u>Compensatory</u>				
Alternative-Based	0.0	0.0	8.3%	0.0
Attribute-Based	8.3%	4.2%	20.8%	8.3%
Simultaneous Blend of alt- and att-based	<u>58.3%</u>	<u>16.7%</u>	<u>41.7%</u>	<u>25%</u>
Total Compensatory	66.6%	20.9%	70.8%	33.3%
<u>Noncompensatory</u>				
Alternative-Based	0.0	0.0	0.0	0.0
Attribute-Based	0.0	0.0	0.0	12.5%
Disjunctive	0.0	0.0	4.2	0.0
Simultaneous Blend of alt- and att-based	12.5%	54.2%	8.3%	37.5%
<u>Sequential Mixed</u>				
Noncom. att-based, then com. alt-based	0.0	4.2%	0.0	4.2%
Noncom. att-based, then noncom. alt-based	8.3%	0.0	0.0	0.0
Noncom. att-based, then com. att-based	8.3%	0.0	4.2%	4.2%
Noncom. att-based, then sim. blend of alt- and att-based	4.2%	12.5%	8.3%	8.3%
Other mixed	<u>0.0</u>	<u>0.0</u>	<u>4.2%</u>	<u>0.0</u>
Total Noncompensatory	33.3%	79.2%	29.2%	66.7%

Hypothesis XXII stated that a higher proportion of subjects in the experimental group used compensatory decision processes than subjects in the control group across levels of task complexity.

Hypothesis XXII was tested using a test of the difference between proportions. Hypothesis XXII was not supported. There were no significant differences in the proportion of subjects who used compensatory decision processes between the two groups across levels of task complexity. The number and percentage of subjects using compensatory processes in each decision task is shown in Table 4.23.

Hypothesis XXIII stated that a significant number of subjects shifted from using compensatory decision-making processes in the low-complexity condition to using noncompensatory decision-making processes in the high-complexity condition across the experimental and control groups

Hypothesis XXIII was tested using the McNemar test for two related samples. Hypothesis XXIV was supported across the experimental and control groups. A significant number of subjects (45.8% in the experimental group, and 41.7% in the control group) shifted from using compensatory processes in the three-alternative task to using noncompensatory processes in the six-alternative task. The number of subjects shifting

Table 4.23. Number (Percentage) of Subjects Using Compensatory Decision-Making Processes by Situational Involvement and Task Complexity

Involvement ^a	Task Complexity	
	Three Alternatives	Six Alternatives
Experimental (n=24)	16 (66.67%)	5 (20.83%)
Control (n=24)	17 (70.83%)	8 (33.33%)

^a difference in percentage of subjects using compensatory decision-making processes between experimental and control group at each level of task complexity; low-complexity task ($z=0.31$, $p>0.1$), high-complexity task ($z=0.98$, $p>0.1$)

decision-making processes in each treatment group is shown in Table 4.24.

Hypotheses XXIV, XXV, and XXVI

Hypotheses XXIV, XXV, and XXVI concerned the degree of fit of the linear conjoint model and the predictive validity of applying the utility values, estimated from the conjoint analysis, in predicting physician drug choice under different levels of situational involvement and task complexity.

Hypothesis XXIV stated that the degree of fit of a linear compensatory model is higher in the experimental group than in the control group.

Hypothesis XXIV was tested using a two-tailed t-test. The percentage of all pairs of alternatives (predicted versus observed preference ranking) that violated the linear model predictions was calculated from the conjoint LINMAP program. The measure was used to indicate the degree of fit of the linear model. The group means and standard deviations of percentage of violations are shown in Table 4.25.

Hypothesis XXIV was not supported. The analysis indicated there was no difference in the mean percentage of pairs which violated the linear model predictions between the two treatment groups. The results indicated that the linear model fit the data equally well in both groups.

Table 4.24. Number (Percentage) of Subjects Who Shifted from Using Compensatory to Noncompensatory Decision-Making Processes by Situational Involvement

Involvement ^a	Number (percentage) of subjects
Experimental (n=24)	11 (45.83%)
Control (n=24)	10 (41.67%)

^a The McNemar test is statistically significant for experimental ($\chi^2 = 9.09$, $df=1$, $p<0.005$) and control group ($\chi^2 = 5.82$, $df=1$, $p<0.025$)

Table 4.25. Mean (Standard Deviation) of Percentage of Violations of Linear Model Predictions by Situational Involvement

Involvement ^a	Percent Violations
Experimental (n=24)	7.208 (4.782)
Control (n=24)	7.625 (4.595)

^a differences between means of experimental and control group; $t=0.31$, $df=46$, $p>0.1$

Hypothesis XXV stated that the prediction of choice based on a linear compensatory model is more accurate in the experimental group than in the control group across levels of task complexity.

The percentage of time the utility values derived from conjoint analysis correctly predicted drug choice by situational involvement and task complexity is presented in Table 4.26. The percentage of correct predictions was significantly better than chance ($p < 0.05$) across levels of situational involvement and task complexity.

Hypothesis XXV was tested using a test of the difference between proportions. Hypothesis XXVI was not supported. There were no significant differences in the percentage of correct predictions between the two groups across levels of task complexity. Overall, the prediction was found to be more accurate in the experimental group than in the control group, even though the results were not statistically significant (Table 4.26).

Hypothesis XXVI stated that the prediction of choice based on a linear compensatory model is more accurate in the low-complexity task than in the high-complexity task across levels of situational involvement.

Table 4.26. Percentage of Time the Utility Values Derived from Conjoint Analysis Correctly Predicted Drug Choice by Situational Involvement and Task Complexity

Involvement ^a	Task Complexity ^b	
	Three Alternatives	Six Alternatives
Experimental (n=24)	66.67% ^c	54.17% ^c
Control (n=24)	66.67% ^c	45.83% ^c

^a difference in percentage of correct predictions between experimental and control group; low-complexity task ($z=0$, $p=1$), high-complexity task ($z=0.58$, $p>0.1$)

^b difference in percentage of correct predictions between three and six alternatives; experimental ($\chi^2=0.36$, $df=1$, $p>0.1$), control ($\chi^2=1.45$, $df=1$, $p>0.1$)

^c probability that percentage of correct predictions reflects chance variation is less than 0.05

Hypothesis XXVI was tested using the McNemar test. Hypothesis XXVI was not supported. There were no significant changes in the percentage of correct predictions between the three-alternative and the six-alternative task in both treatment groups. However, the predictive accuracy was found to be higher in the low-complexity task than in the high-complexity task.

Exploratory Question I

Do situational involvement and task complexity affect the direction of information search?

The effects of situational involvement and task complexity on the direction of information searched were examined using a two-by-two mixed model Latin square analysis of variance with repeated measure on task complexity. The group means and standard deviations of the direction of search are shown in Table 4.27. The results of the analysis of variance are shown in Table 4.28.

Situational involvement and task complexity were not found to have statistically significant effects on direction of search. The interaction effect was not statistically significant. Additionally, there was no significant task order or practice effect. However, it should be noted that subjects in the experimental group acquired the information using relatively more alternative-based processing (positive

Table 4.27. Mean (Standard Deviation) Direction of Search by Situational Involvement and Task Complexity

Involvement	Task Complexity		
	Three Alternatives	Six Alternatives	Overall
Experimental (n=24)	0.024 (0.333)	-0.002 (0.355)	0.011 (0.341)
Control (n=24)	0.021 (0.400)	-0.125 (0.387)	-0.052 (0.396)
Overall (n=48)	0.022 (0.364)	-0.063 (0.373)	-0.020 (0.369)

Table 4.28. Analysis of Variance Source Table for Direction of Search

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.095	1	0.095	0.410	0.525
Order	0.141	1	0.141	0.612	0.438
Invo x Order	0.006	1	0.006	0.025	0.875
S. w. groups	10.150	44	0.231		
<u>Within-Subjects Effects</u>					
Complexity	0.177	1	0.177	3.433	0.071
Invo x Comp	0.086	1	0.086	1.663	0.204
Practice	0.000	1	0.000	0.007	0.933
Invo x Pract	0.015	1	0.015	0.299	0.587
Residual	2.265	44	0.051		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

value of direction of search); while subjects in the control group acquired the information using relatively more attribute-based processing (negative value of direction of search). Furthermore, as the task complexity increased, the relative use of attribute-based processing increased. The effect of task complexity on the direction of search approached significance ($p=0.071$).

Exploratory Question II

Do situational involvement and task complexity affect the proportion of time subjects spend acquiring information on each of the six drug attributes?

The effects of the situational involvement and task complexity on the proportion of time subject spent acquiring information on each drug attribute were examined by using a two-by-two mixed-model Latin square analysis of variance. The group means and standard deviations of proportion of time spent on each attribute by situational involvement and task complexity is shown in Table 4.29.

Table 4.29. Means (Standard Deviation) Proportion of Time Spent on Drug Attributes by Situational Involvement and Task Complexity

Drug Attribute	Experimental		Control	
	3 alt	6 alt	3 alt	6 alt
Cure Rate ^a	0.254 (.091)	0.211 (.088)	0.252 (.133)	0.237 (.095)
Cost per Treatment ^b	0.163 (.076)	0.260 (.111)	0.179 (.085)	0.196 (.065)
Incidence of GI Upset	0.155 (.075)	0.164 (.094)	0.144 (.060)	0.192 (.065)
Incidence of Vaginitis	0.135 (.082)	0.132 (.066)	0.150 (.090)	0.135 (.085)
Duration of Treatment ^a	0.165 (.076)	0.113 (.049)	0.152 (.055)	0.122 (.045)
Dosage Schedule	0.129 (.075)	0.120 (.051)	0.127 (.059)	0.117 (.054)

^a effect of task complexity is significant ($p < 0.05$)

^b interaction effect between situational involvement and task complexity is significant ($p < 0.05$)

The results of the analysis of variance for the proportion of time spent on cure rate information is shown in Table 4.30. The main effect of situational involvement and the interaction effect were not significant. However, the main effect of task complexity was statistically significant ($p < 0.05$). Subjects spent proportionally less time on cure rate information when the task became more complex. The order of the decision tasks did not have a significant effect on the proportion of time spent on cure rate information

Table 4.31 displays the results of the analysis of variance for the proportion of time spent on cost per treatment information. The interaction effect was statistically significant ($p < 0.05$). Following, an analysis of simple effects was conducted to determine the treatment combination that contributed to a significant interaction effect. An analysis of main effect of task complexity at each level of situational involvement indicated that the mean difference in the proportion of time spent on cost information between the three- and the six-alternative task was statistically significant in the experimental group ($p < 0.001$), but was not statistically significant in the control group. Subjects in the experimental group spent proportionally more time on cost information as the task complexity increased, while subjects in the control group spent about equal proportion of time on cost information across the two tasks.

Table 4.30. Analysis of Variance Source Table for Proportion of Time Spent on Cure Rate Information

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.004	1	0.004	0.207	0.651
Order	0.001	1	0.001	0.035	0.852
Invo x Order	0.001	1	0.001	0.040	0.843
S. w. groups	0.772	44	0.018		
<u>Within-Subjects Effects</u>					
Complexity	0.020	1	0.020	4.202	0.046
Invo x Comp	0.005	1	0.005	0.964	0.332
Practice	0.000	1	0.000	0.033	0.858
Invo x Pract	0.000	1	0.000	0.002	0.966
Residual	0.213	44	0.005		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.31. Analysis of Variance Source Table for Proportion of Time Spent on Cost Per Treatment Information

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.014	1	0.014	1.588	0.214
Order	0.004	1	0.004	0.413	0.524
Invo x Order	0.000	1	0.000	0.018	0.893
S. w. groups	0.390	44	0.009		
<u>Within-Subjects Effects</u>					
Complexity	0.078	1	0.078	12.263	0.001
Invo x Comp	0.038	1	0.038	6.013	0.018
Practice	0.003	1	0.003	0.512	0.478
Invo x Pract	0.003	1	0.003	0.405	0.528
Residual	0.280	44	0.006		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

The results of the analysis of variance for the proportion of time spent on incidence of gastrointestinal (GI) upset and vaginitis information are shown in Tables 4.32 and 4.33, respectively. There were no significant main effects for involvement and task complexity for the proportion of time spent on incidence of GI upset and vaginitis. In addition, the interaction effect and order effect were not statistically significant.

The results of the analysis of variance for the proportion of time spent on duration of treatment information are shown in Table 4.34. The main effect of situational involvement and the interaction effect were not significant. The main effect of task complexity was statistically significant ($p < 0.001$). Subjects spent proportionally less time on duration of treatment information as task complexity increased. In addition, the order effect was not statistically significant.

Table 4.35 displays the results of the analysis of variance for the proportion of time spent on dosage schedule information. The main effects of situational involvement and task complexity were not significant. There was no significant interaction effect between involvement and task complexity.

Table 4.32. Analysis of Variance Source Table for Proportion of Time Spent on Incidence of GI Upset Information

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.002	1	0.002	0.317	0.576
Order	0.007	1	0.007	1.137	0.292
Invo x Order	0.016	1	0.016	2.707	0.107
S. w. groups	0.265	44	0.006		
<u>Within-Subjects Effects</u>					
Complexity	0.019	1	0.019	3.769	0.059
Invo x Comp	0.009	1	0.009	1.790	0.188
Practice	0.001	1	0.001	0.254	0.617
Invo x Pract	0.001	1	0.001	0.103	0.749
Residual	0.226	44	0.005		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.33. Analysis of Variance Source Table for Proportion of Time Spent on Incidence of Vaginitis Information

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.002	1	0.002	0.220	0.641
Order	0.004	1	0.004	0.455	0.503
Invo x Order	0.002	1	0.002	0.243	0.624
S. w. groups	0.375	44	0.009		
<u>Within-Subjects Effects</u>					
Complexity	0.002	1	0.002	0.370	0.546
Invo x Comp	0.001	1	0.001	0.177	0.676
Practice	0.000	1	0.000	0.033	0.856
Invo x Pract	0.013	1	0.013	2.788	0.102
Residual	0.212	44	0.005		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.34. Analysis of Variance Source Table for Proportion of Time Spent on Duration of Treatment Information

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.000	1	0.000	0.013	0.908
Order	0.000	1	0.000	0.008	0.929
Invo x Order	0.013	1	0.013	3.599	0.064
S. w. groups	0.162	44	0.004		
<u>Within-Subjects Effects</u>					
Complexity	0.040	1	0.040	14.291	<.001
Invo x Comp	0.003	1	0.003	1.034	0.315
Practice	0.000	1	0.000	0.060	0.808
Invo x Pract	0.007	1	0.007	2.335	0.134
Residual	0.124	44	0.003		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.35. Analysis of Variance Source Table for Proportion of Time Spent on Dosage Schedule Information

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.000	1	0.000	0.035	0.852
Order	0.000	1	0.000	0.029	0.865
Invo x Order	0.001	1	0.001	0.241	0.626
S. w. groups	0.158	44	0.004		
<u>Within-Subjects Effects</u>					
Complexity	0.002	1	0.002	0.525	0.472
Invo x Comp	0.000	1	0.000	0.003	0.954
Practice	0.000	1	0.000	0.003	0.957
Invo x Pract	0.019	1	0.019	5.258	0.027
Residual	0.158	44			

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

However, there was a significant interaction effect between involvement and practice effect. The interaction effect indicated that subjects in each treatment group reacted differently to the sequence of the decision task. Subjects in the experimental group spent a higher proportion of time on dosage information in the second sequence of the decision task than in the first sequence (Dose1 = 0.011, S.D.= 0.052; Dose2= 0.138, S.D. = 0.072). In contrast, the mean difference between the two task sequences was reversed for the control group. Subjects in the control group spent a lesser proportion of time on dosage information in the second sequence of the task than in the first sequence (Dose1 = 0.137, S.D. = 0.054; Dose2 = 0.108, S.D. = 0.056).

Exploratory Question III

Does situational involvement affect choice outcomes across levels of task complexity?

Chi-square analysis was used to examine the significant difference in the frequency distribution of the chosen drug alternative between experimental and control groups. Tables 4.36 and 4.37 display the number and percentage of subjects in each treatment group who chose each drug alternative across the two decision tasks. The choice distributions did not differ significantly in the three-alternative task (chi-square = 4.00, df=2, $p>0.1$). However, the choice distributions were

Table 4.36. Number and Percentage of Subjects Choosing Each Drug from a Set of Three Drug Alternatives by Treatment Group

Drug Alternative	Involvement ^a	
	Experimental	Control
A	3 (12.5%)	0
B	12 (50%)	12 (50%)
C	9 (37.5%)	12 (50%)

^a difference in frequency distribution between the experimental and control groups; $\chi^2 = 4.00$, $df=2$, $p>0.1$

Table 4.37. Number and Percentage of Subjects Choosing Each Drug from a Set of Six Drug Alternatives by Treatment Group

Drug Alternative ^b	Involvement ^a	
	Experimental	Control
A	4 (16.7%)	9 (37.5%)
B	0	1 (4.2%)
C	9 (37.5%)	2 (8.3%)
F	11 (45.8%)	12 (50%)

^a difference in frequency distribution between the two groups; $\chi^2 = 11.78$, $df=3$, $p<0.01$

^b none of subjects in both groups chose drugs D and E

significantly different in the six-alternative task (chi-square = 11.78, $df=3$, $p<0.01$). Fewer subjects in the experimental group chose drug A, and more subjects chose drug C, when compared with the control group.

Exploratory Question IV

What is the relative importance of drug attributes in influencing physician's likelihood of prescribing a set of drug profiles?

The utility values of each drug attribute estimated from conjoint analysis were used to indicate the relative importance of each drug attribute in influencing physician's preference for drug profiles. The utility values obtained from aggregate level conjoint analysis for each treatment group are shown in Table 4.38.

On an aggregate basis, subjects in both groups were similar in the relative importance placed on each attribute. Overall, the attributes in descending order of importance are: cure rate, cost per treatment, incidence of GI upset, incidence of vaginitis, duration of treatment, and dosage schedule.

Table 4.38. The Relative Importance of Drug Attributes Derived from Aggregate Level Conjoint Analysis by Situational Involvement

Drug Attribute	Involvement	
	Experimental	Control
Cure Rate	38.94%	42.37%
Cost per Treatment	21.72%	19.38%
Incidence of GI Upset	11.67%	12.17%
Incidence of Vaginitis	10.48%	9.37%
Duration of Treatment	10.33%	8.48%
Dosage Schedule	6.85%	8.23%

However, the results of individual level conjoint analysis indicated differences in the relative importance placed on each drug attribute between the experimental and control group. The number and percentage of subjects in each treatment group that considered each drug attribute as being most important is shown in Table 4.39.

Chi-square analysis indicated a significant difference in the frequency distribution of percentage of subjects that considered each drug attribute as being most important between the two groups ($p < 0.05$). When compared to the control group, a higher number of subjects in the experimental group considered cost per treatment as the most important attribute, while fewer subjects considered incidence of side effects (eg. GI and vaginitis combined) as the most important attribute.

Exploratory Question V

Is there an association between the relative importance of drug attributes obtained from conjoint analysis, the order of attributes searched, the ranked order of proportion of information searched by attribute, and ranked order of proportion of time spent on each attribute across levels of situational involvement and task complexity?

Table 4.39. Number and Percentage of Physicians Considering Each Drug Attribute as being Most Important by Situational Involvement: Individual Level Conjoint Analysis

Drug Attribute	Involvement ^a	
	Experimental (n=24)	Control (n=24)
Cure Rate	10 (41.67%)	11 (45.83%)
Cost per Treatment	10 (41.67%)	5 (20.83%)
Incidence of Side Effects ^b	4 (16.67%)	8 (33.33%)

^a difference between frequency distributions of experimental and control group; $\chi^2 = 7.09$, $df=2$, $p < 0.05$

^b the categories of incidence of GI upset and vaginitis were combined into one category due to a small number of respondents in each category

The Spearman's rank correlation coefficient was used to determine an association between each of the pairs of the four variables mentioned above. The rank correlation coefficients were calculated for each subject, and then averaged across subjects in each treatment group. In addition, a two-by-two analysis of variance was conducted to determine whether the level of correlation between the variables changed across levels of situational involvement and task complexity.

The average Spearman's rank correlation coefficients between each of the pairs of the variables classified by situational involvement and task complexity are displayed in Table 4.40. Overall, the average Spearman's rank correlation between the variables was low to moderate.

The average Spearman's rank correlation coefficients between order of information searched and ranked order of utility values were not statistically significant across levels of situational involvement and task complexity. The results indicated that there was no significant relationship between the two variables.

In addition, a two-by-two mixed model Latin square analysis of variance indicated that the relationship between order of information searched and ranked order of utility values were not significantly different under differing levels of situational involvement and task complexity. The results of the analysis of variance are shown in Table 4.41.

Table 4.40. Average Spearman Rank Correlations of Attribute Utilities, Proportion of Information Searched by Attribute, Proportion of Time Spent Searching Information, and Search Order by Situational Involvement and Task Complexity

Correlations	Task Complexity	
	Three Alternatives	Six Alternatives
<u>Order and Utilities</u>		
Experimental	0.210	0.138
Control	0.185	0.141
<u>Prop. of Search and Utilities</u>		
Experimental	0.199	0.310
Control	0.232	0.415 ^a
<u>Prop. of Time and Utilities</u>		
Experimental	0.245	0.439 ^a
Control	0.297	0.430 ^a
<u>Order and Prop. of Search</u>		
Experimental	0.238	0.466 ^a
Control	0.336	0.374
<u>Order and Prop. of Time</u>		
Experimental	0.152	0.419 ^a
Control	0.213	0.260
<u>Prop. of Search and Prop. of Time</u>		
Experimental	0.605 ^a	0.716 ^a
Control	0.435 ^a	0.717 ^a

^a significant Spearman Rank Correlation ($p < 0.05$)

Table 4.41. Analysis of Variance Source Table for Average Spearman Rank Correlations between Order of Search and Ranked Order of Conjoint Utilities

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.003	1	0.003	0.010	0.921
Order	0.485	1	0.485	1.550	0.220
Invo x Order	0.077	1	0.077	0.245	0.623
S. w. groups	13.782	44	0.313		
<u>Within-Subjects Effects</u>					
Complexity	0.080	1	0.080	1.242	0.271
Invo x Comp	0.005	1	0.005	0.071	0.791
Practice	0.070	1	0.070	1.089	0.302
Invo x Pract	0.004	1	0.004	0.058	0.811
Residual	2.836	44	0.064		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

The average Spearman's rank correlation coefficient between ranked order of proportion of information searched and ranked order of utility values was statistically significant for the six-alternative task in the control group. In addition, a two-by-two mixed model Latin square analysis of variance indicated significant interaction effect between situational involvement and between-subject task order. For the control group, the correlation between ranked order of proportion of information searched and ranked order of conjoint utility was lower for subjects who first received the high-complexity task (average $r = 0.236$) than those who first received the low-complexity task (average $r = 0.412$). For the experimental group, the relationship was reversed. Subjects who first received the high-complexity task had a higher correlation coefficient (average $r = 0.355$) than subjects who first received the low-complexity task (average $r = 0.154$).

Additionally, the effect of task complexity on the average Spearman's rank correlations approached significance ($p=0.056$). The correlation between ranked order of proportion of information searched and ranked order of conjoint utility values was higher in the high-complexity task than in the low-complexity task. The results of the analysis of variance is shown in Table 4.42.

Table 4.42. Analysis of Variance Source Table for Average Spearman Rank Correlations between Ranked Order of Proportion of Search and Ranked Order of Conjoint Utilities

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.116	1	0.116	0.573	0.453
Order	0.003	1	0.003	0.017	0.896
Invo x Order	0.855	1	0.855	4.240	0.045
S. w. groups	8.870	44	0.202		
<u>Within-Subjects Effects</u>					
Complexity	0.518	1	0.518	3.865	0.056
Invo x Comp	0.031	1	0.031	0.231	0.633
Practice	0.025	1	0.025	0.190	0.665
Invo x Pract	0.193	1	0.193	1.437	0.237
Residual	5.897	44	0.134		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

The average Spearman's rank correlation coefficients between ranked order of proportion of time spent on each attribute and ranked order of utility values was statistically significant for the six-alternative task, but not significant for the three-alternative task. A two-by-two mixed model Latin square analysis of variance indicated that the relationship between ranked order of proportion of time spent on attribute and ranked order of utility values was significantly higher in the six-alternative task than in the three-alternative task ($p < 0.05$). The main effect of situational involvement and the interaction effect were not significant. The results of the analysis of variance are shown in Table 4.43.

The average Spearman's rank correlation coefficients between ranked order of information searched and ranked order of proportion of information searched was statistically significant for the six-alternative task in the experimental group. A two-by-two mixed model Latin square analysis of variance indicated that the relationship between ranked order of information searched of drug attributes and ranked order of proportion of information searched was not significantly different under differing levels of situational involvement and task complexity. The results of the analysis of variance is shown in Table 4.44.

Table 4.43. Analysis of Variance Source Table for Average Spearman Rank Correlations between Ranked Order of Proportion of Time Spent on Drug Attribute and Ranked Order of Conjoint Utilities

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.011	1	0.011	0.088	0.768
Order	0.126	1	0.126	1.036	0.314
Invo x Order	0.076	1	0.076	0.627	0.433
S. w. groups	5.332	44	0.121		
<u>Within-Subjects Effects</u>					
Complexity	0.639	1	0.639	4.362	0.043
Invo x Comp	0.022	1	0.022	0.152	0.699
Practice	0.072	1	0.072	0.488	0.489
Invo x Pract	0.328	1	0.328	2.239	0.142
Residual	6.448	44	0.147		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.44. Analysis of Variance Source Table for Average Spearman Rank Correlations between Order of Attribute Search and Ranked Order of Proportion of Information Searched on Drug Attribute

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.000	1	0.000	0.001	0.977
Order	0.008	1	0.008	0.029	0.867
Invo x Order	0.004	1	0.004	0.015	0.903
S. w. groups	11.860	44	0.270		
<u>Within-Subjects Effects</u>					
Complexity	0.423	1	0.423	2.120	0.183
Invo x Comp	0.216	1	0.216	1.081	0.304
Practice	0.051	1	0.051	0.257	0.615
Invo x Pract	0.129	1	0.129	0.648	0.425
Residual	8.785	44	0.200		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

The average Spearman's rank correlation coefficients between ranked order of information searched and ranked order of proportion of time spent on each attribute was statistically significant for the six-alternative task in the experimental group. However, a two-by-two mixed model Latin square analysis of variance indicated that the relationship between ranked order of information searched and ranked order of proportion of time spent on each attribute was not significantly different under differing levels of situational involvement and task complexity. The results of the analysis of variance is shown in Table 4.45.

The average Spearman's rank correlation coefficients between ranked order of proportion of information searched and ranked order of proportion of time spent on each attribute were statistically significant across levels of situational involvement and task complexity. A two-by-two mixed model Latin square analysis of variance indicated that the relationship between ranked order of proportion of information searched and ranked order of proportion of time spent on attribute was significantly stronger in the six-alternative task than in the three-alternative task ($p < 0.001$). The main effect of situational involvement and the interaction effect were not significant. The results of the analysis of variance is shown in Table 4.46.

Table 4.45. Analysis of Variance Source Table for Average Spearman Rank Correlations between Order of Search and Ranked Order of Proportion of Time Spent on Drug Attribute

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.057	1	0.507	0.266	0.609
Order	0.059	1	0.059	0.276	0.602
Invo x Order	0.134	1	0.134	0.626	0.433
S. w. groups	9.408	44	0.214		
<u>Within-Subjects Effects</u>					
Complexity	0.588	1	0.588	3.209	0.080
Invo x Comp	0.289	1	0.289	1.578	0.216
Practice	0.042	1	0.042	0.227	0.636
Invo x Pract	0.177	1	0.177	0.964	0.332
Residual	8.058	44	0.183		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Table 4.46. Analysis of Variance Source Table for Average Spearman Rank Correlations between Order of Proportion of Search and Ranked Order of Proportion of Time Spent on Drug Attribute

Source	SS	df	MS	F	p
<u>Between-Subjects Effects</u>					
Involvement	0.171	1	0.171	1.629	0.209
Order	0.194	1	0.194	1.848	0.181
Invo x Order	0.012	1	0.012	0.113	0.739
S. w. groups	4.617	44	0.105		
<u>Within-Subjects Effects</u>					
Complexity	0.929	1	0.929	10.903	0.002
Invo x Comp	0.175	1	0.175	2.052	0.159
Practice	0.298	1	0.298	3.502	0.068
Invo x Pract	0.004	1	0.004	0.052	0.821
Residual	3.750	44	0.085		

Invo=Involvement; Comp=Complexity; S. w. groups=Subjects within groups; Pract=Practice

Exploratory Question VI

Is there an association between the order of attribute searched in the low complexity task and the order of search in the high complexity task across levels of situational involvement?

The Spearman's rank correlation coefficient was used to determine the association between the order of attribute searched in the three-alternative task and the order of search in the six-alternative task. The rank correlation coefficient was calculated for each subject and then averaged across subjects.

The average Spearman's rank correlation coefficient is 0.660 and 0.552 for the experimental and control group, respectively. The average Spearman's rank correlation coefficients were statistically significant across treatment groups ($p < 0.05$). The results indicated a positive relationship between the order of search in the two decision tasks. The average ranked order of search of drug attributes by treatment group and task complexity is displayed in Table 4.47.

Table 4.47. Mean (Standard Deviation) of Order of Attribute Searched by Situational Involvement and Task Complexity

Drug Attribute	Experimental		Control	
	3 alt	6 alt	3 alt	6 alt
Cost per Treatment	4.625 (1.765)	4.958 (1.654)	4.542 (1.956)	5.042 (1.574)
Incidence of GI Upset	4.583 (1.501)	4.333 (1.373)	4.000 (1.588)	4.167 (1.239)
Dosage Schedule	3.167 (1.435)	3.750 (0.847)	3.458 (1.382)	3.667 (1.167)
Duration of Treatment	3.333 (0.868)	3.083 (1.139)	3.083 (1.176)	2.792 (0.932)
Cure Rate	3.208 (1.532)	3.333 (0.211)	3.625 (1.837)	3.458 (1.769)
Incidence of Vaginitis	2.083 (1.692)	1.542 (1.215)	2.292 (1.429)	1.875 (1.624)

^a The ranked order ranged from 1-6. An attribute that was searched first was given the rank of six, while an attribute that was not searched or searched the last was given the rank of one. If more than one attributes were not searched, the average rank of those attributes was given.

In addition, a two-tailed t-test was conducted to determine the significant differences between the two groups in the average Spearman's rank correlation coefficients. The results indicated no significant differences in the average Spearman's correlation coefficients between the two groups ($t = 0.837$, $df=46$, $p>0.05$).

Exploratory Question VII

Is there an association between the ranked order of proportion of information searched on drug attributes in the low complexity task and the ranked order of proportion of information searched on drug attributes in the high complexity task across levels of situational involvement?

The average Spearman's rank correlation coefficient was used to determine the association between the ranked order of proportion of information searched of drug attributes in the three-alternative task and the ranked order of proportion of information searched of drug attributes in the six-alternative task. The average Spearman's rank correlation coefficient is 0.108 and 0.264 for the experimental and control group, respectively. The average Spearman's rank correlation coefficients were not statistically significant across both treatment groups. The results indicated that there was no significant relationship between the ranked order of proportion of information searched in the two decision tasks.

The mean proportion of information searched by treatment group and task complexity is displayed in Table 4.48. The ranked order of the proportion of information searched by treatment group and task complexity is displayed in Table 4.49. The extent to which each attribute information is searched seemed to differ between the two decision tasks. The relative attention given to cost information increased as the task become more complex. For instance, in the experimental group, cost was ranked fifth in the extent of search in the three-alternative task, but was ranked first in the extent of search in the six-alternative task.

In addition, a two-tailed t-test was conducted to determine the significant differences between the two groups in the average Spearman's rank correlation coefficients. The results indicated no significant differences in the average Spearman's correlation coefficients between the two groups ($t = 0.476$, $df=46$, $p>0.05$).

Table 4.48. Mean (Standard Deviation) of Proportion of Information Searched of Drug Attribute by Situational Involvement and Task Complexity

Drug Attribute	Experimental		Control	
	3 alt	6 alt	3 alt	6 alt
Cost per Treatment	0.148 (0.055)	0.232 (0.093)	0.152 (0.054)	0.195 (0.059)
Incidence of GI Upset	0.189 (0.059)	0.174 (0.075)	0.172 (0.053)	0.194 (0.064)
Dosage Schedule	0.154 (0.059)	0.131 (0.051)	0.150 (0.041)	0.141 (0.060)
Duration of Treatment	0.164 (0.041)	0.129 (0.050)	0.161 (0.055)	0.131 (0.042)
Cure Rate	0.216 (0.045)	0.205 (0.069)	0.236 (0.110)	0.208 (0.051)
Incidence of Vaginitis	0.129 (0.046)	0.129 (0.067)	0.128 (0.061)	0.131 (0.062)

Table 4.49. Aggregate Ranked Order of Proportion of Information Search of Drug Attribute by Situational Involvement and Task Complexity

Drug Attribute	Experimental		Control	
	3 alt	6 alt	3 alt	6 alt
Cost per Treatment	5	1	4	2
Incidence of GI Upset	2	3	2	3
Dosage Schedule	4	4	5	4
Duration of Treatment	3	5.5	3	5.5
Cure Rate	1	2	1	1
Incidence of Vaginitis	6	5.5	6	5.5

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This research utilized a combination of a process-tracing technique and an analysis of final judgment to determine the effects of situational involvement and task complexity on the information acquisition and decision-making process underlying drug prescribing. In addition, the predictive accuracy of applying the linear compensatory model to predict drug choice under differing levels of situational involvement and task complexity was assessed. Finally, the study examined the relationship between the relative importance of drug attributes derived from an analysis of final judgments and those derived from a process-tracing technique. In this chapter, the results of the research are discussed, conclusions from the findings are drawn, and recommendations for future research in the area of physician drug prescribing are provided.

Discussion

Effects of Situational Involvement and Task Complexity

The hypotheses that there would be significant interaction effects between situational involvement and task complexity on the information acquisition and decision-making

processes were not supported. Additionally, situational involvement, as manipulated in this research, was not found to have significant main effects on the use of decision-making processes. Situational involvement was manipulated by telling physicians in the experimental group to assume that their prescribing decisions would be reviewed and evaluated by their peers and that they would be required to justify their choice of drugs with an infectious-disease specialist. There was no mention of peer review or the need to justify drug choice in the control group.

Subjects in the experimental group were not found to be significantly different from subjects in the control group regarding: 1) amount of time spent acquiring information per alternative; 2) amount of time spent per item of information acquired; 3) proportion of available information acquired; 4) variability in the proportion of information searched across alternatives; 5) variability in the proportion of information searched across attributes; 6) concentration of search; and 7) direction of search.

Contrary to the predictions, subjects in the experimental group spent less time acquiring information and less time per each piece of information acquired, searched a lower proportion of available information, had a higher variability in the proportion of information searched across alternatives and across attributes, and had a higher value in the

concentration of search than did subjects in the control group. Subjects in the experimental group also tended to use a relatively more alternative-based processing than subjects in the control group.

Although the mean differences between the two groups in the above process-tracing measures were not statistically significant, the findings seemed to indicate that subjects in the experimental group tended to acquire and process information in a manner consistent with the use of less analytical decision-making strategies (i.e. noncompensatory processes) in making a drug choice. On the other hand, subjects in the control group tended to acquire and process information more analytically (i.e. compensatory processes).

The results of an analysis of process-tracing measures were found to be consistent with the results obtained from an analysis of individual search patterns. Subjects' search patterns recorded by the Mouselab program were classified into compensatory and noncompensatory processes by independent judges. The percentage of subjects using compensatory processes was higher in the control group than in the experimental group across levels of task complexity. However, the results were not statistically significant (See Table 4.23 in Chapter 4).

The possible explanation for the opposite effect of the situational involvement on the use of decision-making

processes is that subjects in the experimental group - who were asked to assume that their decisions would be reviewed and evaluated by peers and that they would be required to justify their choice - knew or could infer the criteria used in peer review and drug use evaluation and focused their search, accordingly, on those criteria while making drug choice.

Tetlock (1983) argued that the effects of requiring an individual to justify one's opinions to others on decision-making process depend upon whether (s)he knows or can infer the beliefs and preferences of those individuals (s)he needs to explain or justify the decision to. When these beliefs and preferences are known, an individual can reach a decision that is easily defensible by simply adopting those opinions and need not consider all available information in reaching a decision. However, when the beliefs and preferences of these individuals are unknown, (s)he will be motivated to process information carefully and thoroughly in order to reach a justifiable decision. The findings by Tetlock (1983), in a study on a controversial social issue, supported his hypothesis. Subjects who were required to justify their opinion or were accountable to a person whose views were unknown, used more complex information processing strategies than did subjects who were not accountable for the opinions or who were accountable to a person whose opinions were known.

This explanation seems likely for the effects of situational involvement found in this study since physicians frequently encounter drug use review and quality assurance in their practice settings. Normally, the criteria for drug use evaluation are made explicit to physicians. Especially, the cost-conscious health care environment in recent years may influence physicians to think about cost as the salient criterion for drug use evaluation. By knowing and inferring the important criteria used in drug use evaluation and justification, physicians in the experimental group simplified their decision processes by focusing their search on these few important attributes and needed not look at all available attribute information to arrive at a justifiable decision.

Another explanation for the lack of significant effects of situational involvement is that the manipulation used in this research was weak or unsuccessful in increasing subject's level of concern or temporary state of motivation to process information. Although, an analysis of the manipulation check scales indicated that subjects in the experimental group adopted the assumption stated in the scenario, subjects may not believe that there would be any serious consequences associated with drug use review and the need to justify drug choice. Furthermore, the outcomes of making an inappropriate decision in the treatment of uncomplicated urinary tract infection, used as a hypothetical case in this study - may not

be as consequential to physicians as other more serious disease conditions.

Thus, the lack of effects of situational involvement on the decision-making processes in this research did not contradict the involvement literature that found high-involvement subjects used a more analytical decision-making process than low-involvement subjects (Chaiken, 1980; Janis and Mann, 1977; Hagafors and Brehmer, 1983). Additionally, this research manipulated situational involvement as the need to justify the decision to others and the accountability of subjects for their decisions as part of drug use review and evaluation. Therefore, the results are limited to the operationalization of situational involvement used in this research. Different methods of manipulation or operationalizations of situational involvement may lead to different findings.

Although situational involvement had no significant effects on the use of decision-making processes, situational involvement was found to significantly affect the attention given to specific drug attribute information. There was a significant interaction effect between situational involvement and task complexity on the proportion of time spent on cost per treatment information. Subjects in the experimental group spent a significantly higher proportion of time on cost information in the six-alternative task than in the three-

alternative task. This effect was not found in the control group. Subjects in the control group spent about an equal proportion of time on cost information in both decision tasks. The findings seem to support the earlier explanation that subjects in the experimental group knew or inferred cost as an important criterion in drug use evaluation and justification. Subjects in the two groups were not significantly different in the proportion of time spent on cure rate, incidence of GI upsets, incidence of vaginitis, duration of treatment, and dosage schedule information.

Additionally, the results of the individual level conjoint analysis indicated that a higher number of subjects in the experimental group considered drug cost as the most important attribute, while a fewer number of subjects considered drug side effects (e.g. incidence of gastrointestinal upset and vaginitis) to be the most important attribute, when compared with the control group.

Furthermore, situational involvement was found to affect choice outcomes when the task became more complex. The choice distributions between the two treatment group did not differ significantly in the three-alternative task. However, the choice distributions were significantly different in the six-alternative task. A higher number of subjects in the experimental group chose Drug C when compared with the control group (37.5% in the experimental group versus 8.3% in the

control group). In comparison with other drug alternatives in a choice set, Drug C has the highest cure rate, highest cost, and the moderate and balance levels of incidence of GI upsets and vaginitis (See Figure 3.3 in Chapter III). This is an interesting finding since subjects in the experimental group, who were found to spend a significantly higher proportion of time on cost in the six-alternative task, did not select the lowest cost drug. Subjects in the experimental group seemed to tradeoff among cost, cure rate, and incidence of side effects.

One explanation for the finding is that differences in the decision-making processes lead to differences in the choice outcomes. However, this explanation may be unlikely since an analysis of process-tracing measures did not find a significant interaction effect between situational involvement and task complexity in the use of decision-making processes. Another explanation for the effect is that differences in drug attribute importance contributed to differences in the choice outcomes.

Task complexity, as manipulated by varying the number of alternatives in a choice set, was found to have significant main effects on the information acquisition and decision-making processes. As hypothesized, when choosing a drug among three alternatives, subjects spent a higher amount of time acquiring information per alternative, spent a higher amount

of time on each item of information acquired, acquired a higher proportion of available information, had less variability in the proportion of information searched based on first time acquisition of information across alternatives and across attributes, and had a lower value in the concentration of search than when choosing a drug among six alternatives. Subjects were found to use more attribute-based processing as the number of alternatives increased; the result approached significance ($p=0.07$).

It should be noted that the variability in the proportion of information searched across alternatives and across attributes, calculated based on first-time acquisition of information and reacquisition of the same information, were not found to be significantly different under differing levels of task complexity. On the other hand, the variability in the proportion of search measures calculated based only on first-time acquisition of information were significantly different between the two choice tasks. The difference between the two measures lies in the reacquisition of information. It is postulated that the variability of search measures based on first-time acquisition of information reflect variations in the information subjects considered in making drug choice, while the variability of search measures based on all acquisitions reflect both variation in information considered and subjects' memory capacity. Hence, the effect of task

complexity was less pronounced when using the variability of search measures based on all acquisitions.

In addition to process-tracing measures, an analysis of individual search patterns was conducted to determine the effect of task complexity on the use of decision-making processes. The results indicated that a significant number of subjects in both groups shifted from using compensatory processes to noncompensatory processes as the number of alternatives increased.

The findings concerning the significant effects of task complexity on the information acquisition and decision-making processes are consistent with findings reported from previous research (Biggs, et al. 1985; Klayman, 1985; Payne, 1976; Payne and Braunstein, 1978; Shield, 1980). The results support the contingency model based on the cost/benefit framework. According to Onken et al. (1985), the increase in task complexity results in an increase in the amount of cognitive strain and information overload. This effect increases the perceived benefits of using a less analytical strategy to simplify the decision task and reduce cognitive strain. The findings also support the notion that the use of decision-making processes is contingent upon characteristics of decision tasks and other factors.

Furthermore, task complexity was found to affect the attention given to specific drug attribute information.

Subjects spent a significantly lower proportion of time on cure rate and duration of treatment when the number of alternatives in a choice set increased. This is an interesting finding. The decrease in attention given to duration of treatment information is understandable since duration of treatment may not represent an important attribute. However, the decrease in attention given to cure rate information as the number of alternatives increased is surprising given its high importance in drug choice. The results obtained from conjoint analysis and a process-tracing technique found cure rate to be one of the most important attributes. Additionally, previous research has consistently found cure rate or effectiveness to be among the most highly valued attributes (Chinburapa, et al. 1988; Lilja, 1976, Segal and Hepler, 1982, 1985).

The decrease in the proportion of time spent on cure rate may have resulted from the increase in attention given to cost information as task complexity increased. As indicated earlier, subjects in the experimental group spent a significantly higher proportion of time on cost information when the task complexity increased. Moreover, as the number of alternatives in a choice set increased, the proportion of time spent on incidence of GI upset information increased; the result approached significance ($p=0.07$). The results indicate that the relative importance of drug attributes, as indicated

by the proportion of time spent on attributes, differed under differing levels of task complexity. The results are consistent with findings reported by Johnson and Meyer (1984) that found changes in the relative importance of attributes as task complexity increased.

Predictive Accuracy of the Linear Compensatory Model

The degree of fit and the predictive accuracy of the linear compensatory model was also assessed in the study. Conjoint analysis based on the additive main-effect model (i.e. linear compensatory) was used to obtain the part-worths or utility values of drug attributes in influencing physician's preferences. The utility values of drug attributes obtained were then used to predict physician drug choice under differing levels of situational involvement and task complexity.

The degree of fit of the linear model, as indicated by the percentage of all pairs of alternatives (predicted versus observed ranking) that violate the linear model predictions, was not found to be significantly different between the two treatment groups. The linear model appeared to fit the data equally well across experimental and control groups. Thus, the hypothesis that the linear model would fit the data better in the experimental group than in the control group was not supported in the study.

As discussed earlier, one possible reason for the lack of the effect of situational involvement is a weak manipulation of the construct in the study. The second explanation is that the effect of the response mode required for the task dominated the effect of situational involvement. Type of response modes required have been found to affect the form of processing and the use of compensatory and noncompensatory processes (Lichtensten and Slovic, 1971, 1973; Lindman, 1971; Rosen and Rosenkoetter, 1976; Billings and Scherer, 1988; Schkade and Johnson, 1989). The nature of an analysis of final judgement (i.e. conjoint analysis in this study) requires that subjects give an overall judgment for each drug alternative. The judgment required may influence subjects to process information more carefully and more analytically regardless of levels of situational involvement. According to Einhorn et al. (1979), judgement is a more deliberative process and requires more processing time and cognitive effort than choice. Billings and Scherer (1988) studied the effect of response mode and decision importance on decision-making processes. The study found significant effects of response mode across levels of decision importance. Requiring subjects to give a judgment on each alternative was found to be associated with a higher amount of information searched, more alternative-based processing, and less variability of information searched across alternatives. These process-

tracing measures were consistent with the use of compensatory processes in the judgement task.

Furthermore, the predictive accuracy of the linear model was not significantly different under varying levels of situational involvement and task complexity. The percentage of correct predictions was statistically better than chance across conditions ($p < 0.05$). However, the percentage of correct predictions appeared to be slightly better in the low-complexity task than in the high-complexity task, and in the experimental group than in the control group (See Table 4.26, Chapter 4).

The results indicated the robustness of the linear models in predicting drug choice across decision contexts; even though the results of a process-tracing technique indicated an increased use of noncompensatory processes as the number of alternatives increased. The results are consistent with previous research that found support for the robustness of the linear models (Dawes and Corrigan, 1974; Slovic and Lichtenstein, 1971; Johnson and Meyer, 1984). Dawes and Corrigan (1974) listed the contexts in which linear models performed well. These included: 1) the predictor variables have a monotonic relationship with the criterion; 2) there is error in both sets of variables. These two conditions may be present in this study, thus resulting in a good fit of the linear model across levels of situational involvement and task

complexity. The first condition was present because the higher the values of drug attributes (e.g., cure rate), the higher the preference for a drug. The second condition may have arisen if subjects applied decision strategies inconsistently within decision tasks (Johnson and Meyer, 1984).

Correlations of Attribute Importance Measures

The correlations between attribute importance measures obtained from conjoint analysis and those obtained from a process-tracing techniques were examined in the study. For each subject, four measures of attribute importance were obtained: 1) the utility values; 2) order of attribute searched; 3) proportion of information searched for each attribute; and 4) proportion of time spent on each attribute.

The first measure of attribute importance was estimated from the conjoint LINMAP program. The other three measures were obtained from an analysis of information acquisition using the Mouselab program. The average Spearman rank correlation coefficient between each of the pairs of attribute importance measures was used to determine the extent to which the four measures of attribute importance converged. In addition, the change in the level of correlation between these measures under differing level of situational and task complexity was assessed.

In sum, the level of convergence between attribute importance measures obtained from conjoint analysis and those obtained from process-tracing was found to be relatively low in this study (average r ranged from 0.141 to 0.439). The findings were consistent with studies by Sheluga et al. (1979) and Jaccard et al (1986) that found low correlations between utility values estimated from conjoint analysis, order of search, and proportion of information searched obtained from information display boards (average r ranged from 0.09-0.26). The results indicated that attributes that were acquired first or acquired most often by subjects in making a choice may be different from those attributes that were influential in forming a judgment about an alternative.

One possible explanation for the lack of convergence is that measures obtained from the process-tracing technique examine the acquisition of information, while measures obtained from conjoint analysis examine the combination of information in forming a judgment. The lack of convergence may suggest that information acquisition and the combination of information may not be the same for some subjects. Different decision strategies may be used in different phases of decision process, resulting in low correlations between the measures.

Another explanation for the findings is that the different response mode required (choice vs judgment)

contributes to low level of convergence between the measures. As discussed earlier, forming a judgment may be associated with the use of more deliberate and more analytical process than making a choice. Differences in the decision-making process may be associated with differences in drug attribute importance. The evidence is the findings that the attention or the proportion of time spent on specific drug attributes changed when task complexity increased. Additionally, there was low correlation between the ranking of the proportion of information searched in the low- and the high-complexity task.

However, the findings that the level of convergence between the measures increased when task complexity increased seem to contradict the explanation of the response mode as a contributing factor to the low correlations between the measures. If this explanation is likely, we would expect to find the higher correlation between the measures in the low-complexity task (i.e. compensatory processes) than in the high complexity task (i.e. noncompensatory processes). This is because the decision-making processes used in choice and judgment would be expected to be more in line in the low-complexity task than in the high-complexity task.

The possible reason for a higher level of convergence between the measures as the task complexity increased is that there was no time constraint and no cost incurred in acquiring the information from the Mouselab program. When the task

complexity is low, subjects can attend to and acquire all the information relatively easily, hence the order, proportion of search, or proportion of time spent on search may not reflect the importance placed on each attribute. However, when the task becomes more complex, subjects are more selective about their search, thus measures obtained from the process-tracing technique are more in line with the importance placed on each attribute when forming a judgment.

The level of convergence between measures obtained from the process-tracing technique was found to be moderate. The average Spearman rank correlation between proportion of information searched and proportion of time spent on each attribute ranged from 0.435 to 0.717. However, the correlation between the order of search and either of the two measures was found to be quite low (average r ranged from 0.152 to 0.466). The results indicated that attributes that were assessed first may not be attributes that were assessed most often or those that subjects gave the highest attention.

The findings may be explained by examining the correspondence between order of search of an attribute and the order that an attribute was displayed on the Mouselab screen (See Table 4.45 in Chapter 4). The attributes that appeared first and second on the screen (i.e., cost per treatment and incidence of GI upset) were accessed first and second by subjects. Moreover, the attribute that appeared last on the

screen (i.e. incidence of vaginitis) was found to be the attribute that was accessed last by subjects. The results were found in both treatment groups across levels of task complexity. In this study, the order that an attribute appeared on the Mouselab screen was randomly determined and was not based on the predetermined importance level of attributes. Thus, the results indicated that order that an attribute was searched reflected the order that an attribute was shown to the subject rather than reflecting the importance that subject placed on an attribute. Thus, the order of search may not be a valid measure or should not be used as a sole measure of attribute importance.

The measures of proportion of information searched for an attribute and proportion of time spent on each attribute converged moderately and were not found to reflect an order that an attribute appeared on the screen. For example, cure rate was placed fifth on the screen, but was ranked first or second by both measures. The findings seem to indicate that proportion of information searched and proportion of time spent on attribute may be more valid measures of attribute importance than the order of search.

The results in this study were not consistent with studies by Kida et al. (1990) and Sheluga et al. (1979) that reported a high correlation between order of search and the proportion of search of an attribute (average r ranged from

0.83 to 0.91). The reasons for the difference in the findings were not apparent since the researchers in either study did not indicate whether the order that an attribute appeared on the information display boards (IDB) corresponded with the order of search of an attribute or whether the order of attributes on the IDBs were randomly determined.

Conclusions

The results of the study provide support that the information acquisition and decision-making process is contingent on characteristics of decision tasks (i.e. task complexity). An analysis of process-tracing measures indicated that subjects spent less time acquiring information per alternative, spent less time per piece of information acquired, acquired a lower proportion of information, had a lower variability in the proportion of information searched across alternatives and across attributes, focused their search more on the chosen alternative, and used relatively more attribute-based processing as the level of task complexity increased. In addition, a significant number of subjects shifted from using compensatory processes in the low-complexity task to using noncompensatory processes in the high-complexity task.

In contrast, the study did not find the support for the effect of situational involvement on information acquisition

and decision-making process. Neither the interaction effect between task complexity and situational involvement nor the main effect of situational involvement on process-tracing measures was significant. Subjects in the experimental group were not significantly different from subjects in the control group concerning: 1) amount of time spent acquiring information per alternative; 2) amount of time per items of information acquired; 3) proportion of available information acquired; 4) variability in the proportion of information searched across alternatives; 5) variability in the proportion of information searched across attributes; 6) concentration of search; and 7) direction of search. Additionally, the percentage of subjects using compensatory versus noncompensatory processes in each decision task was not significantly different between the two treatment groups.

The results provide partial support for the contingency model for the selection of a decision strategy based on the cost/benefit framework. According to the model, strategy selection is contingent upon 1) the characteristics of the decision problem; 2) the characteristics of the decision environment; and 3) characteristics of the decision maker. The study found support for the effect of task complexity but did not find support for the effect of situational involvement, defined as temporary state of motivation related to perceived importance of making a correct decision. The increased use of

noncompensatory process when task complexity increased may result from an increase in perceived benefits of using a simple and less analytical decision-making process to reduce information and cognitive strain (Onken et al., 1985).

The lack of support for the effect of situational involvement may due to two factors. One is a weak manipulation of the construct. The situational involvement, as manipulated in the study, may not increase subject's level of concern for the decision or temporary state of motivation to process information. Additionally, subjects in the experimental group may not believe that there would be any serious consequences resulting from drug use review and the need to justify drug choice. The second factor is the knowledge of subjects concerning the important criteria used in drug use review and justification. By knowing which attributes are of concern in drug use review and evaluation, physicians in the experimental group could simply focus their search on those attributes, and need not look at all available information in order to arrive at a defensible or justifiable decision (Tetlock, 1983).

Despite the lack of significance of situational involvement on the use of decision-making processes, situational involvement was found to affect choice outcomes. The frequency distributions of the drug of choice between the two treatment groups were significantly different in the six-

alternative task. The results seemed to indicate that the manipulation of drug use review and justification led subjects in the experimental group to choose a different drug than those subjects in the control group when the task became more complex.

Situational involvement and task complexity were found to significantly affect attention given to specific attribute information. There was a significant interaction effect between the two variables on the proportion of time spent searching cost per treatment information. Subjects in the experimental group spent a significantly higher amount of time on cost information than subjects in the control group as the task complexity increased. Additionally, subjects in both groups spent a significantly lower proportion of time on cure rate and duration of treatment information when the number of alternatives increased.

Furthermore, the results of individual level conjoint analysis indicated a significant difference in the frequency distribution of subjects in each group who considered each drug attribute to be most important. More subjects in the experimental group considered cost as most important, and fewer subjects in the experimental group considered incidence of side effects as most important, when compared with subjects in the control group. These findings indicate differences in

the relative importance of drug attributes under varying levels of situational involvement and task complexity.

The study also found support for the robustness of the linear compensatory models in predicting drug choice across decision contexts. The linear model was found to fit the data equally well across experimental and control groups. In addition, the predictive accuracy of the linear model, as indicated by percentage of correct predictions, was significantly better than chance across levels of situational involvement and task complexity. The good fit of the linear model was attributed to the characteristics of the decision contexts that enabled the linear model to perform well rather than a characteristic of the actual decision process used by subjects (Dawes and Corrigan, 1974; Johnson and Myer, 1984).

The level of convergent validity between attribute importance measures obtained from conjoint analysis (utility values) and those obtained from process-tracing technique (order of search, proportion of information search, and proportion of time spent on each attribute) was found to be low (average r ranged from 0.141 to 0.439). The possible reason for the lack of convergence is that measures obtained from process-tracing techniques examine the acquisition of information, while measures obtained from conjoint analysis examine the combination of information in forming a judgment. Different decision strategies may be used in different phases

of decision process, resulting in low correlations between the measures.

The level of convergence between measures obtained from process-tracing measures was moderate except for the measure of order of information search. The order of search measure was found to have a high correspondence with the order that an attribute was displayed on the Mouselab program, thus contributing to the low level of correlation between order of search measure and other process-tracing measures.

The proportion of information searched for an attribute and the proportion of time spent on each attribute converged moderately (average r ranged from 0.435 to 0.717) and did not reflect the order that an attribute was shown to subjects. Thus, these two measures may be more valid measures of attribute importance than a measure of order of information searched.

Recommendations

Suggested Future Research

The generalizability of the findings should be tested using larger and more broadly based samples. This study used a small sample of physicians from a specific practice setting. The results should be replicated with physicians in different types of practice settings such as health maintenance organizations (HMOs), preferred provider organizations (PPOs),

independent practice associations (IPAs), and other fee-for-service private practice settings.

Further study using different diseases and different drug classes provide another avenue for future research. Uncomplicated urinary tract infection used as a hypothetical case in this study is a simple and self-limiting disease. It would be interesting to examine whether the effects of situational involvement and task complexity found in this study extend to other more severe diseases.

Future research that replicates the study using different or strengthened methods of manipulating involvement is also warranted. Involvement has been defined and operationalized in a variety of ways including the concept of commitment (Howard and Sheth, 1969; Lastovicka and Gardner, 1979; Robertson, 1976), personal relevance (Celsi and Olson, 1988; Greenwald and Leavitt, 1984; Zaichkowsky, 1985), purchase importance (Engel and Blackwell, 1978), ego involvement (Sherif and Cantril, 1947), accountability (Russo, 1986), outcome dependency (Russo, 1986), and situational involvement (Houston and Rothschild, 1984). In this study, the manipulation of situational involvement as drug use review and the need to justify one's decision to others resulted in the opposite effect on the use of decision-making processes. A question of whether different methods of manipulating

involvement affect decision-making process differently is worth investigating.

Additionally, this research employed an analysis of information acquisition (Mouselab program) that presented hypothetical prescribing problems to physicians in a well-defined structure in which all available alternatives and relevant drug attributes were given to subjects. This methodology may have provided subjects with part of the solution to the choice problems (Brucks, 1985). Therefore, cautions must be used in generalizing the results to the real practice setting involving actual patients. Future research could improve upon this research by incorporating semi-structured or ill-structured problems in which physicians specify drug attributes that they consider in making drug choice, hence obtaining a better understanding of the underlying decision process and important attributes that affect physician drug choice.

Furthermore, this research varied neither the cost of acquiring different pieces of information nor the sources of that information. Therefore, the effects of varying costs of acquiring different types of information and sources of information on information acquisition behavior and decision-making processes provide another avenue for future research.

The findings that physicians in the experimental and control group did not differ in the use of decision-making

process, but differed in the attention given to specific attribute information and choice outcomes when the task became more complex indicate a need to further understand the relationship between decision-making process, importance placed on drug attributes, and choice outcome. Furthermore, drug choice that represented the optimal choice for the specified patient was not determined in this research. Hence, questions of whether situational involvement and task complexity ultimately affect the quality of drug choice and whether different drug choice results in different patient health outcome should be pursued in future research.

Finally, this study partially supported the Beach and Mitchell Model (1978) based on cost/benefit framework that the selection of decision strategies is a result of balancing between a desire to make a correct decision and a desire to minimize cognitive effort. According to the Beach and Mitchell model, the choice of decision strategies is a function of characteristics of decision problems, decision or task environments, and characteristics of the decision maker. This research attempted to study the interaction effect between characteristic of decision task (task complexity) and decision environments (the importance of making a correct decision and the need to justify the decision to others). However, the interaction effect was not supported in this study. Therefore, future research needs to further examine

the interaction effects between variables proposed by Beach and Mitchell (1978).

Ford et al. (1988), in a review of process-tracing studies, indicated that relatively few studies have examined the effects of decision environments, personal characteristics of the decision makers or the interaction effects of these variables on the choice of decision-making processes. The testing of the propositions developed by the Beach and Mitchell model can further increase or broaden our understanding of the cognitive processes underlying decision making (Ford, et al., 1988).

Implications

The findings from this research have implications for understanding and influencing physician drug prescribing decisions. First, the findings that the relative importance of drug attributes changed depending upon task characteristics and situational involvement indicated that when designing an educational program to influence drug prescribing, specific attributes that would be important in a particular context need to be specified and be incorporated. The general knowledge of what attributes are important may not be sufficient to effectively influence drug prescribing in a specific condition.

Moreover, the evidence from this research that physicians used noncompensatory processes and may not tradeoff attribute values in certain conditions implied that only few important attributes may be considered in decision making. This emphasizes the need to accurately identify these few attributes and pre-existing beliefs regarding those attributes for drug alternatives in order to effectively design communication messages to influence drug choice.

Furthermore, the findings that physicians used less analytical strategy (i.e. noncompensatory process) to make decisions when task complexity increased indicated a need to simplify and limit information that will be presented to physicians in a particular educational program so as not to exceed human capacity to process information.

The use of compensatory decision-making processes can be enhanced by limiting the amount of information provided or by reorganizing the format of presenting information through aggregation and summarization. For example, the results that physicians used relatively more attribute-based processing as task complexity increased indicated that the decision may be simplified by making it easier for physicians to use attribute-based processing through presenting information in a matrix format allowing physicians to compare alternatives across important attributes.

Another approach may be to help reduce the number of alternatives that need to be considered in a particular situation. For example, prescribing guidelines could be developed that would help limit the number of alternatives that physicians will need to consider in a particular situation. The decrease in task complexity will help increase the use of more complex and more analytical strategies in which all relevant attribute information are taken into consideration in making prescribing decisions.

Finally, the findings from this research that the linear model performed well in predicting drug choice even though the process-tracing technique indicated that subjects used a noncompensatory decision-making process demonstrated that a single method of study decision-making may not be sufficient if the researcher's goals are to understand the process underlying decision making. The multimethod approach should be used to study decision-making process.

If the use of a multimethod approach is not possible or practical, the findings of this research indicate that the use of a structural analysis of final judgement alone may yield reasonably good prediction of choice. However, Johnson et. al. (1989) found the ability of the linear model to predict choice decreased when attributes were negatively correlated. In those circumstances, the predictive ability of a structural analysis of the final judgement may be increased by using

multilinear models or multistage estimation procedures to predict choice (Johnson et. al., 1989; Javalgi, 1988).

In sum, the findings of this research indicate that the use of a combination of methods enable researchers to gain insights into how decision-making processes and choice are affected by decision contexts. A better understanding of the decision-making process will aid researchers and administrators in finding ways to improve the quality of physician decision making and patient health outcomes.

APPENDIX A
WRITTEN INSTRUCTIONS AND CASE SCENARIO

DRUG PRESCRIBING STUDY
WRITTEN INSTRUCTIONS AND QUESTIONNAIRE

In the study, you will be shown a hypothetical case of a patient with an infection. Regarding this patient, you will be asked to perform three tasks in which you indicate your preference or choice of a drug from several hypothetical anti-infective drug profiles. All decision tasks involve hypothetical drugs. There are no right or wrong choices; moreover, there is no testing of knowledge or recall.

**Please proceed to the next page and
follow the instructions carefully**

PART A

Please assume that you are the physician treating the hypothetical patient described below. After reading the case, you will be asked to indicate your opinion and feeling associated with choosing a drug for this patient.

Case Scenario

A 25 year-old married female presents with chief complaints of dysuria, urinary frequency, urgency, and lower abdominal pain for two days prior to the visit.

There is no history of chills, fever, or previous treatment for urinary tract infection. Urinalysis is positive for WBCs, and bacteria. Culture is pending. The physical examination is normal. There is no history of renal or hepatic dysfunction. The patient is not pregnant and is not taking any medications on a chronic basis. In addition, there is no history of hypersensitivity or allergic reaction to any medications. Your diagnosis is uncomplicated lower urinary tract infection.

Please proceed to the next page

APPENDIX B
MEASUREMENTS OF PRE-EXISTING INVOLVEMENT

On the following items, please place an "X" in the segment on the scale that best describes your feeling or opinion. For example, on the following "important/unimportant" scale, if you feel the item is "important", place your "X" mark as follows:

important : ~~X~~ : ____ : ____ : ____ : ____ : ____ : ____ : unimportant

If you feel it is slightly unimportant, you should place your "X" mark as follows:

important : ____ : ____ : ____ : ____ : ~~X~~ : ____ : ____ : unimportant

If you feel neutral, you should place your "X" mark as follows:

important : ____ : ____ : ____ : ~~X~~ : ____ : ____ : ____ : unimportant

Please proceed to the next page

ON THE FOLLOWING ITEMS, PLEASE INDICATE YOUR FEELING OR OPINION ASSOCIATED WITH CHOOSING A DRUG FOR THE HYPOTHETICAL PATIENT DESCRIBED IN THE CASE. PLEASE BE SURE THAT YOU ANSWER ALL ITEMS. DO NOT OMIT ANY ITEM AND DO NOT PUT MORE THAN ONE CHECK MARK ON A SINGLE SCALE. THE QUESTIONS DEAL WITH MATTERS OF FEELING OR OPINION. THERE ARE NO RIGHT OR WRONG ANSWERS.

"The task of choosing a drug to prescribe to the patient described in the case (is)":

important : ____ : ____ : ____ : ____ : ____ : ____ : ____ : unimportant

of no : ____ : ____ : ____ : ____ : ____ : ____ : ____ : of concern
concern to me

irrelevant: ____ : ____ : ____ : ____ : ____ : ____ : ____ : relevant

means a : ____ : ____ : ____ : ____ : ____ : ____ : ____ : means
lot to me nothing to me

valuable : ____ : ____ : ____ : ____ : ____ : ____ : ____ : worthless

trivial : ____ : ____ : ____ : ____ : ____ : ____ : ____ : fundamental

beneficial: ____ : ____ : ____ : ____ : ____ : ____ : ____ : not beneficial

matters : ____ : ____ : ____ : ____ : ____ : ____ : ____ : doesn't matter
to me

uninteresting: ____ : ____ : ____ : ____ : ____ : ____ : ____ : interesting

significant: ____ : ____ : ____ : ____ : ____ : ____ : ____ : insignificant

vital : ____ : ____ : ____ : ____ : ____ : ____ : ____ : superfluous

unexciting: ____ : ____ : ____ : ____ : ____ : ____ : ____ : exciting

appealing : ____ : ____ : ____ : ____ : ____ : ____ : ____ : unappealing

mundane : ____ : ____ : ____ : ____ : ____ : ____ : ____ : fascinating

essential : ____ : ____ : ____ : ____ : ____ : ____ : ____ : nonessential

After answering all items, please proceed to the next page

APPENDIX C
MOUSELAB INSTRUCTIONS AND DECISION TASKS

PART B

In this section, you will be asked to make prescribing decisions. The tasks will be conducted using a software program called Mouselab.

The operation of the Mouselab program will be demonstrated and you will be shown a sample decision task. The sample decision task will allow you to become familiar with the program before starting the actual experimental tasks. The sample decision task concerns choosing an apartment to rent. You can repeat the sample decision task as many times as you wish.

When you are ready to begin the demonstration and sample decision task, please inform the experimenter.

Written Instructions for the Mouselab Program

The Mouselab program displays a set of alternatives and their attributes in a table format. Information concerning attributes for each alternative is hidden behind blank boxes. In order to make a decision concerning your choice of alternative, you will need to acquire information about each alternative from the Mouselab program.

To acquire the information about an attribute, move the cursor into the appropriate box by using the "mouse". The box will open and display the information. The box will remain open until the cursor is moved out of the box. Only one box can be opened at one time.

Try to open only those boxes from which you want information. However, as you move the cursor from one box to another, do not be concerned if you inadvertently open other boxes. Just move the cursor as quickly as possible to the desired box.

You may acquire as much or as little information as you consider necessary to make the decision; moreover, you can reopen a box as many times as you wish. However, you are not allowed to take notes on the information you have acquired. There is no time limit, you may take as much time as you need to finish the task.

After you have decided which alternative to choose, indicate your choice by moving the cursor to the box labeled with the name of the alternative at the bottom of the screen and click the mouse button.

PART C

To begin the first experimental task, please assume that you are the physician treating the hypothetical patient described earlier; the case scenario is provided on a card. In reference to the patient described, you are asked to choose a drug for this patient from the alternatives shown in the table.

Please note that each drug alternative is unique, that is, each drug is different from all the other drugs you may choose.

Each drug alternative is described by the following attributes:

- 1) cost of drug (based on average wholesale price) per treatment course
- 2) incidence of gastrointestinal (GI) upset (stomach discomfort, nausea, vomiting, and diarrhea)
- 3) daily dosage schedule
- 4) duration of treatment
- 5) overall bacteriological cure rate
- 6) incidence of vaginitis

Please proceed to the next page

Obtain any information you need to make a decision by using the "mouse" to open boxes in the table. Try to open only those boxes from which you want information. However, do not be concerned if you inadvertently open other boxes. Just move the cursor as quickly as possible to the desired box.

Remember that you may acquire as much or as little information as you consider necessary; moreover, you can reopen a box as many times as you wish. However, you are not allowed to take notes on the information you have acquired. There is no time limit, you may take as much time as you need.

PART E

You are now ready for the second decision task. Again, in reference to the patient described earlier on the card, you are asked to choose a drug for this patient from the alternatives shown in the table. As in the previous task, obtain any information you need to make a decision by using the "mouse" to open boxes in the table. Try to open only those boxes from which you want information. However, do not be concerned if you inadvertently open other boxes. Just move the cursor as quickly as possible to the desired box.

Remember that you may acquire as much or as little information as you consider necessary; moreover, you can reopen a box as many times as you wish. However, you cannot take notes on the information you have acquired. You may take as much time as you need to finish the task.

Please proceed to the next page

This task is independent of the previous task. Each drug alternative is unique, none of them is identical. Further, none is identical to the drug alternatives shown in the previous task.

Each drug alternative in this task is also described according to the following attributes:

- 1) cost of drug (based on average wholesale price) per treatment course
- 2) incidence of gastrointestinal (GI) upset (stomach discomfort, nausea, vomiting, and diarrhea)
- 3) daily dosage schedule
- 4) duration of treatment
- 5) overall bacteriological cure rate
- 6) incidence of vaginitis

APPENDIX D
MANIPULATION OF SITUATIONAL INVOLVEMENT

As you make your prescribing decisions, please assume that the health care organization with which you are affiliated has instituted a program to review and evaluate the quality of anti-infective drug prescribing in terms of its clinical and economic appropriateness. Assume that as part of this project, you will be asked to discuss and justify your choice of an anti-infective drug for this patient with an infectious-disease specialist. In the discussion, you will need to explain your reasons for choosing or rejecting a particular drug alternative. If your decision or rationale for choosing or rejecting a drug is deemed to be inappropriate or unjustifiable, you will be targeted for further review.

Imagine that all of the prescribing decisions that you make throughout the rest of the experiment are in this context.

APPENDIX E
ITEMS USED IN WASHOUT TASK

PART D

In this section, you are asked to indicate your feeling and opinion associated with general political and ethical medical issues. For the following statements, please indicate the extent of your agreement/disagreement with each statement by circling the number that corresponds to your agreement/disagreement. Please answer all items. The statements deal with matters of feeling or opinion. There are no right or wrong answers. In addition, all responses will be kept confidential.

	Strongly Disagree				Strongly Agree		
1.	Admission committees for medical school should have a quota system for minority groups.						
	1	2	3	4	5	6	
2.	House officers should be encouraged to unionize.						
	1	2	3	4	5	6	
3.	Psychologists, nurse-clinicians, and social workers are as important in health care delivery as are physicians.						
	1	2	3	4	5	6	
4.	Medical education would be more meaningful if the course content were specified by the students.						
	1	2	3	4	5	6	
5.	I do everything possible to keep the patient alive.						
	1	2	3	4	5	6	
6.	Extending life for even a few days is worth any suffering the patient must endure.						
	1	2	3	4	5	6	
7.	If a patient presents with a "no win" problem, I refer him/her.						
	1	2	3	4	5	6	
8.	I tell the patient the full truth.						
	1	2	3	4	5	6	

Please proceed to the next page

	Strongly Disagree				Strongly Agree		
9. When my patients die, I feel I did everything I could for them.	1	2	3	4	5	6	
10. Most patients really try to get well.	1	2	3	4	5	6	
11. Conscientious patients deserve more attention than noncompliant ones.	1	2	3	4	5	6	
12. When the time comes that medical care will have to be rationed, those with high IQs should get the best care.	1	2	3	4	5	6	
13. The patient is primarily responsible for managing his/her problem if it is obesity, chemical addiction, or frequent, unwanted pregnancies.	1	2	3	4	5	6	
14. Those patients under 40 years old deserve better treatment than those over 80.	1	2	3	4	5	6	
15. The quality of medical care would improve if vagrants, homosexuals, and malingerers were segregated into special groups.	1	2	3	4	5	6	
16. Medicine would make considerable progress if specialty boards were abolished.	1	2	3	4	5	6	

After you have answered all items, please proceed to the Mouselab system to begin the second decision task

APPENDIX F
INSTRUCTIONS FOR CONJOINT RANKING TASK

PART F

In this task, you will be given a set of 18 hypothetical drug profiles described on 3" x 5" cards. You are asked to rank the drug cards in order of the likelihood that you would prescribe them in the situation described. Please perform the task as if your decision will be evaluated and you will be required to discuss and justify your choice of a drug with an infectious-disease specialist.

This task is independent of the previous tasks. Each drug alternative is unique, none of them is identical. Further, none is identical to the drug alternatives shown in the previous tasks.

As before, each drug alternative in this task is described according to the following attributes:

1. cost of drug (based on average wholesale price) per treatment course
2. incidence of gastrointestinal (GI) upset (stomach discomfort, nausea, vomiting, and diarrhea)
3. daily dosage schedule
4. duration of treatment
5. overall bacteriological cure rate
6. incidence of vaginitis

Please proceed to the next page

First, please sort the 18 hypothetical drug profiles into three groups indicating the likelihood that you would prescribe the drug to the described patient. The three groups are:

1. high chance of prescribing
2. fair chance of prescribing
3. low chance of prescribing

Upon sorting, you can place as many cards as you wish in each group. There is no need to place an equal number of cards in each group. You can switch cards from group to group until you have settled on a final grouping.

**Please start sorting now, and after
you have finished, proceed to the next page**

Now, please examine each of the three groups individually. Of all the cards that you placed in each group, please rank the cards from the highest chance to the lowest chance that you would prescribe each drug to the described patient. When you finish ranking the drug cards in each group, all of the 18 cards should be ranked from the highest to the lowest chance. The profile you prefer most for the patient is ranked 1st, the least preferred is ranked 18th. If you wish, you can still switch cards from group to group, so that the final ranking reflects your best judgment regarding your likelihood of prescribing each drug.

After ranking is completed, please proceed to the next page.

APPENDIX G
MANIPULATION CHECK AND BACKGROUND INFORMATION

PART G

- I. In this section, you will be asked to indicate your feeling or opinion associated with the decision tasks you have just completed. On the following statements, please indicate the extent of your agreement/disagreement with each statement by circling the response that best corresponds with your feeling or opinion. Please answer all items.

- | | Strongly
Disagree | | | | | | Strongly
Agree |
|--|----------------------|---|---|---|---|---|-------------------|
| 1. As I made prescribing decisions for the described patient, I assumed that I would be required to explain and justify my choice of drug with an infectious-disease specialist. | 1 | 2 | 3 | 4 | 5 | 6 | |
| 2. As I made prescribing decisions, I assumed that my choice of drug for this patient would be reviewed and evaluated by my peers. | 1 | 2 | 3 | 4 | 5 | 6 | |

II. BACKGROUND INFORMATION

1. Which of the following best describes your type of specialty? (Circle one)
- A. Family Practice B. General Practice
C. Internal Medicine D. Obstetrics/Gynecology
E. Other (please specify) _____
2. How many years have you been in practice? _____
3. Compared to the average physician, how would you rate your expertise in the treatment of urinary tract infection? (check one)
- very high : ____ : ____ : ____ : ____ : ____ : ____ : very low
4. Your Age (Circle one)
- A. 20-29 B. 30-39 C. 40-49
D. 50-59 E. 60-69 F. >70

The End

THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

APPENDIX H
FORMS USED IN ASSESSMENT OF SEARCH PATTERN

Assessment of Individual Decision-Making Process

Judge:

Subject ID:

Number of alternatives:

Please examine subject's information acquisition patterns and indicate your assessment of decision-making processes used in each task by circling the appropriate classifications listed below.

a. Compensatory Process - Alternative-based Subject examined one drug alternative across all drug attributes, then examined the second drug alternatives on all attributes, and so on, until all drug alternatives were examined prior to making a choice

b. Compensatory Process - Attribute-based (Additive Difference) Subject examined a pair of drug alternatives across all attributes (attribute-based search pattern). The preferred alternative is then compared to the third alternative, and so on, until all alternatives are compared. The final choice is the preferred of the final pair of alternatives;

c. Compensatory Process - Attribute-based Subject examined all drug alternatives on one attribute, then examined all alternatives on a second attribute, and so on until all attributes associated with drug alternatives were examined prior to making a choice

d. Compensatory Process- Simultaneous Blend of Alternative-and Attribute-based Subject examined all drug alternatives and attributes using a simultaneous blend of alternative-based and attribute-based search patterns;

e. Noncompensatory Process - Alternative-based Subject examined drug alternatives across attributes one at a time; however, subject did not examine all available information on each alternative. Some drug alternatives were searched on a few attributes and then discarded. Some alternatives may be searched on all attributes, and/or some alternatives may not be searched prior to making a choice;

f. Noncompensatory Process - Attribute-based Subject examined all alternatives across one or few drug attributes (attribute-based pattern). Then, subject examined only a subset of drug alternatives on a few attributes using an attribute-based search pattern prior to making a choice;

g. Noncompensatory Process- Disjunctive Subject examined only one or two information items on drug alternatives prior to making a choice;

h. Noncompensatory Process - Simultaneous Blend of Alternative and Attribute-based Subject did not examine all available information on each alternative prior to making a choice. Subject examined drug alternatives and their attributes using a simultaneous blend of alternative- and attribute-based search patterns;

i. Noncompensatory Process - Attribute-based / Compensatory -Alternative-based Subject examined all alternatives across one or few drug attributes (attribute-based pattern). Then, subject examined only a subset of drug alternatives on all attributes using an alternative-based search pattern prior to making a choice;

j. Noncompensatory Process - Attribute-based /Noncompensatory - Alternative-based Subject examined all alternatives across one or few drug attributes (attribute-based pattern). Then, subject examined only a subset of drug alternatives across a few drug attributes using an alternative-based search pattern prior to making a choice;

k. Noncompensatory Process - Attribute-based / Compensatory --Attribute-based Subject examined all alternatives across one or few drug attributes (attribute-based pattern). Then, subject examined only a subset of drug alternatives across all drug attributes using an attribute-based search pattern prior to making a choice;

l. Noncompensatory Process - Attribute-based / Noncompensatory - Simultaneous Blend of Alternative and Attribute-based Subject examined all alternatives across one or few drug attributes (attribute-based pattern). Then, subject examined only a subset of drug alternatives on one or more attributes using a simultaneous blend of alternative- and attribute-based search pattern;

m. Noncompensatory process Subject did not examine all available information on all drug alternatives. However, the subject's search pattern did not follow any of the above classification.

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