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CONTINGENT VALUATION AND UTILITY MODELS FOR ECONOMIC EVALUATION OF PHARMACEUTICALS: A STUDY OF ANTIHISTAMINES

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CONTINGENT VALUATION AND UTILITY MODELS FOR ECONOMIC EVALUATION OF PHARMACEUTICALS: A STUDY OF ANTIHISTAMINES

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

Gregory Reardon, B.S., M.S.

* * * * *

The Ohio State University

1987

Dissertation Committee: Approved by

Dev S. Pathak, D.B.A.

David W. Grauer, M.B.A, J.D.

Richard Segal, Ph.D.

College of Pharmacy
DEDICATION

To my Mom and Dad
ACKNOWLEDGEMENTS

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VITA

August 2, 1957 .................. Born - Youngstown, Ohio

June, 1981 ..................... B.S., Pharmacy, College of Pharmacy, The Ohio State University, Columbus, Ohio

1982 - 1985 ................... Graduate Teaching Associate, College of Pharmacy, The Ohio State University, Columbus, Ohio

December, 1982 ................. M.S., Pharmacy, College of Pharmacy, The Ohio State University, Columbus, Ohio

September, 1986 - present . . Assistant Professor, College of Pharmacy, The Ohio State University, Columbus, Ohio

Major Field .................... Pharmaceutical Administration

Second Field .................... Finance
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CHAPTER I
INTRODUCTION TO THE STUDY

PROBLEM STATEMENT

Overview of Broad Problem

Application of formalized economic evaluation techniques to health care is only a recent phenomenon (Warner & Luce, 1982). Cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) have been commonly used in the great majority of these economic studies. As such, formalized CBA/CEA studies of medical-related health care are a phenomenon that is less than 25 years old (Bloom, p. 5, 1982). The trend of health care CBA/CEA studies, as identified by the Office of Technology Assessment, is shown in Figure 1.

Although the trend in economic evaluation has steadily increased for both health care and pharmaceutical-related literature, the CBA/CEA studies that have been published in the latter category have generally been limited to a few path-breaking drugs. As Larson, Bootman and McGhan (1985) report,

The few classes of drugs that have been the focus of study include vaccines, drugs to prevent tuberculosis, antipsychotics (especially their relationship to reducing institutionalization), and anti-ulcer drugs. Anti-hypertensive drugs have been included in studies of hypertension programs; other areas have been studied less extensively (p. 64).
Considering the number of therapeutic drug categories, and the multitude of drug products falling within these categories, formalized economic evaluation of pharmaceuticals is an area that remains ripe for research.

Previous economic evaluations of individual pharmaceuticals have used, among other methods, cost-benefit analysis as an evaluative technique. Wagner (1982) indicates that most cost-benefit analyses of pharmaceuticals have concentrated on:

...direct and indirect costs, leaving psychosocial costs to be considered in some other way. The benefits of a strategy are generally measured as reductions in the direct and indirect costs of illness resulting from the outlay of direct program costs. This approach represents a step back from the attempt to measure "willingness-to-pay" for a given consequence in favor of a "human capital" approach in which the value of a consequence is determined by its effect on an individual's ability to produce goods and services (p. 7).

Because the productivity or human capital method represents the norm in cost benefit analysis (CBA) of pharmaceuticals, the question remains to what extent these "psychosocial costs" account for the total benefits from a given pharmaceutical. For many pharmaceuticals, particularly those that have the potential to dramatically alter morbidity and even mortality, the effect on a person's ability to produce goods and services may be quite significant. Use of the productivity method, despite other well-known limitations, might capture a significant part of the total benefit value for these types of wonder drugs. However, many, if not most pharmaceuticals, may not have a readily-measurable effect on productivity.
Productivity loss is typically measured in hours of missed work time. If a drug affects quality of work performed, rather than the quantity of hours worked, the productivity measure will need to be refined to include qualitative aspects. Further, the so-called "psychosocial costs" would account for a greater proportion of the total benefit value for those pharmaceuticals without dramatic life-altering properties. For these drugs this psychosocial component cannot be ignored, if the evaluation is to be accurate.

Rowe and Chestnut (1984) classify productivity, cost of illness, contingent valuation and health status index each as methods of determining willingness-to-pay. In Wagner's terminology, therefore, "willingness-to-pay" is the same as the more appropriate term, "contingent valuation." The focus of this study was to apply a contingent valuation technique as a method of determining the value of benefits, as measured in dollar terms, of pharmaceutical therapy for the treatment of a specific disease state. Specifically, this study examined the association between expressed monetary (dollar) and attitudinal-utility valuations that are linked to the benefits of antihistamine pharmaceutical products used in the treatment of allergic rhinitis.

Although the disease of allergic rhinitis is unlikely to have a serious effect on the morbidity and mortality of an afflicted individual, two factors make this condition of special scientific interest. First, unlike many disease conditions previously examined in cost-effectiveness studies, the prevalence of allergic rhinitis is extremely high. Estimates of prevalence in the total population range from 13 to
Even if health effects of allergic rhinitis are small, relative to more serious disease conditions, the high prevalence of this disease may have significant aggregate societal value for the intervention outcomes.

Secondly, in a condition like allergic rhinitis, one would expect the effect of psychosocial costs to weigh more heavily in relation to direct productivity costs than in the case of more serious diseases. A similar relationship would likely be seen with many pharmaceuticals that are used to treat non-serious health problems. For these drugs, contingent valuation may be especially valuable as a means of capturing the value of the major health outcomes. Thus, successful application of contingent valuation to evaluate pharmaceutical therapy in allergic rhinitis may serve as a model for future applications to pharmaceutical treatment of minor disease conditions with high prevalence.

Specific Problem to be Investigated

Since application of formalized contingent valuation techniques to pharmaceuticals is lacking, it was necessary to develop an appropriate methodology that could be used as a model for future evaluative applications. Contingent valuation methodologies used in non-health care studies have employed a number of techniques to value a good or service. One approach has been to present the subject with a particular non-marketed good or service, such as, days of breathing pollution-free air, and to ask the subject, through an iterative bidding process, to
identify a global dollar value measure that is equivalent to the perceived value of the overall good (Rowe & Chestnut, 1984; Schulze, Cummins, Brookshire, Thayer, Whitworth, & Rahamatian, 1983). A more recent approach measures the overall value of a good or service by asking the subject to assign dollar values to specific attributes or components of the good or service (Loehman, Boldt, and Chaikin, 1981). The total value of the good or service is then estimated as an additive function of the component or attribute valuations; in essence, the basic assumption of this approach is that total product value is equivalent to the sum of the values of product features or benefits. In general, many of such techniques are potentially useful for application to the economic evaluation of pharmaceuticals. However, as empirical works, most contingent valuation studies have not made use of retrodictive or concurrent criterion comparisons to support claims that the obtained contingent valuation measures are indeed reasonable.

Thus, in order to advance the theory of contingent valuation, it is necessary to empirically test the validity of a proposed contingent valuation measure against other economic techniques that purport to measure the same or similar dimensions. Since contingent valuation is derived from economic utility theory (Keeney & Raiffa, 1976), it seems logical to use previously-tested utility measures as a basis of comparison with contingent valuation measures. This is the essence of the problem addressed by this study. The primary goal of this study was to

---

1 Chapter II, "Review of the Literature," provides an extensive overview of the development of contingent valuation studies, along with descriptions of many types of methodologies used in both health care and non-health care applications.
test the explanatory and predictive power of established utility measurement techniques against a contingent valuation measure of an economic good.

Although a wide variety of utility measurement techniques have been studied, this study focused on two major approaches: the self-explicated utility measurement and the hybrid utility measurement approach. The first approach, known as the compositional or self-explicated approach, computes the overall utility for a given multiattribute alternative (which may be a good or service), as the sum of a subject's ratings for each attribute component of that alternative. There are two basic types of self-explicated models, unweighted and weighted. In the unweighted self-explicated model, the overall utility is derived through use of the following equation (Akaah & Korgaonkar, 1983):

$$ U_h = \sum_{i=1}^{n} u_{ik}^{(h)} $$

where $U_h$ is the overall utility of alternative h with attribute categories, i, of 1 through n, each having an attribute level for each category, identified by k. The expression on the right hand side of the equation, then, is simply the sum of the "desirability" or utility ratings, $u_{ik}^{(h)}$, for each attribute level that is characteristic of the alternative. Desirability responses, $u_{ik}^{(h)}$, are usually normalized for each respondent (Akaah & Korgaonkar, 1983).

The weighted self-explicated (or two-stage) model adds the additional dimension of attribute "importance" to overall utility. This is represented by the following equation:
where the equation is the same as for the unweighted type, except that now, an "importance" rating, \( w_i \), has been determined by the subject for each attribute category (Akaah & Korgaonkar, 1983).

The second approach to utility measurement is known as the Huber-hybrid model, which was originally proposed by Huber and his colleagues, and is an extension of the self-explicated approach. In the Huber-hybrid model, subjects are asked to rate individual attribute levels of an alternative in terms of desirability, as in the unweighted self-explicated approach. In addition, the same individuals assign global value ratings of desirability for alternatives, which are described as a "package" of various attribute levels. There are three types of Huber-hybrid models. The first type is the additive hybrid and is represented as follows (Akaah & Korgaonkar, 1983):

\[
V_h = a + \sum_{i=1}^{n} b_i u_{ik}(h)
\]

where \( V_h \) is the overall rating assigned by the subject to the entire product profile, \( h \), for a given alternative. On the right hand side of the expression, \( b_i \) is the coefficient that has been derived to reflect the relative contribution of attribute \( i \) to \( V_h \), \( a \) is an intercept term, and \( u_{ik}(h) \) is the same "desirability" rating for attribute \( i \) as used in the unweighted self-explicated model. Ordinary least squares can be used to derive the beta and alpha coefficient terms (Huber, Sahney & Ford, 1969), by using self-explicated measures as independent variables and ratings of selected product profiles as the dependent variable.
The second type of Huber-hybrid model is the **addilog hybrid**. This model is represented as:

\[
V_h = a + \sum_{i=1}^{n} b_i \log u_{ik}^{(h)}
\]

and is the same as the additive model, but with the exception that the attribute "desirability" ratings are transformed logarithmically. (Akaah & Korgaonkar, 1983). Huber, Sahney and Ford (1969) proposed this model, hypothesizing that a person's perception of differences in stimuli may be proportional to the logarithm of the actual difference. In other words, an individual's true perception of desirability increases, but at a logarithmically decreasing rate, for each additional interval scale unit of desirability which the individual assigns to an attribute.

A third type of Huber-hybrid model has been advocated as possibly being superior to the first two (Huber et al., 1969; Einhorn, 1970). This is the **multiplicative hybrid** and is described as follows:

\[
V_h = \prod_{i=1}^{n} a_i u_{ik}^{(h)} b_i
\]

This model would be especially useful in adjusting for interactions which may occur among attributes. Indeed, interaction of attributes, in some cases, might be severe enough to invalidate results obtained by using the previous two Huber-hybrid model types. Further, this model has been suggested to be especially useful where some stimulus variables act as screening variables (Huber, Sahney and Ford, 1969).

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2 Taking the log of the left side of equation (4) and keeping the right side as it is, produces an expression equal to equation (5).
This study used overall utility measurements for products, which were derived from the five functional equation forms shown above, as comparative criteria for the contingent valuation measures. Strengths of association, between the contingent valuation measures and the utility measurement techniques described above, provided some insight into the mathematical basis of the contingent valuation measurement itself.

Although aggregate functions might have been derived for the sake of comparison with individually-derived functions, economists generally agree that problems arise when utility measurements are aggregated. The expected result of aggregation would be a substantial loss of explanatory power in the model (Keeney, 1976). For this reason, this study derived individual functions of utility and contingent valuation.

NEEDS ASSESSMENT

Why Study Needed to be Conducted

This study was suggested in response to an apparent need for a model for evaluating pharmaceuticals that have a significant effect on the psychosocial condition of the patient. In her study of past economic evaluations of pharmaceuticals, Wagner (1982) concludes that "(p)erhaps the greatest shortcoming of the literature is the inadequacy of attempts to deal with the psychosocial benefits and costs that cannot be captured as indirect costs (p. 63)." As mentioned, a contingent
valuation methodology, as was used in this study for evaluating pharmaceutical therapy for the treatment of allergic rhinitis, might be helpful in overcoming this shortcoming. Wagner (1982) also suggests that economic evaluation of pharmaceuticals should concentrate on questions for which answers are not obvious (p.64).

Although this study did not provide generalizable CBA or CEA measures for pharmaceutical interventions, the question of economic advantage is not apparent for drugs used to treat allergic rhinitis symptoms. This study may provide some of the theoretical foundations needed for further investigation into this area of uncertainty.

**Potential Significance of Study**

The major potential contribution that this study might make to pharmaceutical administration is in terms of the application and testing of a contingent valuation methodology to cost-benefit analysis that could be adopted by investigators within the field. Contingent valuation could be applied in many areas within the domain of pharmaceutical administration, in addition to pharmaceutical products. Examples of potential areas for application include clinical and non-clinical pharmacy services, pharmacy educational services, wholesaler and manufacturer services, public pharmaceutical programs, and other third party pharmaceutical programs.

Secondly, a comparison between the five criterion utility measures, and with the contingent valuation measure, was expected to provide insight into attribute inter-relationships and functional associations.
of attribute utility measures with overall product contingent valuation and utility.

Thirdly, this study used a mail questionnaire to gather economic evaluative data. The instrumentation procedure used in this study could offer a more efficient and less costly alternative to personal interview techniques, which have been the rule for contingent valuation studies in the past. Further, refinement of the mail questionnaire for contingent valuation should contribute to the pioneering work originally performed by Loehman et al. (1981) in the field of atmospheric science. Improvement of the mail questionnaire might encourage further application of contingent valuation in pharmaceuticals, by using this as an instrumentation technique.

OBJECTIVES/HYPOTHESES

Objectives of Project

Objectives of this study were as follows:

1. To measure a global value of willingness-to-pay, on an individual basis, for complete avoidance of all symptoms of allergic rhinitis. In other words, to find an individual's contingent valuation for complete avoidance of the disease state of allergic rhinitis.

2. To develop a selected set of product attributes which adequately reflect product features of actual antihistamine pharmaceutical products used to treat allergic rhinitis.

3. To develop an orthogonal array of selected product profiles of antihistamine pharmaceutical therapies used to treat allergic rhinitis, from the selected set of product attributes.3

---

3 This is needed in order to develop a factorial design for measuring main effects of product attributes. Note that the product profiles generated from an orthogonal array of a selected set of attributes can, but do not necessarily resemble actual pharmaceutical
4. To develop a set of hold-out or test product profiles which contain attribute sets that adequately reflect actual antihistamine pharmaceutical products used to treat allergic rhinitis.

5. To develop attitudinal-utility scales to measure desirability for individual product attributes as well as for the hold-out and orthogonal product profiles.

6. To apply contingent valuation to measure the value of antihistamine pharmaceutical products (in dollars) for the orthogonal and hold-out product profiles identified above.

7. To compare weighted and unweighted self-explicated utility measurement techniques, measured on an intra-individual basis, to determine the extent to which each are able to predict contingent evaluations for the product profiles.

8. To compare the three Huber-hybrid utility measurement models, measured on an individual basis, to determine the extent to which each are able to predict contingent evaluations for the product profiles.

9. To find the association of contingent valuation measures with selected respondent demographic attributes.

10. To determine the mathematical nature of the relationship of changes in health status with contingent valuations for those changes.

11. To address possible sources of bias, or alternative hypotheses, which may affect interpretation of study results.

**Research Hypotheses**

Five research hypotheses were tested. They are stated as follows:

1. There is a positive relationship between each of the following measures of utility and the contingent valuation measures for the set of orthogonal product profiles:
   a. Unweighted self-explicated utility scores.
   b. Weighted self-explicated utility scores.
   c. Additive Huber-hybrid utility scores.

therapies for allergic rhinitis that are available in the marketplace.
d. Addilog Huber-hybrid utility scores.
e. Multiplicative Huber-hybrid utility scores.

2. The strengths of relationship between utility measures and contingent valuation measures differ between the five models for the set of orthogonal product profiles.

3. There is a relationship between socioeconomic variables, including income, and contingent valuation ratings.

4. There is a positive relationship between measures of contingent valuation predicted by utility models and actual contingent valuation for the set of hold-out product profiles.

5. There is a difference in the strengths of correlation between the five utility models in the prediction of hold-out product profile contingent values.

PARAMETERS OF STUDY

This study was limited to a single disease condition of a chronic, cyclical nature: allergic rhinitis. While other disease conditions, such as asthma and bronchitis are often associated with allergic rhinitis, these disease states were not directly evaluated.

Alternative treatment interventions, which served as the basis for product attribute selection, were limited to single-entity antihistamine products. Originally, it had been hoped that the following products also could have been included: allergen extract injections, topical/oral decongestants, topical corticosteroids and mast cell stabilizers. However, subsequent to a review of the literature to determine attribute categories for these drugs, it was decided that the heterogeneity of product attribute categories, needed to compare all of these classes of drugs, would require an orthogonal array of product
profiles that would be too large for an individual subject to evaluate. A smaller orthogonal array could have been produced, but could be done so only at the expense of a failure to adequately describe the major attribute categories of any of the products included. For this reason, it was decided to limit the study to single-entity antihistamines. Obviously, this would be a major drawback if the goal of the study was to compare all relevant alternative treatments for allergic rhinitis. The significance of this observation is discussed in greater detail in Chapter V, "Conclusions."

Non-pharmaceutical interventions, such as avoidance of allergens to prevent the immunological response, were also not considered in this study because of operational difficulties in product comparisons. It is important to note, however, that in a CBA or CEA study, all relevant alternatives for allergic rhinitis therapy need to be considered, whether pharmaceutical or not.

A common caveat that should be noted with studies of contingent valuation is the fact that societal willingness-to-pay is not necessarily equal to the sum of each individual's willingness-to-pay. In this study, the sum of individual disease sufferers' willingness-to-pay to avoid allergic rhinitis, or the adverse effects of antihistamine therapy, may not be the same as societal willingness-to-pay. For instance, an individual may have little concern if a side effect of drug therapy affects the number of work days missed if he/she is paid full salary for all sick days, regardless. In this case, some other member or members of society must bear the cost of this consequence. However, since no attempt is being made in this study to generalize the actual
contingent valuations to a large target population, this point of contention will need to be investigated in future studies in attempting to obtain more generalizable results.

Many of the parameters that ordinarily need to be considered for CBA were not examined in this study. This study was not an application of CBA; it was an attempt to examine the validity of a contingent valuation measure that has been proposed to be of value in application of CBA to an economic question. It is hoped, however, that the results of this study will assist in the use of contingent valuation measures in future CBA applications.

**Assumptions/Premises**

Basic assumptions made in this study included the following:

1. The subjects view the rating scales used in this study on an interval scale. The validity of this assumption was tested by a measurement of the reliability of the scales used in this study.

2. The stated willingness-to-pay to completely avoid allergic rhinitis (in dollars) is an unbiased estimate of a normal distribution of willingness-to-pay values that could be stated by the individual. The stimuli of the disease-free description (absence of allergic rhinitis) was assumed to elicit a compensating surplus response that can be described according to the model shown in Figure 2. (Chestnut & Violette, 1984b; Loehman & De, 1982; Bradford, 1970).
In this diagram, an individual, at the point of equilibrium, is willing to make trade-offs in income ($M$) for health status ($D$) that are represented by indifference curve $I$. An individual at point 1 on indifference curve $I$ has a utility function that can be represented as $U(M^*, P_x, D^*)$, where $M^*$ is the initial income of the individual, $P_x$ is the price of all goods, and $D^*$ is the initial health status of the individual (Loehman and De, 1982). A given increase in health status, $d$, such as would be achieved by complete elimination of the disease state of allergic rhinitis, is presumed to have positive utility. Thus, an individual given this benefit would achieve the higher indifference curve $II$ (Chesnut and Violette, 1984). At point 2, on indifference curve $II$, the
individual's utility function now becomes \( U(M^*, P_x, D^* + d) \), where \( d \) is the change in health status associated with the removal of the allergic rhinitis disease symptoms. Now, the individual is asked to determine the decrease in income (the compensating surplus), \( m \), that must occur before that individual is once again at the same level of utility as at the point of equilibrium, point 1. This new point is indicated as point 3 on indifference curve 1. The utility function at point 3 becomes: \( U(M^*- m, P_x, D^* + d) \). Thus, \( m \) is equal to the compensating surplus that is taken from the individual to leave him/her at the same level of utility as at equilibrium. Since point 1 and point 3 lie on the same indifference curve, it follows that

\[
U(M^*, P_x, D^*) = U(M^*- m, P_x, D^* + d) \tag{6}
\]

The expression on the left and right of the expression are, of course, the utility functions at point 1 and point 3 respectively. Several assumptions follow from this model.

First, income (\( M \)), health status (\( D \)) and the price of all goods (\( P_x \)) are assumed to be independent of each other. Secondly, both health status (\( D \)) and income (\( M \)) have positive diminishing marginal utilities; the indifference curves are convex. Assuming this to be true, one could determine the relative size of the derivatives of health status and income for a change from a baseline health status/income coordinate. The logic for this is shown in Figure 3.
If a decrease in allergic rhinitis symptoms (an increase in health status), \( d_1 \), is offered to a subject, the subject can be asked to determine the compensating surplus of income loss or willingness-to-pay, WTP, required to return the individual to the same indifference curve containing the baseline health status/income coordinates, \((D_0, M_0)\). Conversely, the subject can determine the compensating surplus or willingness-to-accept, WTA (an income gain), required to return the individual to the indifference curve for a given increase in allergic rhinitis symptoms, \( d_2 \) (a decrease in health status). If the changes in health status are scaled such that the vector lengths, \( d_1 = d_2 \), then the ratio of WTA/WTP (vector lengths) will show the relationship of the change in
marginal utilities between health status and income. If WTA/WTP > 1, then support would be found that the marginal utilities of income decrease at a greater rate than those of health status, in this study. In effect, this model outlines the basis of the dilemma of whether to choose willingness-to-pay or willingness-to-accept as the measurement of choice for contingent valuation. Only if the change in marginal utilities of income and health status are equal, will WTP = WTA (i.e. WTA/WTP = 1, WTA - WTP = 0).

3. The target population of university employees who have allergic rhinitis was presumed to be a more homogeneous and highly-educated group of subjects than the population of all individuals in the United States with allergic rhinitis. As such, the results obtained from this study were assumed to yield more reliable values than would the same results drawn from the latter unsegmented population.

4. The product profiles will act as stimuli to elicit a compensating surplus (or WTP) response, which in this study is defined as the contingent valuation.

5. Product features will be translated by subjects as representing expected product health care benefits. For example a product attribute level for the attribute category "dosage form" is "capsule." Although "capsule" is a product feature, the actual entity, with which the individual associates a value, is an unknown benefit which is derived from this product feature (Pathak, 1979). The individual may feel that the capsule dosage form is easy to
swallow. It is ease of swallowing and not "capsule" per se that the individual values.

Non-health benefits may be associated with a given product feature. For example, a capsule dosage form may be aesthetically appealing to an individual. For the sake of clarity, however, all benefits associated with the product profiles in this study were classified as health-care related.

A related point concerns the concept of the expected benefit. If a person is risk-averse, he/she may value the expected value of a certain outcome more highly than an uncertain outcome with the same expected value. For the sake of illustration, consider the abbreviated product profiles shown in Table 1.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Product A</th>
<th>Product B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>Antihistamine</td>
<td>Antihistamine</td>
</tr>
<tr>
<td>Adverse Effect:</td>
<td>Functional performance reduced by 50% in all patients.</td>
<td>Functional performance reduced by 25% in half of patients, 75% in other half.</td>
</tr>
</tbody>
</table>

A person who is risk-averse will value Product A more highly than Product B, even though the expected value of the effect on performance is the same for both products. Although the value of
risk or options has been found by some economic evaluators to be of importance (see Violette and Chestnut, 1983, for a review of economic evaluation of risk studies), the question of risk aversion, neutrality, or preference is still very controversial. In diseases or drug therapies yielding possible severe morbidity and mortality effects, a good study would find it difficult to assume away the effects of risk aversion. But, because the consequences of health benefit outcomes in this study are not considered to be serious, and in nearly all cases are readily reversible, this research did not consider the effect of risk or option values upon contingent valuation. Thus, in this study, Keeney's (1976) assumption of risk neutrality was used.

**Methodology/Design**

The first step of the study methodology was the development and testing of a mail questionnaire that could be used to measure the dimensions identified in the objectives and hypotheses sections. This process consisted of a number of individual tasks that were performed sequentially to properly operationalize the theory of contingent valuation into a testable form. In order to achieve objective 2, a selected set of product attributes, which adequately reflect features of actual antihistamine pharmaceutical products, was first developed.

In the first phase of content validation, secondary sources were used as the basis for obtaining an initial list of product attributes.
In the second phase, three other pharmacists, in addition to the author, studied the summarized information obtained in the first phase. The goal of this phase was to determine attribute categories which are common between products. Examples of attribute categories included such things as dosage form, adverse effects, dosing interval, etc. Each pharmacist was then asked to generate a list of attribute categories which might be relevant to consumers, based upon the summarized information, as well as the pharmacists' personal knowledge and experience. The list of attribute categories chosen by the pharmacist panel was then edited to a 47 item list of potential attribute categories.

The third phase of content validation involved rating of the categories by allergy sufferers. A convenience panel of 10 allergic rhinitis sufferers was chosen, whose purpose was to rate the product attribute categories in terms of importance. The results of the allergy sufferer panel were analyzed. Seven attribute categories were selected to be included in the questionnaire.

The fourth step was the construction of brief attribute level descriptions for each of the selected attribute categories. A review of the literature provided a basis for determining the range and number of levels. The number of attribute descriptions per category (number of levels) varied between two and four. The final list of attribute categories and levels was used as the stimuli in the self-explicated scale.

The fifth step was the construction of product profiles from the category and level lists. Since the Huber-hybrid model was being used,
a full selection of all possible product profiles was not needed. Rather, an orthogonal array of a much smaller subset of all possible combinations sufficed as a product profile set to be used in this study. The goal of the orthogonal arrangement was to obtain product profiles that were realistic and which, in most cases, emulated actual pharmaceutical products for which subjects were familiar. In addition to the orthogonal array, three hold-out profiles were constructed to simulate three actual pharmaceutical products that were not contained in the orthogonal profile set.

The sixth step of the study was the development and pilot testing of a questionnaire to obtain the measurements needed for the research hypotheses. Four researchers assisted in critiquing and refining the questionnaire prior to administration. A convenience sample of 12 allergy sufferers was selected and responded to the questionnaire.

In the seventh and final stage of the study, the results of the pilot test were analyzed and the questionnaire was improved. The final version of the questionnaire was sent to a simple random sample of 2,000 University employees. The methodology used in this study if discussed at greater length in Chapter III, "Methodology and Design."

**Variables**

The variables included in the final questionnaire were:

1. Demographic and disease state variables of the individual including:
   a. Age.

4 The argument in favor of this parsimonious approach is supported by other empirical studies (Green & Srinivasan, 1978; Green, 1974).
b. Sex.
c. Income.
d. Education.
e. Time required to complete the questionnaire.
f. Enrollment in Health Insurance Plans.
g. Existence of allergic rhinitis symptom history.
h. Existence of asthma, other allergies (i.e. contact, food).
i. Cyclical nature of allergic rhinitis - recurrent acute or chronic.
j. List of pharmaceuticals being used to treat allergic rhinitis.
k. Self-treatment or physician treatment status.
l. Global severity rating of allergic rhinitis symptoms.

2. Stimuli for asking subject to estimate the amount that would be spent to avoid allergic rhinitis for some percentage more and less of the disease symptoms.

3. Estimates of subject for contingent valuation to avoid various severities of allergic rhinitis for six months.

4. Individual product attribute stimuli.

5. Orthogonal and hold-out product profile stimuli.

6. Responses on Likert scale of subject to desirability of individual product attributes.

7. Responses on Likert scale of subject to importance of individual product attributes.

8. Responses on Likert scale for desirability of orthogonal and hold-out product profile descriptions.

9. Responses on the Likert scale for contingent valuation of orthogonal and hold-out profiles.

10. Perceived costs-of-illness associated with the disease state of allergic rhinitis.
11. Percentage breakdown, for self-pay and insurance coverage, of perceived costs-of-illness of allergic rhinitis.

Subjects

Subjects used as units-of-analysis in this study were chosen so as to be of a fairly homogeneous nature. In his empirical study of aggregation functions of utility, Moore supports the notion that a priori segmentation upon homogeneous demographic characteristics produces the best chance for an aggregation utility function (greatest homogeneity) for a group of subjects (Moore, 1980). Ideally, subjects should have had a sufficient level of comprehension to minimize the risk of unreliability of responses to the mail questionnaire format. Since the goal of this study was to validate the contingent valuation and utility function measures and not to generalize measured benefits of treatments to a very large target population, the target population chosen was based on three selection criteria:

1. Homogeneity of demographic attributes.
2. Higher level of language comprehension.
3. Convenience of reaching and follow-up of sample respondents.

Examples of utility validation studies which chose subjects on a similar basis are the following: 1) Moore (1980); 2) Rosko, DeVita, McKenna, & Walker (1985); 3) Rosko and McKenna (1983); 4) Huber et al. (1969); and 5) Levy, Webster, & Kerin (1983).

The target population of interest for this study was the entire staff and faculty of the Ohio State University Columbus Campus who suffer from allergic rhinitis (excluding full-time students who are also
staff or faculty members). It is believed that this group satisfies all three criteria. There exists a homogeneity of background in terms of geographic location and work situation. Secondly, the group of subjects have an educational background which is presumed to exceed that of the general public. Thirdly, the convenience of location and superior frame provided a means of readily identifying subjects for initial contact and follow-up, when needed.

Analysis of Data

Unlike many studies of utility assessment, which advocate preference rankings, the utility data were gathered in this study by using a scale that was designed to be perceived as being interval, namely a nine-point Likert scale. As a check on this assumption was provided by analysis of reliability. Assuming that the data is intervally-scaled, Ordinary Least Squares (OLS) was the method of choice for data analysis. This was performed with OLS by using the General Linear Model (GLM) program contained within the Statistical Analysis System (SAS, Version 1982). The results are shown in Chapter IV, "Analysis of Data and Results."

Generalizeability/Limitations

The target population was defined as all allergic rhinitis sufferers who are faculty and staff members at the Ohio State University. Obviously, the results from this study are only generalizable, in a statistical sense, as a probability of representing the experimentally-accessible population of Ohio State University employees, who suffer from allergic rhinitis.
Since frame error was perceived to be very low in this study, and because the methodology was designed to reduce the possibility of non-response bias, external validity is unlikely to be a major problem in this study (as it relates to generalizing to the target population). However, specific threats to external validity as it relates to the target population are discussed in greater detail in Chapter V, "Conclusions."

The major problem of generalizeability would arise in attempts by future researchers to describe the validation results found in this study as holding for other target populations. Since the target population in this study consisted of subjects over 18 years of age, in a single geographical area, with higher income and educational levels that average, ecological representativeness of this group to say, all allergic rhinitis sufferers in the U.S, or individuals suffering from other low-morbidity disease conditions, is certainly open to question. This study did not establish validity for the contingent valuation measure in all applications with all populations. No single study could achieve this result. However, the relevance of this study lied in testing the null hypothesis that utility and contingent valuation are unrelated.

Since the contingent valuation measure may interact with personal variables not included in this study (e.g. unemployment status, children), future researchers in pharmaceutical therapy would still be required check the validity of contingent valuation measures used in their studies. However, the results of this study may provide a
pattern for later comparison. Further support or disapproval of contingent valuation theory with different populations would hopefully lead in either one of two directions. Either, contingent valuation of pharmaceutical therapy is not found to be based in theory, or else the theory does hold in many mixed applications, and thus is applicable in economic evaluations of pharmaceuticals.

Since the variables of contingent valuation and utility are defined in detail in the methodology chapter, measures used in this study can be replicated by future researchers. In this way, variable representativeness can be supported. Contingent valuation can become a focused construct in pharmaceutical therapy with precise and measurable dimensions.

The measures employed in this study should be able to be applied to many disease conditions, for a wide variety of individuals. Although the mail questionnaire is being used as the instrumentation technique, it seems feasible that the variables studied could be measured through use of personal or even telephone interviews.

ORGANIZATION OF THE STUDY

This study consists of five chapters, a selected bibliography, and appendices (a glossary of terms used in this study is shown in in Appendix F). In Chapter I, "Introduction to the Study," a basic overview of the study is provided. The discussion focuses upon identification of the research problem and an assessment of the need for the study to be performed. Objectives and hypotheses are stated in research form, and parameters of the study, including a brief
description of the methodology and design, is included. Assumptions and premises, upon which the study are based, is discussed.

Chapter II, "Review of the Literature," provides an in-depth review of contingent valuation and utility measurement literature as it relates to the economic evaluation of pharmaceuticals. The methodologies used and conclusions reached in previous studies are critically examined. A discussion of how the literature reviewed is has provided a methodological foundation for the research performed within this study is also included.

Chapter III, "Methodology and Design," descriptions of the target and experimentally-accessible populations as well as the study sample and the sampling procedure are included. Content validation techniques used in the study are reviewed. The study variables and each of the instruments used are described in detail. Finally, the relationship of the research hypotheses with the statistical techniques employed to test them is described in detail.

In Chapter IV, "Analysis of Data and Results," the research hypotheses are stated in null form. The statistical procedures used in analyzing the results are explained. The results of the analysis are described in summary form.

Chapter V, "Conclusions," provides a brief summary of the goals of the study as well as an in-depth examination of the meaning of the results found in Chapter IV. Limitations and generalizeability of the study are examined at length. Recommendations for future research are included.
CHAPTER II
REVIEW OF THE LITERATURE

FOUNDATIONS OF CONTINGENT VALUATION THEORY

Origin of the Contingent Valuation Method

The first published work to empirically study the contingent valuation method has been generally identified to be that of R.K. Davis in 1963 (Randall, Hoehn, & Brookshire, 1983, p. 638; Roberts, Thompson, & Pawlyk, 1985, p. 214; Schulze, d'Arge, & Brookshire, 1981, p. 151). Davis' 1963 article, "Recreation Planning as an Economic Problem," was based upon his dissertation work, and was followed up, three years later, with a related article comparing contingent valuation with travel costs for recreation (Knetsch & Davis, 1966). However, Davis' work did not stimulate further empirical research, until the publication of a few key articles in the early seventies. Bradford (1970) and Randall, Ives, and Eastman (1974) published studies which examined the use of contingent valuation for the valuation of non-marketed environmental resource commodities. Bohm (1972) applied the contingent valuation technique to value television broadcasts in Sweden. Acton (1970) conducted a door-to-door survey to evaluate a life-saving cardiac care program for his unpublished doctoral dissertation. Three years later he published, through the Rand Corporation, the first application of
contingent valuation to health care (Acton, 1973). Since these early studies, the volume of reported contingent valuation studies has grown at a dramatic pace (Randall et al., 1983, p. 638-9), with an increase in the number of studies performed on non-environmental goods and services. (Thompson, Read, & Liang, 1984). Despite the broadening of the scope of applications, the stronghold of research rigor, for contingent valuation, still seems to remain in the area of environmental resource analysis. For this reason, application of contingent valuation to environmental policy analysis comprised a significant portion of this review.

The underlying motivation for contingent valuation research is the belief that it provides a viable means of transforming public choice from the abstract to the observable. From implicit wants, individual preferences become known to policy-makers as explicit expressions of preference, in monetary terms (Brooks, 1983). Societal goals, the logic of contingent valuation begins, are better met in a democratic society through the promotion of individual public choice. Acton (1976b) describes this basic assumption as one, where,

individuals' preferences...count; ...citizens can and should play a role in policy-making for governmental services that affect them directly. Their health, their friends, their taxes, their pain and suffering, and their welfare are at stake. Understandably, they have an interest in the public activities that may be undertaken. Individuals are the ultimate recipients of the impact of programs (p. 60-1).

Related to this premise is the study of welfare economics. Anderson (1977) states that "(t)he fundamental issue of welfare economics is how to determine whether a society has been made better or worse off."
Welfare economists resolve this issue into two components, economic efficiency and income-distributional equity." The focus, by and large, of contingent valuation applications has been in the area of economic efficiency. Hence, contingent valuation in a context of efficiency has been a perennial theme throughout this review. The problem of distribution has not been directly addressed in the contingent valuation literature.

Contingent Valuation, as is benefit-cost analysis in general, is based firmly in modern welfare economics (Anderson & Settle, 1977, p. 11; Fischer, 1979b, p. 170; Harris, 1984, 200-1). As Fischer (1979b) points out, "(t)his is not to say that the willingness-to-pay principle is uncontroversial, but simply that it has a clear, understood philosophical rationale." Unfortunately, this does not tell us much, because many schools of economic thought exist that would repudiate cost-benefit analysis, but are based upon a core described as "the entire corpus of micro and welfare economics" (Randall, 1985).

In welfare economics, as it applies to cost-benefit analysis, or as Randall (1985) describes it, the "neoclassical mainstream in twentieth century thought about the economics of policy," two schools are presumed to exist. The first school, described as "neoclassical/rational planning," presumes an economic world where the market, due to inherent imperfections, has failed; consequently, government has a clear role in "fixing" the market by creating a welfare state and regulated economic policies (Randall, 1985). Cost-benefit analysis, of which contingent valuation is a component, would serve as a tool for government to make
better allocation decisions. The second school, "public choice/utilitarian," also presumes market failure. However, in this second school, government has also failed. Both the free market and government are presumed to be incapable of directing the optimal allocation of all goods and services. According to this theory, society, through the interaction of various interest groups, coalitions and institutions (private and governmental) is able to determine the correct allocation mix to optimize total utility or satisfaction for its members (Harris, 1984, p. 200-1). Cost-benefit analysis would then serve as a tool to support one group's claim over another for a given allocation of societal resources.

The methodology of this neoclassical mainstream is described by Randall (1985) as being "unabashedly reductionist."5

The reductionist neoclassical mainstream maintains the fiction that there exists a scientific realm (where the universal truth of propositions is at least a valid question), a metaphysical realm (where it is not), and a clear basis for distinguishing between the two. The establishment and maintenance of a science of economics is thus believed by the mainstream to require a sharp separation of science and ideology (p. 1023).

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5 Reductionism is the theory that complex phenomena ultimately can be understood completely in terms of regular relationships between simple, sense-observable entities... Reductionist thought is characterized by a preoccupation with the atomistic, the elemental and the individualistic (wholes are seen as sets of individual units); the search for timeless and universal relationships (i.e. scientific laws); deductivism; and empiricism. Reductionism reached its zenith in logical positivism. That position being untenable, modern reductionists are inclined to believe that the very best of science is represented by the hypothetical-deductive model [Hempel] (Randall, 1985, p. 1023).
This "fiction" of a sharp separation between the ideology and the science of cost-benefit analysis, and therefore contingent valuation theory, seems to be a major factor in the conflict between proponents of the contingent valuation technique and its critics. What is of particular interest is the fact that this disagreement is essentially unsolvable! Mushkin (1979) defines the essence of the debate: "problems of operational application (with willingness-to-pay) continue to pose real difficulties...What analytical approaches may be followed to give reality to the theoretical concepts?" (p. 324). In effect, critics of the technique have maintained a position of logical positivism - the operational definition of contingent valuation is, at present, weak, therefore the concept itself is weak. Because, as Randall pointed out above, the position of logical positivism is untenable, proponents of contingent valuation, perhaps without realizing it, answer their critics by taking a position of "partial" reduction. This "less extreme form of operationism," as an ideology, is attributed by Pinson (1964, p. 40) to Carnap (1956):

> If a concept is introduced into some scientific system one must be able to construct some proposition containing this new concept, which, together with one or several other propositions containing only already tested terms, entails observation statements whose truth can be directly tested. This approach avoids the disadvantages of the extreme operationist (positivist) position while still guaranteeing the empirical significance of concepts.

The focus of some studies of contingent valuation, and particularly of this study, is to compare observable bits and pieces from the contingent valuation concept with "already tested terms" from the science of

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6 see Pinson & Angelmar (1964) for further discussion of the rise and fall of logical positivism.
economics. This, in essence, makes conceptual validation a major goal for contingent valuation research.

The major generalizations that are apparent from the review of contingent valuation literature are:

1. The concept of contingent valuation can be defined, before testing, in several ways; however, the concept is not fully defined in an operational sense.

2. The literature indicates that many applications of the technique have been performed.

3. Consequently, the concept is likely to be operationalized in many different ways.

4. Attempts to validate the construct of contingent valuation have resulted in adaptations to the operational definition the concept studied.

5. Therefore, the operational definition of the contingent valuation concept is likely to change, to evolve, with greater scientific study.

Perhaps a good starting point, for an illustrative discussion of the state of the art (and science) of contingent valuation, would be a review of current operational definitions of that term.

**Contingent Valuation Defined**

Because the terms, "willingness-to-pay" and "contingent valuation" have been used interchangeably in the literature, it would seem best to start with the definition of contingent valuation, and then describe how "willingness-to-pay" can be reconciled to meet the stricter requirements of the former term. Boyle (1985) et al. state that,

Contingent valuation (CV) has become a commonly used tool for valuing items such as natural amenities that are not traded in markets...The term "contingent valuation" is used because people are asked to state the value they place on a non-market good or service contingent on a hypothetical market existing in which to trade this item (p. 188).
Roberts (1985) et al. also discuss this hypothetical market, where "the user values the recreation experience contingent on the described experience and market" (p. 214). Schulze et al. (1981), in describing six experiments in valuing environmental goods, told how,

in each case, the household [studied] was confronted with a possible change in an environmental attribute and [was] asked for a valuation. Because the valuation was contingent on the specific hypothetical change identified (through photographs, brochures, or other means), we propose that such approaches be called contingent valuations. Individuals can be queried about willingness to pay, minimum compensation, evasive behavior, past experiences, current experiences, potential site or activity substitutions, potential expenditure adjustments, income compensation coupled with potential behavioral adjustments, etc. which can be utilized with appropriate theoretical structures to estimate demand curves for environmental attributes (p. 152).

What is particularly noteworthy from Schulze's comments is the assortment of techniques available to the contingent valuation analyst to bring the contingent valuation concept to operational manifestation. Unfortunately, the concept is too frequently confused with the technique (even Boyle, above, called contingent valuation a "tool"). Certainly, this distinction needs to be recognized more clearly. The lack of conceptual clarity is even more apparent when one examines the term, willingness-to-pay.

Thompson (1984, p. 196) and Cocheba (1981, p. 312) both equate willingness-to-pay with consumer surplus. Walsh (1983) describes it in a similar manner, illustrating the concept of consumer surplus, where "net benefits of recreation use have been measured as the area under the demand curve above [emphasis added] the price of recreation at a new or expanded site, which represents users' maximum willingness to
pay, given the existence of other sites in the region" (p. 195). Appelbaum and Laitinen (1979) point out how willingness-to-pay is often mentioned without definition, but he describes it informally as a limit price: "the greatest amount which a consumer is willing to pay to obtain some specified good" (p. 211). It is interesting to note that, here, in contrast to derivation of consumer surplus, actual price is not even considered. Anderson (1977) also describes willingness-to-pay as simply economic demand, and also chooses to make a clear distinction between this and consumer surplus. Put in perspective, the dilemma between consumer surplus and the entire demand is the least of the problems with willingness-to-pay research. What is most problematic is the general lack of agreement among WTP researchers as to what is "WTP." In general, the "apparent" concepts being measured by WTP studies have included each of the following:

1. The [maximum?} amount an individual would pay to increase their, or someone else's probability of survival (Acton, 1973).

2. The amount of other resources an individual will sacrifice to secure a given commodity (Zeckhauser, 1975, p. 424).

3. The amount which would compensate a person for increased risk of death or decline in functional health status (Clarke, 1979).

4. The "psychosocial costs" of illness that an individual would pay to avoid (Wagner, 1982, p. 6-7).

5. Consumer [singular or plural?] demand (Bohm, 1979, p. 143).

6. Each of three alternative definitions:

   a. How much consumers say they are willing to pay to for pollution reduction [which defines willingness to pay in terms of willingness to pay].

7 The term, "apparent," is used, because one has no real way of knowing what was intended without personally communicating with these researchers.
b. Market transactions (wages or property values) to input pollution reduction.


7. "The amounts of money people would be willing and able to pay for various possible benefits" (Thompson, 1986).


10. Discrete patient responses (yes/no) to a range of prices for a medication counseling service which the respondents had used (Brown, Kirking, & Ascione, p. 69-71).

11. Inference of an estimated market price for housing attributes from hedonic price regressions, and subsequent regression to derive a consumer demand curve. Willingness to pay then estimated as the area under the demand curve (Lerman & Kern, 1983, p. 360).

12. An equivalent pay raise demanded as a substitute for an offer of a more pleasant job (Stern, 1978, p. 87).

The point of this list is not to admonish the application of willingness to pay techniques to various disciplines. This, in itself, is something to be commended. The problem that is apparent, from a close examination of the list, is that the willingness to pay studies are measuring a number of concepts, in addition to individual economic demand or consumer surplus. At the very least, one could argue that basic assumptions vary considerably between WTP applications shown on the list. Rather than make the logical positivist error by calling for greater uniformity in the use of the term, willingness-to-pay, toward a single constructive meaning, what is needed, at a minimum, is for researchers to make it explicit what conceptual definitions are used for the term, WTP, in their research, and furthermore, what science or
ideology is employed as a basis for interpretation of their research findings.

Due to the lack of agreement regarding the conceptual meaning of WTP, the term, contingent valuation, is used in this study. Contingent valuation applies the concept of a hypothetical market to prompt subjects to evaluate changes in levels of attributes of some commodity, in a fairly constant manner from study to study. Its foundations in the neoclassical mainstream of welfare economics is fairly clearly established, even if interpretations of results (e.g. Pareto vs. Kaldor-Hicks) vary, according to the researcher. For the remainder of this study, research which is labeled by an author as "willingness-to-pay," but which fairly clearly represents the concept of contingent valuation, is described by the latter term.

**Survey Methodology**

The instrumentation techniques used in contingent valuation studies have ranged across the various methods available for survey research. Bishop, Heberlein and Kealy (1983) relate these techniques to the contingent valuation concept:

> Contingent valuation employs personal and telephone interviews and mail surveys to ask people about the values they would place on non-market commodities if markets did exist or other means of payment such as taxes were in effect. That is, subjects are asked about their willingness to pay or compensation demanded, contingent [authors' emphasis] on the creation of a market or other means of payment. All payments and receipts are hypothetical.

It should be noted however, that some contingent valuation studies have used actual payments as transactions for contingent valuations, or as a check for hypothetical payments (Bohm, 1972; Knetsch and Sinden, 1984).
The question of which type of instrumentation technique is best to use for contingent valuation has been discussed a great deal, most researchers preferring the personal interview. Early studies, including those of Davis (1963), Acton (1973) and Randall (1974) all used personal interviews. Acton (1976b) contended that, through the personal interview, "...it is possible to pose questions that get at the underlying issues of willingness to pay....People were willing to complete the [personal] interview and seemed relatively comfortable and responsive in doing so (the refusal and breakoff rates were negligible)" (p.66). Fischer (1979b) questioned Acton's contention, however, by arguing that half of the responses obtained by Acton were "incoherent" (p.189). Although Acton did not mention the coherency problem explicitly, Fischer was able to surmise this finding from Acton's exclusions of subjects from various analyses, and the reasons given for their exclusion. Bockstael and McConnell (1980) and McConnell (1977) defend the use of the direct interview as an alternative to travels costs and other indirect means of demand curve determination for non-marketed resource commodities. Two advantages noted are, the flexibility of use for various situation where travel cost is ruled out, and the absence of a need for the direct interview to meet the substantial econometric demands of the former technique (Bockstael and McConnell, 1980, p. 61).

The direct interview technique lends itself well to use of the most common means of asking the contingent valuation question, the iterative bidding game (Boyle et al., 1985). The bidding game has been used in
both telephone and personal interviews. Boyle, et al. (1985) describe the process:

Bidding begins with an interviewer posting an initial bid (starting bid) to a respondent. If the respondent is willing to pay the initial bid, the interviewer revises the bid upward until a negative response is obtained. A negative response to the initial bid results in the interviewer revising the bid downward until an acceptable amount is found. The final bid is a measure of the respondents' Hicksian compensating or equivalent surplus for the item being valued (p. 188).

The same authors note that the bidding process rules out the use of the less-expensive mail survey, but surprisingly, that the iterative bidding process, because of an evident starting-point bias, may not be an appropriate technique to use in contingent valuation studies:

The problem is, one does not know what values to choose for appropriate starting bids and no single starting bid will be appropriate for all respondents. In addition, our empirical results are very discouraging for those who would argue that bidding helps people to consider their preferences more carefully on contingent valuation studies. The ultimate conclusion may be that iterative bidding is not worth the trouble and expense (p. 193).

The telephone interview poses an obvious advantage to the personal interview technique, since expense and time can be dramatically reduced for the study sponsor. Further, this technique may, dependent on the sampling method, provide greater strength to the evaluation of external validity (e.g. random digit dialing), where an adequate mailing or personal interview frame is not available. The literature is sparse in examples of the telephone interview in contingent valuation. Only two examples were found. The telephone technique was used with apparent success following a screening by mail questionnaires of recreational divers (Roberts, Thompson & Pawlyk, 1985). The authors used this
technique because numerous ports of entry and exit for divers ruled out
the use of intercept interviews. In a study sponsored by the American
Pharmaceutical Association, three valuation questions were asked of
respondents by phone, in a Lou Harris survey (Smith, 1983). No instru-
ment problems were noted in this study, although the methodological
discussion was so limited that no conclusions could be drawn about the
telephone method used in this particular application.

The mail survey technique, used in this study, has been used to a
greater extent, with evidence of success, but with some possible draw-
backs. Bishop et al. (1983) used the mail technique to study the value
of goose hunting permits to hunters. The authors asked subjects open-
ended questions and randomly-generated single "take-it-or leave it"
amounts to ascertain valuations. Different types of question formats
produced similar responses within willingness-to-pay and willingness-
to-sell market scenarios. However, the willingness-to-pay/sell effect
was associated with widely different valuations, although this type of
finding certainly has not been limited to studies where mail question-
naires were used.

Cocheba and Langford (1981) also used an open-ended question format
on their mail questionnaires. In asking hunters to value resource
organization efforts to increase goose populations, the researchers
found some useful results, but noted several drawbacks of the open-
ended technique. One-fourth of the respondents left the willingness-
to-pay question blank. Further, 16 percent of the returned question-
naires contained responses which proved, on the basis of cross check
questions, to be unusable.
Muller and Reutzel (1984) also used the mail technique, and found similar problems.
In their study, university undergraduates were mailed questionnaires that included open-ended questions regarding the subject's willingness-to-pay for various reductions in the probability risk of death from automobile accidents. The authors stated that many results of inconsistency were obvious, because subjects answered questions of equivalent meaning, phrased in various ways, with widely divergent answers. Further, the authors reasoned, from analysis of results, that subjects paradoxically valued other persons' lives 100 times more than their own.

However, as noted previously, Fischer (1979b) claimed similar problems with Acton's (1973) study of interventions to lower the probability of fatal heart attacks. Because Acton used personal interviews, one wonders to what extent the problems found in Muller and Reutzel's work is attributable to the instrumentation technique, and how much can be assigned to the cognitive evaluation of an event, death, which is of remote probability with the most extreme of consequences. Along this line, Muller and Reutzel, in the same study, note over a 200-fold difference between various studies of the value of a life, as determined from explicit willingness-to-pay questions. Because of the difficulties and unique methodological requirements of these studies, further discussion of "value-of-life" research is limited in scope and detail, in this review.

In a study conducted by Loehman and De (1982), residents in the San Francisco area were asked to value selected discrete dollar amounts to
pay for a specified reduction in symptoms that were a consequence of air pollution. Because iterative bidding was ruled out, due to the use of the mail questionnaire, the number of dollar choices was limited to ten. Since values ranged from $0 to $10000, on a logarithmic scale, reliability was an inherent problem at the individual respondent level. To overcome this, Loehman used an aggregation procedure, using Logit analysis, to determine willingness-to-pay, as explained by selected socio-demographic characteristics (particularly, health status and income). Despite a favorable review by Chestnut and Violette, Loehman's study carries some potentially serious problems. First, the model does not test possible interdependency between various symptoms. The assumption is simply made that total willingness to pay for a given increase in health status is a simple additive function of willingness to pay for reduction of individual symptoms. Secondly, the contingent valuation scale is defined by the author as a series of "paired comparisons," although it seems closer in appearance to a Likert scale. Although subjects may, in fact, have viewed the scale as Loehman proposes, the scale should have been checked for an upward bias, which would result if a "Likert perception" was the case. Despite the problems noted above, the "paired comparison" format may provide an alternative to an open-ended question format.

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8 It differs from Likert in one respect. The subject is asked to circle the discrete value which is the most he/she would pay for a symptom reduction. In the Likert scale, the subject would be asked to circle the value which most closely describes the perceived "true" value.
The work using mail surveys has yielded mixed results as far as the reliability of this technique is concerned. The problem associated with choosing a single technique to employ, seems to one of balancing trade-offs of each, rather than choosing one reliable, all-weather instrument. Bishop et al. (1983), discuss the dilemma of instrument choice in their conclusion.

Some would argue that personal interviews yield more accurate results because of greater flexibility [than mail surveys] in the amount and nature of the information that can be provided to subjects and because of opportunities for iterative bidding. Interviews may in fact provide opportunities to help subjects more fully explore preferences and constraints to predict more accurately how they would behave in real markets. Our concern is that such interview procedures would be superimposed on inherently artificial contingent markets. Doing so may cause subjects to base answers even more on the information received and other aspects of the interview situation and less on the relevant economic parameters. Only further empirical work can determine which basic approach is correct (p. 632-3).

Thus, although some problems, including non-response to open-ended questions, in mail surveys have been noted, personal interviews may produce values which are even less valid. It would seem that choice of an instrument technique is a decision that is very situationally-dependent; the researcher must weigh the benefits and problems associated with each technique, prior to choosing one.

Sources of Bias

This section addresses various factors that may add noise or bias into contingent valuation measures. In effect, these sources of bias serve as alternative hypotheses to explain, or more correctly, question, the variance found in the dependent contingent valuation measure. Although
some points of the bias discussion, to follow, have been raised by critics of the contingent valuation technique, it is reassuring, from the perspective of theory development in contingent valuation, that the most intelligent and in-depth discussion of bias has been raised by users of the technique. The following sources of bias, as identified in the literature, are discussed in detail:

1. Hypothetical bias
2. Information bias
3. Strategic bias
4. Starting-point bias
5. Vehicle bias

In addition, several other sources of bias, identified in the literature, are briefly mentioned.

Bishop et al. (1983) argue that, despite the dimensionality appearance of these various biases, all are closely related and stem from the artificiality that is characteristic of contingent markets (p. 629). The authors further argue that the term, "bias," has often been used too loosely in the literature, because random error, alone, is insufficient to establish bias (p. 629). Randall et al. (1983) provide an additional warning about the interpretation of possible sources of bias:

While not all the anomalies and discrepancies [of contingent valuation results] can be blithely dismissed, neither should all be taken seriously. Some genuine anomalies require explanation. Nevertheless, some claims of discrepancies reflect problems with particular research designs and naïve interpretation of results, rather than inadequacies inherent in the contingent valuation method (p. 641-2).
Nevertheless, consideration of these sources of bias or random error provides a means of checking the degree to which variance in the dependent valuation measure is attributable to something other than the "true" valuation effect.

Hypothetical Bias

Harris (1984) states that this form of bias "can result when the respondent feels that the situation to which he is reacting is too hypothetical and unrealistic, and responds accordingly" (p. 203). Roberts et al. (1985) approach it in a somewhat different manner. They state that hypothetical bias results "when individuals fail to carefully consider the consumption decision presented in the hypothetical market, either because they lack incentive to do so, or, in a personal interview, they are given insufficient time" (p. 215). Schulze et al. (1981) pose the bias as a problem "induced by not confronting the individual with an actual situation, i.e., an organized market with well-defined prices" (p. 153). The authors emphasize the difficulty, however, in testing such a bias, because of confounding factors that would influence validation criteria. Although empirical studies of hypothetical bias are few, Bohm (1972) found similar responses between respondent's willingness and actual payments for television programs.

Randall et al. (1983) argues that the concept of hypothetical bias is weakly defined, citing conflicts in the literature between descriptions of the bias as both systematic distortion (downward for WTP and upward for WTA) and simply a manifestation of high noise levels [presumably, of a random nature] (p. 641). Brookshire and Crocker
(1981) believe the problem with this bias to be one of information (p. 241).

**Information Bias**

Schulze et al. (1981) describe this bias as a potential set of biases "induced by lack of or type of, information given to the consumer in the contingent market" (p. 153). The authors point out the possible influences that various informational factors can have on the contingent valuation. These include: available substitution alternatives to the commodity evaluated; how other respondents behaved; whether aggregate bids were sufficient to achieve the required goal; and the alternative sequencing of questions (p. 157).

Both Schulze et al. (1981) and Brookshire and Crocker (1981) describe the crux of this issue as one of ex ante vs. ex post responses. Although both authors are in disagreement regarding the degree to which a hypothetical market might approximate an actual decision-making scenario, in a public policy sense, both agree that responses to the offer of a commodity should, necessarily, be different for an individual deciding "what could be" (ex ante) and "what might have been (ex post)." Randall et al. (1983) argue further that:

Variations in the materials describing the contingent valuation market may influence the contingent choices. Such responses, however, may not evidence any kind of bias at all. If the various elements of contingent valuation market structure are relevant to the choice problem, information that changes the structure of the market should [author's emphasis] (arguably) change the circumstantial choices made therein. Economists regard the responsiveness of prices to changes in market conditions as a virtue. Surely, contingent values should be similarly responsive to changes in contingent market conditions (p. 641).
Thus, the problem of informational bias seems to be one of finding an appropriate survey instrument which can emulate an actual market. Unfortunately, such a market does not exist in a pure sense for the types of commodities that have been studied. As a result, other criteria have been used to validate the quality of information provided in a contingent valuation instrument. These criteria are not without "informational" problems of their own. These will be discussed in more detail in the section, "Attitudes, Behavioral Intentions and Behavior."

Strategic Bias

This form of bias has been studied fairly extensively. Roberts et al. (1985) describe this as occurring when respondents give dishonest values of willingness to pay to influence the mean sample evaluation. This is presumed to be done by respondents who wish to avoid paying a user fee or wish to influence the level at which a public good is provided (p. 215). Schulze et al. (1981) provide a classical illustration of how the strategic bias might occur. The biased respondent is described as a "free-rider."

...If nearby residents were asked how much they were willing to pay to clean up the air near a power plant, and if they suspected that control costs would be borne by consumers and owners everywhere, local residents would have an incentive to overstate their willingness to pay. On the other hand, if residents suspected that they would be individually taxed an amount equal to their own willingness to pay, then a clear incentive would exist to understate their own true value, hoping that others would bid more (p. 156).

Schulze et al., in the same review, note that three empirical studies have failed to support the existence of strategic bias (Bohm, 1972; Scherr and Babb, 1975; Smith, 1977). Like Schulze, above, Bohm (1972)
hypothesized that the free-rider problem would be bi-directional, with an upward or downward bias depending on the free-rider respondent's strategy. Again, we see the dilemma of random versus systematic error. In a 1979 Swedish study, Bohm argued that strategic bias, as a contingent valuation phenomena, may be questionable in theory because a majority of people vote in general elections (at least this is the case in Scandinavian countries), despite the fact that the marginal influence of their vote is dwarfed by marginal expenses associated with the act of voting.

Starting-point Bias

This form of hypothesized bias is a direct consequence of the bidding procedure. Boyle et al. (1985) studied this validity threat in great detail. The schema for this potential bias arises in the iterative bidding framework when the initial bid influences the final bid. Because the initial bid is designed to only initiate the bidding process, it should not be functionally interdependent with the final (contingent valuation) bid (p. 189). The authors reviewed the literature and found two studies where evidence of this bias was fairly clear (Rowe, d'Arge & Brookshire, 1980; Brookshire, d'Arge, Schulze & Thayer, 1981). However, they also examined three studies which reported no evidence of starting point bias (Randall & Brookshire, 1978; Randall, Grunewald, Johnson, Arness and Pagoulatos, 1978; Thayer, 1981), although the small number and narrow range of starting bids in each of these latter studies left some doubt as to what extent the potential threat was permitted to occur (Boyle et al., 1985, p. 189-190). The
authors concluded that starting point bias may be an artifact of hypothetical markets. They found their "empirical results [to be] very discouraging for those who would argue that bidding helps people to consider their preference more carefully in contingent valuation studies. The ultimate conclusion may be that iterative bidding is not worth the trouble and expense" (p. 193).

Vehicle Bias
This can occur if the specific characteristics of the instrument affect the contingent valuation response. Starting point bias is considered to be a form of this bias, since it is a function of the bidding process. However, the choice of payment vehicle specified in the hypothetical market may also influence the contingent valuation. Schulze et al. (1981) state that, from economic theory, when a payment vehicle allows the individual to substitute over a wide range of potential commodities for purchase, the bid should be higher, or compensation lower, than where the range is smaller (p. 157). Randall et al. (1974) found significant evidence of instrument bias, but Harris (1984) believe that careful instrument design and testing should be sufficient to alleviate most of the problem.

Other Sources of Bias
Several other sources of bias have also been mentioned in contingent valuation studies:

1. Sampling bias
2. Interviewer bias
3. Non-response bias
4. Enumerator bias
5. Endowment bias
6. WTP/WTA bias

Sampling, interviewer and non-response bias are certainly not limited to contingent valuation studies, but are problems of survey research, in general. Endowment bias was described by Knetsch and Sinden (1984) in a study where they found subjects much more willing to give up newly acquired income than existing income for commodities. This concept is closely related to the last source of "bias" - differences in responses for willingness to pay and willingness to accept questions. The issues related to the pay/accept dilemma are discussed in greater detail in a subsequent section.

**Major Issues in Contingent Valuation Methodology**

Several issues have particular importance in the interpretation and extrapolation of contingent valuation results for public policy. Whereas the "Sources of Bias" section described, for the most part, potential threats to internal validity of the contingent valuation methodology, this section includes a discussion of those external validation threats which are unique to this methodology. The issues to be discussed are:

1. Attitudes, Behavioral Intentions and Behavior
2. Willingness-to-Pay and Willingness-to-Accept
3. Income and Wealth Effects
4. Societal and Individual Willingness-to-Pay
Attitudes, Behavioral Intentions and Behavior

The issue to be discussed here is one of determining to what extent responses obtained from contingent valuations are applicable in public choice decisions. In essence the particular problem is a function, once again, of the hypothetical market, which is manifested in the survey questionnaire. Dorfman (1979) provides the spirit of the frontal attack on contingent valuation methodology by stating that,

as a last resort, there is always the questionnaire. Economists tend to eschew this approach, largely because they believe that it is almost impossible to get a valid answer to a hypothetical question. Their preference is to observe what people do rather than what they say they would do.

Although Dorfman's comments were made from the perspective of a value of life discussion, the "hypothetical" criticism has not been limited to life or death valuation decisions. Cocheba and Langford (1981, p. 312) echo the sentiments of Scott (1965, p. 36), who argued, "ask a hypothetical question and you get a hypothetical answer" and Pearse (1968, p. 88), who maintained that it is difficult "...to obtain rational and consistent expressions of value from recreationists simply by asking direct but hypothetical questions."

Randall et al. (1983) summarized related comments by stating that the view of much of this literature is that one should be quite cautious in the use of attitudes to predict behavior (p.637). Grouping attitudes with contingent valuations, the authors, however reject the idea that negative or inconclusive results with attitude-behavior comparisons reflect poorly on the validity of contingent valuation results. The authors believe specific types of attitudinal information
to be more reliable than others in predicting behavior, with a poorest
to best ranking of: affective attitudes, behavioral intentions, and
contingent choices. To support this contention, they cited work per­
formed by Grether and Plott (1979) which compared contingent with pref­
erence choices in choosing among lotteries. These authors found con­
tingent choices to predict actual behavior (lottery purchased) in a
manner superior to preference choices. Brookshire and Crocker (1981)
discuss a concept similar to Dorfman's comment of studying "what people
do rather than what they say they would do." In describing the issue
of \textit{ex ante} and \textit{ex post} costs, the authors state that in making cost-
related decisions,

\begin{quote}
 an individual in the contingent valuation approach is set­
ing forth his evaluation of the prospective sacrifices in
utility as a result of the expressed contingencies. Thus,
cost is a choice-bound concept and choices are based on
prospects referenced in the type of information provided.
The valuation decision, implicitly the cost and thus the
proposed behavior, is stated at the time of decision based
on the contingent information provided. Cost, then, in its
relationship to choice must be based in expectations, \textit{not}
\textbf{experience} \cite{author's emphasis} \cite{p. 239}.
\end{quote}

The authors make two suggestions from this discussion: 1) the dis­
crepancies between observed and proposed behavior are not an issue in
valuing non-market commodities \textit{unless} \cite{author's emphasis} the informa­
tion which underlies the proposed behavior is identical to that which
may lead to any actual behavior observed; 2) the contingent valuation
framework provides valuations in terms of expected value (of a prospec­tive outcome) for an individual, for given information \cite{p. 239}.

This issue, more than any other, is likely to continue to fuel the
fires of disagreement between traditional utility theorists and human
capitalists on the one side, and contingent valuationists on the other. Rivett (1978) once stepped into the line of fire between utility theorists and cost-benefit analysts by stating that

what is distressing is how seldom any of the proponents (of either side) feel it possible that they {italics added} might be mistaken...if one is proposing a method it would be better not to be solely in an advocate's position but also to explain weakness of the method one is supporting (p. 821).

Certainly, an analogy can be drawn where the human capitalists and utility theorists must validate their ex post work in terms of public choice antecedents (since they imply that they can anticipate them from their behavioral results). Likewise, contingent valuationists have a responsibility to empirically explore weaknesses with their technique and must empirically evaluate validity with other measures of public choice.

Willingness-to-Pay and Willingness-to-Accept

The dilemma is which type of question to ask respondents: their willingness-to-pay for, as Mishan (1970) called them, potential possessions, or their willingness-to-accept to be compensated for the loss of existing possessions? The answer is by no means clear. Several studies have found quite significant differences between pay and accept measures (Bishop et al., 1983 {goose hunting permits}; Knetsch and Sinden, 1984); Randall, Ives & Eastman, 1974 {aesthetic environmental improvement}; Horvath, 1974 {salt-water fishing}). In each of these studies, the willingness-to-accept measure substantially exceeded willingness-to-pay. Krutilla and Fisher (1975) argue that this
condition is to be expected, in the case of positive income effect, because willingness-to-pay is bounded by income, whereas willingness-to-accept is not. Willig (1976) and Randall and Stoll (1980) have even attempted to functionally describe, in terms of consumer surplus, the relationship between a quantity change of a commodity and the consequent effect on both consumer and equivalent surplus measures. Willig's model, if valid, would obviate the need for direct valuation, and could require only indirect valuation measures such as travel costs.

Bockstael and McConnell (1980) attacked several of the assumptions upon which Willig's model was based, and instead argued that a direct contingent valuation WTP or WTA technique should be used, but did not choose to recommend one measure over the other. Schulze et al. (1981) note that the WTP/WTA difference may be the consequence of many factors besides the income effect, including: different property rights structures; failure of the respondent to relate to the contingent market presented [WTP or WTA may be unrealistic in a given contingent market]; and protest bids based on ethical considerations. These authors discuss the fact that no experiments have been performed to explain the reason for the WTP/WTA difference.

Thus, we are left with a dilemma that has been explained hypothetically and in a predictive sense, but is severely lacking in the empirical explanation necessary to describe and validate this concept. Perhaps, this explains the trend in the literature for a discussion, but without resolution, of the problem.
Income Effects

One issue in contingent valuation research which is notable, particularly because the lack of attention that has been paid to it, is the income-contingent valuation relationship. Although the role of income has been widely studied in the value-of-life studies (Jones-Lee, 1976; Landefeld & Seskin, 1982), it has not been given serious treatment in other contingent valuation studies.

Because income effects are normally considered to be an issue of distribution, rather than efficiency, it may be the thought of contingent valuation researchers that this is an issue for public policy analysts who wish to explore the implications of Kaldor-Hicks in greater detail. Secondly, unlike researchers who rely on indirect means of obtaining valuation estimates, researchers in the area of contingent value have not had to rely on disposable income estimates to obtain their efficiency measures. This argument is supported by Knetsch and Sinden (1984) who state that "wealth positions would be expected to vary little with or without most entitlements normally at issue" (p. 507). Indeed, the WTP/WTA dilemma is perplexing, primarily because the positive income effect is posited by researchers to be very slight for the types of commodities being studied.

Empirical evidence for an income-contingent valuation relationship is not strong for two commodities measured: relief from arthritis symptoms and television programs. Thompson et al. (1984) asked respondents to value WTP as a both a percentage of income and as an absolute dollar amount. Comparing the absolute dollar valuation with family income,
the authors found that WTP rose with income until a plateau WTP, between $27 and $38 dollars per week was reached, for an annual income range of $5,000 to $30,000. The mean WTP for respondents earning above $30,000 was $54 per week. These results have uncertain implications. The descriptive analysis was limited to a two-way frequency distribution; inferential discussion was simply that the linear relationship between income and contingent valuation was significant at a 90% level of confidence. No slope or correlation coefficient values were provided.

Less support for the relationship was found in an earlier study. After evaluating five contingent valuation measures, Bohm (1972) could find a significant relationship (which was positive) between WTP and income in only one of the measures.

Societal and Individual Willingness-to-Pay
In general, the goal of contingent valuation research has been described as one of improving policy decisions for society by explicitly stating the value of the individual for a given commodity. Acton (1976b) describes an ideal scenario for contingent valuation whereby WTP values are summed for all individuals (using a balloting procedure) to determine societal willingness-to-pay for a public program. If this measure of societal willingness-to-pay were to exceed the "costs" of the program, then policy-makers would have a green light to go ahead with it. However, no one has attempted such a large-scale project to determine societal WTP. Thus, we are left with the task of making societal conclusions from small-sample studies.
Generally, contingent valuation studies have limited aggregation to sample respondents (Daubert and Young, 1981), although some studies, such as Loehman and De (1982) have attempted to classify benefits according to selected levels of socio-demographic variables, which could, potentially, be projected to large target populations. However, no study reviewed has, in fact, attempted to weigh and interpolate these socio-demographic bids to a well-defined target population.

Zeckhauser and Shepard (1976) discuss this issue with regard to value of life, and find it difficult to define the consequences of aggregating family members values. Consequently, they avoid an in-depth societal discussion, arguing that:

this question gets us into many thorny issues relating to the structure of a social welfare function....Equally thorny is the question of adding expenditures by different members of society to benefit some target group. The expenditures are commonly indirect, in the form of higher prices or taxes....The implication for programs that provide health and life-preservation benefits is straightforward: the implicit trade-off rates they use should be consistent with the redistributational objectives and accomplishments of other programs in society (p. 34).

Mushkin (1979, p. 325) suggests three areas to examine in the flow of health care benefits: 1) benefits to the individual; 2) benefits to family and friend; and 3) net benefits to society.

Thus, the dilemma is fairly clear. The difference between society and individual perspectives becomes problematic when expenditures for some type of public commodity become divorced, and are unrelated to the benefits that are obtained by individuals within the society. This may be seen in hypothetical examples of water pollution control where an upstream community bears the expense of water treatment, but a
downstream community is able to reap the benefits without cost. Similarly, it can be seen in the case of health insurance coverage, where most of the marginal costs of therapy are borne by members of society other than the one who may reap the greatest marginal benefits. This problem would be one of the free-rider bias discussed earlier. Although contingent valuationists are hesitant to draw conclusions about the financing and returns of benefits (in most cases financing schemes are not even discussed), it would certainly aid policy-makers to have some discussion of these implications from those persons who are in the best position to know, the original researchers.

**CONTINGENT VALUATION IN HEALTH CARE**

To begin with a classification of contingent valuation studies as health-care related, it may help to describe what criteria are used for inclusion. One could use the World Health Organization definition of health as complete mental, physical and social well-being, but this would require that we include many studies, e.g. aesthetic environmental and leisure commodities that are individually tangential, but in the whole certainly contributory to mental and social well-being. If this point sounds far-fetched, a simple test may suffice to bring some validity to this argument. List all leisure time activities which impact in some positive manner in promoting mental, physical or social well-being in your life. Then determine whether any one of them is funded, to a significant extent, by non-market mechanisms (e.g. taxes, transfer payments). If such non-market mechanisms exist, it may be concluded that the program's maintenance and survival, and further your health status, are affected by conditions outside the realm of you and your fellow leisure enthusiasts' direct financial support.
limited to commodities affecting physical and pathological mental condi-
tions.

Two subclasses of contingent valuation health studies have been not-
ed in the literature: 1) a series of evaluation studies for pollution
control; and 2) a few studies covering a variety of morbidity states.
Most of the pollution studies have been reviewed in great depth by
Chestnut and Violette (1984b) in a study published by the Environmental
Protection Agency. A summary of contingent valuation studies reviewed
by Chestnut and Violette are reproduced in Table 2.
## Table 2

### SUMMARY OF CONTINGENT VALUATION STUDIES OF AIR QUALITY

<table>
<thead>
<tr>
<th>Authors (Year)</th>
<th>Type of Approach</th>
<th>Brief Description</th>
<th>Crucial Assumptions</th>
<th>Data Sources</th>
<th>Important Findings (1983 dollars)</th>
<th>Usefulness for Pollution-Related Morbidity Valuation and Other Comments</th>
</tr>
</thead>
</table>
| Loehman et al. (1979) and Loehman and De (1982) | Contingent valuation | A mall survey of Tampa, Florida, residents obtained WTP estimates for avoidance of minor and severe respiratory symptoms for 1 day, 1 week or 3 months each year. | - Mail survey is adequate for CV approach.  
- Preference for use of median rather than mean WTP. | General population survey | - Estimated median WTP for avoidance of 1 day of respiratory symptoms: minor - $3 to $4, severe - $11 to $18.  
- WTP was much higher for those without medical insurance.  
- WTP influenced by current health status. | - Relevant for short term respiratory symptoms.  
- Ambiguity in reference to decreases in existing symptoms or prevention of additional symptoms makes responses for 1 week and 3 months especially suspect. |
| Rowe and Chestnut (1984) | Contingent valuation | A study of asthmatics in a high pollution area near Los Angeles, in conjunction with a UCLA epidemiological study, to explore WTP versus COI for reductions in asthma symptoms and mitigating behavior. | - Use of individual defined "bad asthma day".  
- Ranking of benefits of reducing asthma symptoms can be interpreted so that WTP for benefits would be in same order. | Survey of a panel of asthmatics | - Mean WTP for a 50% reduction in "bad asthma days" per year: $600 or $21 per "bad asthma day" reduced.  
- Individual's WTP exceeds COI incurred by the individual by 1.6 to 2.3 times.  
- Provides evidence that mitigating behavior does occur. | - Relevant for valuation of impacts of air pollution as it aggravates asthma.  
- Conclusion that WTP exceeds COI 1.6 to 2.3 times is subject to interpretation of the rankings of benefits. |
| Brookshire et al. (1979) | Contingent valuation | Survey of Los Angeles area residents concerning WTP for reductions in air pollution, separating acute and chronic health effects and visibility effects. | - WTP to prevent health and aesthetic impacts are additive.  
- General public is able to reasonably assess air pollution impacts and provide meaningful valuation. | General population survey | - WTP to reduce health effects is about 2/3 of total WTP to reduce pollution, on average.  
- Income is positively related to WTP. | WTP estimates not useful for morbidity valuation due to uncertainty about the change in morbidity being valued. |
<table>
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<th>Authors</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Loehman et al. (1981)</td>
<td>Contingent valuation</td>
<td>Survey of San Francisco area residents concerning WTP for reductions in air pollution, separating health and visibility effects. Replication of Brookshire et al. (1979).</td>
<td>General public is able to reasonably assess air pollution impacts and provide meaningful valuation.</td>
<td>General population survey</td>
<td>- WTP to reduce or prevent health effects is about 1/2 of total WTP to reduce pollution, on average, but WTP for health and visibility are not necessarily additive.</td>
<td>- WTP estimates are not useful for morbidity valuation due to uncertainty about the change in morbidity being valued.</td>
</tr>
<tr>
<td>Schulze et al. (1983)</td>
<td>Contingent valuation</td>
<td>Survey of Los Angeles area residents regarding a severe ozone episode that recently occurred, asking WTP to prevent the episode, focusing on the health effects of high levels of ozone.</td>
<td>Responses about a specific episode in the past can be generalized.</td>
<td>General population survey</td>
<td>WTP is influenced by individual's preferences for outdoor recreation.</td>
<td>WTP estimates are not useful for morbidity valuation because interpretation of WTP to have avoided a past episode is not clear.</td>
</tr>
</tbody>
</table>
The authors were quite critical of many of the studies reviewed and stated four major points to be considered in future contingent valuation studies for changes in morbidity.

First, the authors argued that the dilemma between societal and individual willingness-to-pay cannot be ignored. This is of interest to a great extent in health care scenarios since subsidized medical care and sick leave, and worry and inconvenience suffered by other family members, may result in cases where an individual's willingness to pay may actually be less than what society would be willing to pay for health improvement interventions (p. 6-1, 6-7). However, this point was not explored in any of the empirical studies reviewed by the authors.

Secondly, the authors argue that acute and chronic illness should be approached differently. Acute illnesses can be resolved in an individual's lifetime, and the effect on family, friends, employers, and taxpayers can be defined more easily than with chronic illnesses. Chronic illnesses typically mean a permanent change in an individual's lifestyle, oftentimes consisting of, or leading to, morbidity states for which the respondent is unfamiliar. Contingent valuation studies are known to be more effective in conditions experienced by the respondent. Thus, acute illness measures are more likely to be accurate than are measures of chronic illness (p. 6-7). A related point not discussed by the authors is the fact that the time flow of benefits and expenditures can be more easily circumscribed for acute illnesses; in many cases, discounting would not be necessary. The same cannot be said for
chronic illness. In cases of chronic illness, the amount of cognitive processing required to reduce these time flows to a present value contingent valuation may be impossible for respondents to consistently determine.

Thirdly, the appropriate measure of morbidity studied would be dependent upon the policy being evaluated. To properly estimate contingent valuation measures for changes in morbidity, the change in morbidity must be clearly defined. The authors give several examples, including the number of people expected to become ill in a given period, work days lost and restricted activity days (p. 6-7).

Fourthly, the contingent valuation for changes in morbidity is influenced by the current health of the individual. The authors argue that there is "some evidence that individuals who are in worse health are willing to pay more to prevent additional morbidity or to reduce current morbidity" (p. 6-8). This is of interest, because it suggests that increasing, rather than diminishing, returns to health status exist. Unfortunately, they do not provide references for this argument.

The remaining contingent valuation studies in health care consist of a small assortment of health intervention valuations. The first important health care study was that of Acton (1970), which examined direct valuations of an emergency cardiac care service to reduce the probability of mortality. This study, and related works (Acton, 1973; Acton 1976b) have already been discussed in some detail. The samples studied included a random sample of Boston township residents, trade
union leaders attending a university conference, and business executives attending an executive-training program. Respondents were asked, in personal interviews to identify, in answer to open-ended questions, their WTP for various probabilities of avoiding death from heart attack, with and without medical interventions. Acton (1973) found that respondents were willing to pay $56 for a 1/500 chance of having their lives saved by the ambulance program in the following year, and $43 for a 1/1000 chance. From these values, the author implied that large groups would be willing to pay $28,000 and $43,000, respectively, for each year of life saved by the ambulance service (109-10).

Despite the historical significance of Acton's work, it has been criticized a great deal. Thompson et al. (1984) report that Acton reached his valuation conclusions despite "substantial variability in the answers received - evidence that subjects were erratic in their perceptions of probabilities - and admission that his methods lacked established reliability and validity" (p. 199). As a result of his review of Acton's work, Fischer (1979b) recommended that future applications of contingent valuation be limited to the most basic and straightforward applications in health care.

At the same time of the Acton's first publication, Keeler (1970) published a health care study for the Rand Corporation, which empirically examined contingent valuation in health care. This study related disease costs to allocations of medical resources.

Thompson et al. (1984) also use an open-ended question format for their contingent valuation study of reduction in arthritis morbidity.
The measures used in this study were unique in two ways. First, respondents were asked to compare their contingent valuation for complete relief of the disease state of arthritis, for each week, with the perceived amount that they were paying for arthritis care for the same period. However, results of responses to these questions were not reported. The authors apparently intended to use the perceived cost-of-illness/willingness-to-pay comparison questions to put the respondent in the proper frame of mind to answer the follow-up WTP questions, which were analyzed.

The second way in which the work of Thompson et al. was unique, is found in the follow-up WTP questions. Here, the authors asked respondents to report their contingent valuations for complete relief from arthritis as both an absolute dollar amount, and as a percentage of income. Employing stepwise regression for analysis of the dependent variable of WTP as a percentage of income, the authors found the following independent variables to contribute significantly to explanation: 1) number of arthritis symptoms; 2) Blue Cross/Blue Shield coverage (dichotomous); 3) number of total knee replacements undergone; 4) recent changes in personal habits (dichotomous); 5) recent changes in sleep habits (dichotomous). The relationship was positive for variables 1, 2, and 3. However, a recently noted change in personal or sleep habits was associated negatively with the dependent variable.

At a 95% level of confidence, the authors found significant (presumably positive) relationships with simple correlations of the following variables with WTP as a dollar amount:
1. The number of medications taken to treat arthritis
2. The number of purchases made for arthritis care
3. The amount of purchase charges made for arthritis care
4. Out-of-pocket purchase costs
5. A change in personal habits (dichotomous)
6. The seriousness of the level of arthritis severity

Using personal interviews, the authors reported a 27% response rate on WTP questions, which they argued as being comparable to that of Acton's study. They attributed missing answers to interview questions as being a function (in a large part) of advanced age, limited education, and lack of paid employment for many of their subjects. However the authors found a 96% response rate with the same group on the Index of Well-Being Scale which they included in their study. Perhaps the open-ended nature of their WTP questions contributed to the problem. They did not address this point, but instead insisted that most subjects need to be prodded to answer the open-ended WTP questions in order to gain high response rates.

Berwick and Weinstein (1985) examined the contingent valuation of 62 patients for various levels of ultrasound therapy, in normal pregnancy. The authors found some interesting results in their study. When the sum of WTP was calculated for the seven attributes that comprised the ultrasound therapy, the authors found an aggregate WTP of $1,217 for the service. However, when the service was offered as a non-divisible package of all seven attributes, patients were willing to pay an average of only $706. Thus apparent interaction between attributes
suggests that the sum of part-worths is greater than aggregate commodity value for this service.

Using an innovative approach the authors devised a methodology to derive the nature of the characteristics of the ultrasound therapy which the patients valued. Surprisingly, the authors found that 44% of the money subjects said they would be willing to pay for the therapy was attributable to test information to be used in non-medical and non-decisional realms of their own utility. The authors pointed out that a cost-effectiveness study which focused only on the value of ultrasound for medical decision-making would miss nearly half of the total value of that therapy.

Berwick et al. also found that willingness-to-pay was highly correlated with income, at a 99.5% level of significance. The slope of the association revealed that subjects would be willing to pay $2.30, for overall ultrasound therapy, for every $100 of income. Wealthier subjects appeared to be willing-to-pay a greater proportion of their income for medical-decisional information than were poorer patients.

The authors revealed that only two of the 62 patient surveys had to be excluded due to gross inconsistencies. Unfortunately, discussion of the instrument used for patient interviews was limited. Thus, one cannot determine what type of question was used to obtain patient valuation responses.

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10 However, no correlation coefficient was reported.
CONTINGENT VALUATION IN PHARMACY

Four studies have appeared in the pharmacy literature that describe contingent-type valuation processes for various types of pharmacy counseling services. (Brown, Kirking & Asicone, 1983; Huffman, 1973; Schondelmeyer & Trinca, 1983; Smith, 1983). Each study is discussed in some detail in this section to ascertain the level of the state-of-the-art of CV applications in pharmacy literature.

Although attempts to develop direct means of valuing pharmacy counseling services were noble in intent, two major drawbacks are shared by the four studies. First, on the basis of the methodology used and the references cited, no researcher made use of any established methodology from the economics literature for application to pharmacy. As a result, no clear validation comparison can be made between the pharmacy studies and related applications in other fields.

Secondly, perhaps as a consequence of the first drawback, each study made extensive use of low levels of statistical analysis. The most sophisticated statistical analyses performed were tests of significance on contingency tables. As such, the results were much more difficult to summarize and interpret than would have been the case by using more sophisticated statistical techniques, such as those used by other researchers in contingent valuation studies.

The first direct valuation study to be performed in pharmacy was that of Huffman in 1973. However, this author's work was extremely limited, and was discussed in the publication in only a single paragraph. Researchers, in this study, briefly explained the purpose of
patient medication records to 500 randomly selected consumers. Ninety-six percent indicated that the pharmacist should provide the service. Huffman reported that 98% of those consumers favoring such a service would be willing to pay up to 25¢ for such a service. No valuation studies were found for pharmacy services from the time of Huffman's work until ten years later when the next three works appeared in a single issue of American Pharmacy.

The work of Schondelmeyer and Trinca (1983) was the most ambitious of the three. The authors designed the study such that patients in five chain-owned pharmacies were offered a counseling service, at four levels of price, at the time of presenting an antibiotic prescription to a pharmacist. Those patients willing to pay the stated price were then given a seven minute consultation with a specially-trained pharmacist. After completing the consultation, patients were asked post-test questions about the value of the consultation service.

A number of problems were apparent with this study. First, the demand curve which was determined was limited to four price levels. Perhaps, it would have been better to select either a greater number of levels, or a randomly-determined bid offer to subjects. However, the greater weakness was a consequence of a phenomenon found by using these four price levels. When the price was increased from no charge to $1.00, demand dropped from 88% to 25% of subjects accepting the service, respectively. But, when the price was increased to $2.00, demand increased to 36%. Although this result may have quite possibly been

Although this could have required the use of complex econometric methods.
the result of noise or some form of bias, these possibilities were not explored. Instead, the authors stated that:

This finding illustrates the pricing principle that a product or service priced too low will make consumers skeptical and concerned about the commodity's quality and value. Pharmacists who underprice their services not only create doubt in their patients, but probably undervalue the time required for and the worth of their own services (p. 67).

Although this may very well explain the kink at the $2.00 price level, because price may convey market information, it is an extremely broad leap from association to causation.

A number of other problems confound the results of this study. A significant variation in valuations appeared to exist between pharmacies where the service was provided, yet the authors chose to ignore the contribution that this noise may have made to the reliability of the aggregate valuation measures. In measuring the relationship of demographic factors with willingness to pay, the authors found none, save age "to be significantly related to the decision to choose the counseling service (p. 67)." Yet, throughout this study the authors did not reveal, for these or any other variables, the statistical techniques used to draw inferences such as these, or even the confidence level applied to the results! Editorial control appears to be the only reasonable explanation for deletions of statistical discussions from the text of this study. Consequently, any conclusions drawn from this work should be derived with caution.

In the Brown et al. (1983) study, 102 patients taking cardiovascular medication were studied. A counseling service was provided to patients, which consisted of three levels: 1) initial interview;
2) follow-up discussion; and 3) a mailed refill-reminder system (provided to only some patients). Post-treatment interview questions included willingness-to-pay questions for future uses of the service for four levels of price, as well as a question measuring the importance of the service. Results of the WTP questions were listed as a frequency distribution and were cross-tabulated with variables of reminder-card treatment, sex and payment mechanism. No inferential statistics were used for WTP results, thus the results could not be extrapolated outside of the study sample. Discernible trends for the study sample included a greater likeliness for the following groups to pay some positive amount for the service: reminder-card treatment; females; and third party program members. Statistical analysis using t-tests were performed on importance ratings of the service between those groups who stated any positive willingness-to-pay for the service and those who were not willing to pay. No p-value was greater than 0.05 for importance ratings for the three components of the service, which was favored by the group willing to pay a positive amount. However, no discussion of practical significance was attempted.

The greatest problem noted with the Brown et al. study is the weak statistical design and analysis. The study is extremely limited in interpretation, the analysis being limited to a discussion of the WTP contingency table. However, the authors were extremely careful in drawing conclusions from their research.

The Smith (1983) study has been mentioned earlier. This study consisted of discussion of three questions of consumer WTP (conducted by
Lou Harris and Associates) for three levels of pharmacy service; 1) patient medication record review; 2) pharmacy-based counseling service; and 3) an in-home pharmacist counseling service. Again, interpretation of results is awkward since the data was simply reported as a frequency distribution of responses to WTP categories. Inferential statistics, which would presumably be available from the research firm, were not reported.

**COMPARISON WITH OTHER VALUATION TECHNIQUES**

In the literature, several comparisons have been made between contingent valuation and other forms of benefit valuation. The following types of benefit valuation are examined in relation to contingent valuation: 1) shadow prices; 2) human capital (or health productivity function); 3) cost-of-illness; and 4) health status index.

**Shadow Prices**

In shadow price methodology, benefits are valued in terms of the market prices of goods that are comparable to the non-monetary goods being evaluated. Shadow pricing techniques have included, most popularly, travel cost and hedonic price analysis. Randall et al. (1983) reviewed studies which empirically compared contingent valuation with shadow prices. In general, consistency was found between both methods in evaluation of the following commodities:

1. Recreation site values (Knetsch and Davis, 1966)

2. Improved air quality (Brookshire, Thayer, Schulze & d'Arge, 1982; (Loehman, Boldt & Chaikin, 1981)
3. Community facilities of western energy boom towns (Cummings, Schulze, Gerking & Brookshire, 1982)


5. Goose hunting permits (Bishop & Heberlein, 1979)


**Cost-of-Illness**

Cost-of-illness is a form of shadow pricing with specific application to health care. Thompson et al. (1984) believe this technique to be inadequate for the value of health, and note the failure of this technique to accurately capture the value of arthritic pain (p. 196-7). Similarly, Chestnut and Violette (1984b) argue that, for changes in health status, both out-of-pocket losses and personal discomfort would be measured by a contingent valuation function, although only the former could be captured with a cost-of-illness technique (p. 3-9). As such, Chestnut and Violette point out that COI serves as a lower-bound estimate for contingent valuation. Harrington and Portney (1982) describe four components of an individual's contingent valuation for pollution reduction:

1. The opportunity cost of the change in time spent sick due to the change in pollution.

2. The change in medical expenditures associated with the change in time spent sick as a result of the change in pollution.

3. The change in defensive expenditures associated with the change in pollution.

4. The direct disutility (pain and discomfort) associated with the change in pollution.
These authors argue that cost-of-illness methodology only includes the income and medical expenditure effects of items one and two, whereas an individual's contingent valuation would include, in addition, items three and four. Thus, presuming pain and defensive expenditures to be negatively valued, WTP will always equal or exceed COI.

In the only empirical study in health care known to compare these two measurement techniques was that of Rowe and Chestnut (1984). These researchers studied the value of air pollution reduction for asthmatics, and developed a cost-of-illness regression model that explained 31% of subjects' contingent valuation tax bids. A comparison of individual cost-of-illness values with contingent valuation tax bids was found by the authors to establish a range of WTP/COI ratios of 1.6 to 2.3. Thus, in this study, WTP always exceeded COI (medical expenditures and income lost to asthma). A value of 2 was established as "an appropriate rule-of-thumb estimate" in this study (p 4-53).

Human Capital

The Human Capital or Health Productivity Function approach to the valuation of health benefits has already been discussed in detail in Chapter I, "Introduction to the Study." Although some researchers, including Landefeld and Seskin (1982) and Conley (1976) have attempted to model the theoretical relationship between human capital (HC) and contingent valuation for value of life scenarios, empirical comparisons between human capital and contingent valuation measures in health care have been lacking. Thompson (1986) provides a good summary of points of concurrence from studies that have described the contingent valuation/human capital relationship:
First, HC and WTP are basically different. Whereas HC deliberately restricts its focus to economic aspects—usually in a retrospective manner—WTP seeks to be comprehensive, most often from a prospective viewpoint. Second, the appealing theoretical completeness of WTP is dimmed by its practical difficulties. Third, HC and WTP share related defects. While HC may unjustly value people by what they earn, WTP is influenced by how much money people have and can afford to pay. The inexactitude introduced in HC by market imperfections possibly based on poor information is matched in WTP by inconsistent or irrational personal judgments. Fourth, it may often be best to use HC and WTP simultaneously, with each shedding light on the other, with HC having the greater precision and serving as a lower bound for the fuller but less exact WTP.

Thus, Thompson paints a picture of two imperfect measures: WTP and HC. Willingness-to-pay is shown as being less precise, but, on the other hand, presumably less biased than the human capital approach.

The discussion of the use of HC as a lower bound estimate of WTP parallels the contingent valuation/COI comparison. In general, it would appear that HC/COI measures are lower because they represent supply-side measures, based upon the price of labor and market goods, respectively (D.S. Pathak, personal communication, 1986). Contingent valuation, in contrast, is based upon demand-side concepts. Because consumer surplus has a non-negative value for individuals who consume a good (assuming rationality, utility preferences, etc.), it makes sense that supply side measures, based on cost estimates, provide a lower bound estimate to techniques, such as contingent valuation, that measure demand for consumers who are likely to want to consume the commodity studied.

Further, greater precision and a downward bias is more likely with these supply-side side measures because the price is specified to a limited range. Unlike contingent valuation, which includes consumer surplus measures, the converse, producer surplus, is not captured in traditional HC/COI studies.
Health Status Index

Of all the valuations techniques studied, comparisons between Health Status Index (HSI) and contingent valuation are the most limited in the literature. Chestnut and Violette (1984b) note one similarity, however, between these two techniques:

When conducting CV studies or surveys to construct a health status index, the standard assumption is that individuals have well formulated values and the goal of the survey is to elicit those values. However, in some instances individuals may not have previously considered the tradeoffs in the way they are being addressed in the study and may have to formulate their opinions during the course of the interview. This means that the survey instrument itself is extremely important because it can influence this value formulation process.

The only empirical study found, which attempted to relate HSI to contingent valuation was that conducted by Murphy (1979). In this study the researcher found that a health status index, "Pleasure Hour Equivalent," was stated by subjects to be equivalent in value to slightly more than twice a person's hourly take home wage. However, it appears that this study may be flawed by a failure of the researcher to consider the effect of diminishing marginal returns to income and pleasure hours. Perhaps, this is why the author states an improbable relationship of "the value of a week of one's time [that] can be estimated as approximately worth 7 times his take home salary" (p. 208).

RESEARCH NEEDS

Randall et al. (1983) believe that a considerable body of empirical data has accumulated that vaguely suggests that underlying principles are at work which govern human behavior in contingent markets. The
next phase of research to be focused upon, they argue, "is a systematic conceptual and empirical exploration of the various influences on the performance of contingent markets (p. 648)." These authors state that further research should include rigorous theoretical analyses based upon microeconomic theory, but should also include "socio-psychological research into the decision-making process." Thus, these authors seem to propose greater development of construct validity, particularly through convergent validation using human behavior research, to provide a rigorous explanation of the contingent valuation method.

In terms of health care applications of contingent valuation, Chestnut and Violette (1984b) recommend that future studies address the relationship between contingent valuation and measures of illness, including work loss days, restricted activity days and bed days due to illness, because these measures are likely to be continued to be used in epidemiological studies. The authors suggest that it would be useful to ask subjects to compare out-of-pocket expenses with the above measures of illness, and relate these to the contingent valuation measure. In particular, studies of short-term illness are to be preferred, in this context. Short-term illnesses, the authors state, "that interfere temporarily with normal daily activities are familiar experiences for most people, and are therefore readily addressed in a CV survey (p. 6-14)."

Thus, it is hoped that this study of contingent valuation of antihistamines for allergic rhinitis may satisfy some of these recommendations for further study. Although the disease itself may be of a
chronic nature, the cyclical nature and temporary effect on daily life activities that are characteristic of the disease might satisfy Chestnut and Violettes's condition for acute disease states. Because this study includes some measures of disease severity for each respondent, the association between morbidity and contingent valuation can be addressed to some degree. Finally, the use of attitudinal ratings and perceived cost-of-illness measures may satisfy the need, stated above, to study the association of the contingent valuation with measures that purport to convergent, in a validation sense.

However, as noted, some bias problems are to be expected with this study, as were found in previous work. The challenge of this and further studies is to develop ways to overcome the noise introduced by these problems in attempting to measure the construct of contingent valuation.
CHAPTER III
METHODOLOGY AND DESIGN

INSTRUMENT DEVELOPMENT

The primary goal of this study was to test the relationship between a measure of contingent valuation and five utility measures for antihistamine products to treat the disease of allergic rhinitis. Further, the study was designed in such a way that these utility measures could be used as independent variables to explain the dependent measure of contingent valuation. Because the independent utility measures are purported to be convergent with the dependent variable, this study may contribute to conceptual understanding of contingent valuation, as well as test the validity of a proposed contingent valuation measure in health care.\textsuperscript{13}

Dimensions to be Measured

A brief discussion of the variables measured was presented in Chapter I, "introduction to the Study." In this section, the underlying constructs that served as the basis for variable selection is described. A review of the literature and problem definition revealed that the following dimensions would need to be studied in subjects: 1) socioeconomic characteristics; 2) allergic rhinitis disease state;

\textsuperscript{13} The expressed need for such an approach has been mentioned in detail in Chapter II, "Review of the Literature, Research Needs."
3) perceived cost-of-illness of allergic rhinitis; 4) contingent valuation for avoidance of allergic rhinitis; 5) attitudinal utility ratings for antihistamines; and 6) contingent valuation for antihistamines. Each dimension is discussed below.¹⁴

Socio-Economic Characteristics

In general, most contingent valuation studies have examined the relationship between the CV measure for a given commodity and demographic attribute characteristics of respondents. Although no common core of attributes have been established as requisite for CV analysis, most attention has been placed upon attributes such as income, age, sex, commodity usage, and geographic location. (Bohm, 1972; Chestnut and Violette, 1984b). Thompson et al. (1984), in a study of contingent valuation for arthritis relief, also included several variables related to types of health insurance coverage. Thus, the goal of variable selection for this dimension was one of finding the key demographic factors which, based upon the literature review, might have a relationship with the utility and contingent valuation measures. Because aggregation by demographic variables was not a particular goal of this study, the number of variables chosen for this dimension was restricted to a small number.

¹⁴ Specific variables that were based upon these dimensions, were defined in the final questionnaire, and are discussed, in an operational sense, in the "Development of First Questionnaire" section of this chapter.
Allergic Rhinitis Disease State
The health-related CV studies of Thompson et al. (1984), Loehman and De (1982) and Rowe and Chestnut (1984) were used as a basis for selecting variables to measure the dimension of the disease state of allergic rhinitis. It is presumed that individuals who suffer to a greater extent from allergy symptoms would be more likely to offer higher contingent valuations for relief, from the allergy disease state, and for antihistamine therapy. Thus, the focus of variable selection in this dimension was on symptom severity and past drug therapy for allergic rhinitis.

Perceived Cost of Illness of Allergic Rhinitis
Both the Thompson et al. (1984) and Rowe and Chestnut (1984) obtained cost-of-illness estimates for subjects, in addition to contingent values. Although the motivation for acquiring this information is not mentioned in the published work of the former, Rowe and Chestnut made a clear attempt to study the relationship between the two dimensions. This study also examined this relationship, but in a different manner. Subjects were asked to recall perceived costs of allergy therapy for a time period of six months. They were told to consider the sum of these costs in comparison to their contingent valuation to avoid the disease state of allergic rhinitis for the same six months. One might argue that this direct comparison might have led to a higher correlation between the CV and COI measures, than would have been the case if no direct comparison was stated. However, this risk was taken in the hope that such a comparison would strengthen respondents' cognitive assessment of the hypothetical contingent valuation questions.
Contingent Valuation for Avoidance of Allergic Rhinitis

Thompson et al.'s (1984) contingent valuation question for complete relief from arthritis served as the basis for a similar type of measurement in this study. This measurement was proposed for three reasons. First, it has been found that cost-of-illness is a lower bound estimate of contingent valuation (Harrington and Portney, 1982; Rowe and Chestnut, 1984); hence, a comparison of CV with COI, for an equivalent time period, may be used to test this hypothesis. Secondly, socio-demographic and allergic rhinitis characteristics could be compared with the CV measure to find possible relationships. Thirdly, contingent valuation for various levels of symptom relief could be studied to compare marginal contingent valuations for discrete changes in allergic rhinitis health status.

Attitudinal Utility Ratings for Antihistamines

Green, Goldberg and Montemayor (1981) and Huber, Sahney and Ford (1969) have empirically tested hybrid utility estimation models and found them useful for evaluation of an antibiotic product and hospital ward services, respectively. "In sum," Green et al. state, "the hybrid model and its various extensions would appear to offer considerable flexibility in combining the speed and convenience of self-explicated utility measurement with the greater power and generality of decompositional methods" (p. 41). Although Akaah and Korgaonkar (1983) found that hybrid conjoint models (including Huber-Hybrid) did not outperform a traditional conjoint model in their study of an HMO service, the authors recommended further testing to understand specific scenarios when the
hybrid models can be used as alternatives to traditional compositional or decompositional models. In a subsequent article, Green (1984) agreed that further applications of the hybrid model must be studied. The strategy of this technique, he stated, would be to obtain the most detailed and individualized utility function that could be supported by the data (p. 156).

Five utility models were investigated in this study: two self-explicated models and three Huber-hybrid models. The plan for utility measurement in this study was to construct self-explicated and full-profile stimuli and scales in a manner similar to that used by Green et al. (1981) and in Hoepfl and Huber's work (1970). The stimuli used in this study differed in one important way from that used by Green et al. and others. No price information was included in either the full-profile or self-explicated section. It was felt, in this study, that price information would significantly bias respondents' demand valuations. As such, the deletion of price from full product and individual attribute descriptions would suggest that, from a marketing perspective, the descriptions are not fully specified. Obviously, the hypothetical nature of the instrument used and limitations on the description provided would, alone, suggest that the subjects are evaluating products with less-than-perfect information. The point to be emphasized here, however, is a note of caution -- price may indeed imply more than simply a sacrifice in the level of consumption of other goods and services for one who purchases a product. Thus, utility measurement, in particular that of the full-profile antihistamine products,
might be expected to differ from that obtained with inclusion of price attributes, in a manner directly related to the importance of the market information that price might ordinarily provide, in addition to simple changes in wealth. Unfortunately, the importance of this price information is not known.

Contingent Valuation for Antihistamines

The hypothetical market was defined as a number of antihistamine products, each carrying brief descriptions, for which the respondent assigned a dollar valuation, contingent upon the right to use each of the given products for a specified time period. Because the same stimulus for the CV rating of an antihistamine product would, out of necessity, be used for attitudinal-utility ratings, it was decided to describe the stimulus for contingent valuation in the same full-profile manner as Green and others have used for conjoint analysis studies. These profiles were constructed to describe the most important attributes consumers would use in product evaluation, with the exception of price.

Although Loehman et al. (1982) attempted to find direct contingent valuations for individual commodity attributes, it was decided, in this study, that such an approach would be considered by subjects as being unrealistic, even for a hypothetical market. Asking an allergy

15 The emphasis in this hypothetical market was upon the product, the first "P" of marketing. The other three "P"'s, price, place and promotion were not clearly mentioned because it was assumed that allergy sufferers would be familiar with markets for these drugs, and would interpret product profiles in terms of the market mechanisms with which they were most familiar.

16 It should be noted that Loehman et al. presented individual
sufferer to place a dollar valuation on a product feature, such as a low level of drowsiness, was expected to, at best, produce unreliable valuations, and at worst, frustrate respondents to the point of discontinuing completion of the questionnaire. For this reason, contingent valuations were elicited only in response to full product profile stimuli.

Selection of Product Attribute Categories

The first step in construction of an instrument for this study was to define the most important product attribute or feature categories. An initial list of potential feature categories was derived from study of several sources of literature regarding antihistamine drug products. Particular emphasis was placed upon the following references: Facts and Comparisons (1986), United States Dispensatory Drug Information - Advice for the Patient (1986), and the allergic rhinitis works by Rick- etti (1985), Golbert (1981) and Mathews (1985). From this literature review, a list 56 types of product features was developed, which might potentially be of importance to allergy sufferers.

attributes as benefits, e.g. "to avoid 1 day per year of coughing/sneezing," rather than the features of the commodity evaluated: pollution control mechanisms.

17 Additional references consulted are included in the bibliographic section at the end of this work.

18 The list, entitled "Antihistamines - Profile of the drug class," is presented in Appendix A.
Pharmacist Panel Surveys

The initial list of product features was presented to four pharmacists, including this writer, for final selection of potential product feature categories. With the possible exception of allergist physicians, pharmacists were considered to be one of the most reliable groups to provide this information, for two reasons. First, as distributors of many antihistamine products, each pharmacist in the panel was not restricted to having sold a single or small group of antihistamine products, and hence, may have had a better understanding commonalities and differences between products. Secondly, the pharmacists are experienced with fielding questions, providing advice, and directly selling antihistamine products to allergy sufferers. It was thought that, for this reason, the pharmacist group would be most capable of understanding both supply-sided features and demand-sided needs.

Pharmacists were advised to use the initial list of 56 product categories merely as an aid in identifying potential categories to be included in the allergy sufferer questionnaire. The questionnaire used in the first pharmacist experience survey is included in Appendix A, "Pharmacist Panel - Round 1 of Category Selection." These questionnaires were completed by the pharmacist and returned. At this time the original list of 56 potential categories, obtained from the literature review, was revised and a new list was generated, solely from the combined responses of this first pharmacist survey. Redundant responses by two or more pharmacists were combined into single items. Conversely, a potential category item, suggested by a pharmacist, which
appeared to represent more than one concept was broken down into two or more category item descriptions. Also, many items were reworded in a way presumed to be understandable by allergy sufferers, because some of the panelists had made frequent use of medical and pharmacy jargon. From these results, an aggregate category list of 48 items was generated (See Appendix A, "Category List"). This new aggregate list was then sent to each of the four pharmacist panelists for a second round of responses. They were instructed to make any changes or additions to the new list, but were told to regard this list from the perspective of allergy sufferers. The questionnaire sent to the panelists in this second survey is included in Appendix A, "Pharmacist Panel - Round 2 of Category Selection." Very few changes were made by panelists in this list. Thus, the next step was to survey allergy sufferers for their views regarding the categories that were created.

Allergy Sufferer Panel Survey
A consumer panel was chosen consisting of a convenience sample of 10 allergic rhinitis sufferers (6 men; 4 women) who were either self- or physician-diagnosed as having had the disease in the past year. Three of the women, quite coincidentally, had had nursing training, although none of the participants had a pharmacy or medical academic background. The age range of panelists was from early twenties to early sixties.

Forty-seven items, which were obtained from the results of the second pharmacist survey, were included in the questionnaire sent to these 10 allergy sufferers. A description of the disease state of allergic rhinitis, although it was not labeled as such, was included in the
introduction of the questionnaire. Respondents were then asked to rate each of the 47 potential categories, e.g. "Time required for drug to work at peak effectiveness," on a seven-point Likert scale of importance (0 = No Importance to 6 = Extremely Important). The actual questionnaire used in this case is reproduced in Appendix B, "Allergy Sufferer Panel - Questionnaire #1." An area of the questionnaire was left open for respondents to add any categories which might not have been found in the list of items provided to them. However, the only two items written into this section were "Type of advertising" by one respondent and "How much the product costs" by another. Because price was purposely excluded from the list, it is surprising that only one respondent noted its absence. The person including the "Type of advertising" comment, in later communication, revealed that she thought that she would be unlikely to buy a product which was advertised in a "ridiculous" way, as she had thought many antihistamines were. Because this was believed to be a minority opinion and in view of the fact that the item, "How much product is advertised," was rated as of low importance, "Type of advertising" was not considered for inclusion as a category in the final questionnaire. Means ratings for each of the category items are shown in Table 3.
Table 3

RATINGS OF ANTIHISTAMINE CATEGORIES BY ALLERGY SUFFERERS

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>MEAN*</th>
<th>STANDARD DEVIATION</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time required for drug to work at &quot;peak&quot; effectiveness</td>
<td>5.60</td>
<td>0.70</td>
<td>10</td>
</tr>
<tr>
<td>How quickly the product works after being swallowed</td>
<td>5.60</td>
<td>0.70</td>
<td>10</td>
</tr>
<tr>
<td>How well the product works to stop itchy eyes</td>
<td>5.60</td>
<td>0.70</td>
<td>10</td>
</tr>
<tr>
<td>How well the product works to stop sneezing</td>
<td>5.50</td>
<td>0.85</td>
<td>10</td>
</tr>
<tr>
<td>How effective product is in stopping all symptoms of allergic rhinitis</td>
<td>5.10</td>
<td>0.99</td>
<td>10</td>
</tr>
<tr>
<td>Ability to take whenever needed</td>
<td>4.90</td>
<td>1.10</td>
<td>10</td>
</tr>
<tr>
<td>How well the product works to stop watery eyes</td>
<td>4.90</td>
<td>1.29</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes drowsiness</td>
<td>4.80</td>
<td>1.62</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes general &quot;fuzziness&quot; in the mind</td>
<td>4.80</td>
<td>1.32</td>
<td>10</td>
</tr>
<tr>
<td>Whether side effects fade away after a few days of taking the product</td>
<td>4.70</td>
<td>1.77</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes dizziness</td>
<td>4.70</td>
<td>1.64</td>
<td>10</td>
</tr>
<tr>
<td>Whether product is safe to take while driving</td>
<td>4.70</td>
<td>1.42</td>
<td>10</td>
</tr>
<tr>
<td>Whether allergy symptoms get worse than before the product was taken, after the product is stopped</td>
<td>4.60</td>
<td>2.27</td>
<td>10</td>
</tr>
<tr>
<td>How long product lasts before it has to be taken again</td>
<td>4.50</td>
<td>1.43</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes blurred vision</td>
<td>4.50</td>
<td>2.07</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product becomes less effective the more it is used</td>
<td>4.50</td>
<td>1.84</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes sedation</td>
<td>4.40</td>
<td>1.65</td>
<td>10</td>
</tr>
<tr>
<td>Whether there is danger of interaction of the product with other medications</td>
<td>4.40</td>
<td>2.27</td>
<td>10</td>
</tr>
<tr>
<td>How well the product works to stop nasal itching</td>
<td>4.30</td>
<td>2.11</td>
<td>10</td>
</tr>
<tr>
<td>Does product require a prescription</td>
<td>4.20</td>
<td>1.81</td>
<td>10</td>
</tr>
<tr>
<td>How bad the danger of taking an overdose of the product is</td>
<td>4.20</td>
<td>2.25</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes constipation</td>
<td>4.20</td>
<td>1.81</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes abdominal upset</td>
<td>4.20</td>
<td>1.75</td>
<td>10</td>
</tr>
<tr>
<td>Whether there is danger of interaction of the product with alcohol</td>
<td>4.20</td>
<td>1.81</td>
<td>10</td>
</tr>
<tr>
<td>How well the product works to dry runny nose</td>
<td>4.10</td>
<td>2.51</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 3 (continued)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>MEAN</th>
<th>STANDARD DEVIATION</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whether the product causes excessive dryness of nasal passages</td>
<td>4.00</td>
<td>1.89</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes fast pulse</td>
<td>4.00</td>
<td>2.00</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes difficulty in urinating</td>
<td>3.80</td>
<td>2.10</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product causes dry mouth</td>
<td>3.30</td>
<td>2.26</td>
<td>10</td>
</tr>
<tr>
<td>Package sizes available</td>
<td>2.80</td>
<td>1.55</td>
<td>10</td>
</tr>
<tr>
<td>Whether there is a danger of interaction of the product with other diseases</td>
<td>2.80</td>
<td>2.66</td>
<td>10</td>
</tr>
<tr>
<td>Whether product was once available by prescription only</td>
<td>2.50</td>
<td>2.37</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product can be used in females of child-bearing age</td>
<td>2.44</td>
<td>2.96</td>
<td>9</td>
</tr>
<tr>
<td>Appearance of product packaging (box, bottle, labels, etc.)</td>
<td>2.30</td>
<td>1.89</td>
<td>10</td>
</tr>
<tr>
<td>Appearance of drug to be taken</td>
<td>2.30</td>
<td>1.83</td>
<td>10</td>
</tr>
<tr>
<td>How easy the product is to swallow</td>
<td>2.30</td>
<td>1.77</td>
<td>10</td>
</tr>
<tr>
<td>Whether product is available as a tablet, capsule, liquid, etc.</td>
<td>2.20</td>
<td>2.10</td>
<td>10</td>
</tr>
<tr>
<td>How safe the product is to take if you have high blood pressure</td>
<td>2.20</td>
<td>2.53</td>
<td>10</td>
</tr>
<tr>
<td>How much the product is advertised</td>
<td>1.90</td>
<td>1.45</td>
<td>10</td>
</tr>
<tr>
<td>How good the product tastes</td>
<td>1.90</td>
<td>1.85</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product can be used if you have a thyroid condition</td>
<td>1.90</td>
<td>2.60</td>
<td>10</td>
</tr>
<tr>
<td>Whether product is made by generic as well as brand name companies</td>
<td>1.80</td>
<td>1.99</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product can be used if you have glaucoma</td>
<td>1.80</td>
<td>2.57</td>
<td>10</td>
</tr>
<tr>
<td>Whether product can be used to help you sleep</td>
<td>1.20</td>
<td>1.40</td>
<td>10</td>
</tr>
<tr>
<td>Whether product is safe to take while pregnant</td>
<td>1.11</td>
<td>2.09</td>
<td>9</td>
</tr>
<tr>
<td>Whether product can be used for motion sickness</td>
<td>0.90</td>
<td>0.99</td>
<td>10</td>
</tr>
<tr>
<td>Whether the product can be used if you are breast feeding.</td>
<td>0.67</td>
<td>2.00</td>
<td>9</td>
</tr>
</tbody>
</table>

*(0=No importance to 6=Extremely Important). Table is sorted in descending order of importance ratings.*
Attribute Category Descriptions

Once the results of the allergy panel survey had been analyzed, the next phase was to summarize the findings in a usable manner which could be used to identify the most important categories. Starting with the most highly-rated items, from the top of Table 3, each item was examined and subsequently grouped with items of apparently similar dimensions. Because one of the goals of category selection was to limit the number of categories to a maximum of eight, this grouping process was stopped once eight separate dimensions had been identified. This occurred at a point at which approximately the top half of items in Table 3 had been examined. The eight categories that were identified are shown in Table 4. The items that were suggestive of the category labels are shown under their respective headings.

Two criteria, other than importance ratings, were used to screen some of the highly-rated items from inclusion into category dimensions. For the purpose of this section, the first criterion, variance, was described as the degree to which product features, for existing products, differed from one another. If a product feature was invariant, it was not believed to be a critical factor in describing a product - the assumption being that respondents would be generally familiar with important invariant factors, and would not assume, a priori, a difference between one product and another in regard to a particular

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19 These category dimensions were defined in terms of product features, although some of the items, e.g. "causes dryness," were expressed in terms of benefits. This was done, because, as described in Chapter I, categories would eventually be represented to subjects as expressions of product features.
Table 4
CATEGORY DIMENSIONS SUGGESTED BY ALLERGY PANEL RESULTS

ONSET

Time required for the drug to work at "peak" effectiveness.
How quickly the product works after being swallowed.

EFFECTIVENESS

How well the product works to stop itchy eyes.
How well the product works to stop sneezing.
How effective product is in stopping all symptoms of allergic rhinitis.
How well the product works to stop watery eyes.
How well the product works to stop nasal itching.
Whether the product works to dry runny nose.

DROWSINESS

Whether the product causes drowsiness.
Whether the product causes general fuzziness in the mind.
Whether product is safe to take while driving.

DIZZINESS

Whether the product causes dizziness.
Whether product is safe to take while driving.

PRESCRIPTION STATUS

Does product require a prescription.

INTERACTION

Whether there is danger of interaction of the product with other medications.
Whether there is danger of interaction of the product with alcohol.

DURATION

How long product lasts before it has to be taken again.
Table 4 (continued)

DRYNESS

How well the product works to dry runny nose.*
Whether the product causes excessive dryness of nasal passages.

*This item was included in both DRYNESS and EFFECTIVENESS categories because it was felt that a nasal drying effect is likely to be the result of both antihistaminic and anticholinergic activity, for most antihistamines used to treat allergic rhinitis.

20Invariant factor.

Secondly, a second criterion for exclusion was described as incidence. Incidence refers to the degree to which the category feature, when variant among products, actually becomes manifest. The logic in this case was to exclude categories that occurred in very rare instances, provided that they were not life-threatening or chronically debilitating. A list of those highly-rated items which were not included in category groups, and the reasons for their omission, are included in Table 5.

Eventually, all of the eight categories above, with the exception of DIZZINESS, were included in the final questionnaire. Orthogonal design considerations necessitated the deletion of one of the original eight categories. Because the dizziness problem was believed to be the least significant of the eight in terms of variance and incidence, and in comparison of importance ratings, it was decided to sacrifice this

20 For example, all antihistamines are invariant on the general category, "therapeutic modality," because all are drugs. We would leave it up to subjects to realize the fact that the entities described by the eight category features are, indeed, drugs and not some other form of therapy.
Table 5
HIGHLY-RATED ITEMS EXCLUDED FROM CATEGORY SELECTION

<table>
<thead>
<tr>
<th>ITEM</th>
<th>REASON FOR EXCLUSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to take whenever needed.</td>
<td>No variance</td>
</tr>
<tr>
<td>Whether side effects fade away after a few days of taking the product.</td>
<td>No variance</td>
</tr>
<tr>
<td>Whether the product causes blurred vision.</td>
<td>Very low incidence</td>
</tr>
<tr>
<td>Whether the product becomes less effective the more it used.</td>
<td>No variance; No incidence</td>
</tr>
<tr>
<td>Whether allergy symptoms get worse than before the product was taken, after the product is stopped.</td>
<td>No variance; No incidence unless combined with a sympathomimetic</td>
</tr>
<tr>
<td>Whether the product causes constipation.</td>
<td>Very low incidence</td>
</tr>
<tr>
<td>Whether the product causes abdominal upset.</td>
<td>Very low incidence*</td>
</tr>
<tr>
<td>How bad the danger of taking an overdose is</td>
<td>Very low incidence</td>
</tr>
</tbody>
</table>

*Some antihistamines, such as diphenhydramine have been associated with death resulting from overdose, particularly with infants. It appears however, that even the worst antihistamines in this regard would not be life-threatening to adults, unless the overdose was intentional, and unless other depressant drugs, such as alcohol were taken in combination. In any case, the therapeutic index for antihistamines would be no worse than that of many over-the-counter products, including aspirin, acetaminophen, ibuprofen and the sympathomimetics.
dimension for the benefit of parsimony in the number of product profiles included in the questionnaire. Thus, the remaining seven dimensions were: 1) Onset; 2) Effectiveness; 3) Drowsiness; 4) Prescription Status; 5) Interaction; 6) Duration; and 7) Dryness.

Selection of Product Attribute Levels

The antihistamine literature was further studied with regard to these seven categories. The goal of this study was to determine the characteristics and range of particular antihistamine products in these areas. The results of the literature review, and the explanation for the number and range of levels identified for each category are described below, by category.

Onset: The range of times for onset of action for various types of antihistamines included a minimum time of 15 minutes for some entities to a maximum of 120 minutes for terfenadine in some individuals (Facts and Comparison, 1986). Mequitazine is known to have a peak plasma level at about 6 hours after ingestion, and may very well require more than two hours for noticeable therapeutic activity (Brandon, 1985). However, an estimate of onset of activity for this drug has not been reported.

In order to adequately capture a range to describe expected time of onset for antihistamines in most individuals, it was decided to represent the 15 minute to two hour range in terms of two levels for onset: 30 minutes and 90 minutes. Older antihistamines would be classified as 30 minute onset products, with the newest generation of these drugs (e.g. terfenadine, astemizole) having the slower rate of activity being represented at 90 minutes.
Effectiveness: The available evidence from the antihistamine literature did not reveal a significant interactive relationship between any antihistamine drug class and its effectiveness on particular types of allergic rhinitis symptoms (Brewster, 1982; Sorkin and Heel, 1985). It seems logical, from what is known of antihistaminic action, that a product that is a more effective $H_1$-antagonist should produce improvement in allergic symptoms overall, without appreciable selective effects on particular symptoms. For example, if Drug Y is a more effective $H_1$-antagonist than Drug X, then a proportional decrease in say, nasal itching symptoms, using Drug Y, should be associated with a similar proportional decrease in irritated eyes and sneezing, because all are mediated, to the greatest degree, by the presence of histamine, in allergic rhinitis. Interactive effects, if present, would likely be due to anticholinergic or central depressant effects. These effects are included, separately, in the DRYNESS and DROWSINESS categories. Thus, effectiveness was described as a compounded dimension of relief of itchy/watery eyes, nasal itching and sneezing, because no product was presumed to cause a selective reduction in only some subset of this symptom group.

Sorkin and Heel (1985) have written an excellent summary of over twenty effectiveness studies comparing terfenadine against chlorpheniramine, clemastine and dexchlorpheniramine. In the study, effectiveness was rated in terms of the percentage of subjects reporting "excellent to good" relief of symptoms. Facts and Comparisons (1986) had rated dexchlorpheniramine as among the most effective antihistamine
drugs available. Thus, it was decided to use the average percentage rating for dexchlorpheniramine as the point of maximum effectiveness for antihistamine drugs. This value was similar in scope to that of chlorpheniramine; approximately seven out of ten respondents declared 'excellent/good' relief. Terfenadine was anchored as being slightly less effective than chlorpheniramine and dexchlorpheniramine; on average, approximately six of ten respondents reported 'good to excellent' relief. Finally, because it was believed that the remaining antihistamines could be appropriately classified from as effective as placebo to the upper range of dexchlorpheniramine, it was decided to describe a third level of effectiveness as the lowest possible value in the range, equivalent to placebo. Approximately four in ten respondents reported 'good to excellent' relief with placebo, on average, in the Sorkin and Heel review. In all, three levels of EFFECTIVENESS were defined: 1) 4 persons in 10 reported 'good to excellent relief' of allergic rhinitis symptoms (similar to placebo); 2) 6 persons in 10 reported this level of relief; and 3) 7 persons in 10 reported this level of relief.

Drowsiness: A summary of the studies related to drowsiness and antihistamines is presented in Table 6. The lower range of drowsiness was chosen from this table, as being represented by approximately one person in ten reporting drowsiness after taking placebo. This is similar in drowsiness incidence to that of terfenadine. The upper range of this drowsiness effect is much more difficult to identify. Both Facts and Comparisons (1986) and Herxheimer (1972) report

21 The assumption is that such drowsiness is spurious, and would likely be normal for a drug that has no CNS drowsiness effect.
### Table 6

#### STUDIES OF DROWSINESS EFFECT

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>FINDINGS OF SEDATION INCIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorkin and Heel (1985)</td>
<td>Terfenadine (2.2 to 20%), Placebo (4.4 to 20%, other antihistamines (18 to 60%)</td>
</tr>
<tr>
<td>Weiner (1982)</td>
<td>Chloropheniramine or Azatidine (10 to 50%)</td>
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<tr>
<td>Mellilo (1982)</td>
<td>Dexchlorpheniramine (55%), Terfenadine (15%), Placebo (11%)</td>
</tr>
<tr>
<td>Dugue (1982)</td>
<td>Placebo (12.5%), Dexchlor. (24.3%), Terfenadine (10.5%)</td>
</tr>
<tr>
<td>Barlow (1982)</td>
<td>Terfenadine (12.6%), Chlor. (26.4%), Dexchlor. (24.6%), Clemastine (22.4 %)</td>
</tr>
<tr>
<td>von Maur (1985)</td>
<td>Tripelennamine (25%), diphenhydramine (23%), chlor. (14%), hydroxyzine (19%), trimeprazine (11%)</td>
</tr>
<tr>
<td>Roehrs (1984)</td>
<td>Sleepiness of terfenadine = placebo; diphenhydramine sig. greater than placebo</td>
</tr>
<tr>
<td>Dor (cited in Henahan, 1983)</td>
<td>Dexchlor. (24%), terfenadine (11%), placebo (13%)</td>
</tr>
<tr>
<td>Pastarello (cited in Henahan, 1983)</td>
<td>Terfenadine (15%), Placebo (10%), Dexchlor. (53%)</td>
</tr>
<tr>
<td>Kemp (1984)</td>
<td>Terfenadine (7.6%), placebo (2.4%), chlor. (19%)</td>
</tr>
<tr>
<td>Falliers (1984)</td>
<td>Terfenadine (2.5%), placebo (2.4%), chlor. (7.6%)</td>
</tr>
<tr>
<td>Levander (1985)</td>
<td>Clemastine produced sig. greater sedation than hydroxyzine or azatidine</td>
</tr>
<tr>
<td>Backhouse (1982)</td>
<td>(Moderate/severe sedation) - Terfenadine (2.2%), placebo (4.4%), chlor. (25%)</td>
</tr>
<tr>
<td>Brandon &amp; Weiner (1982)</td>
<td>Placebo (7.5%), chlor. (18%), terfenadine (11%)</td>
</tr>
<tr>
<td>Kagan (1980)</td>
<td>Terfenadine (5.5%), placebo (5.5%)</td>
</tr>
<tr>
<td>Lockhart (1983)</td>
<td>Terfenadine (15%), placebo (9%)</td>
</tr>
<tr>
<td>Brostoff &amp; Lockhart (1982)</td>
<td>Placebo (6%), terfenadine (12%), chlor. (29%)</td>
</tr>
</tbody>
</table>
diphenhydramine to be among the worst of the antihistamines in sedative-drowsiness effects. Roehrs, Tietz, Zorick and Roth (1984) reported that subjects were almost 50% sleepier with diphenhydramine than with placebo. Tester-Dalderup (1984) suggested that the drowsiness effect for drugs such as diphenhydramine may even exceed a 60% incidence. In view of these reports, an uppermost value for the level of drowsiness was chosen at a 60% incidence; six people in 10 reported drowsiness after taking the drug.

It was believed, from the review of literature, that most antihistamine drugs used for allergic rhinitis would fall somewhere near the middle of this 10% to 60% incidence range. Therefore, two additional levels were chosen: 1) 30% incidence; and 2) 40% incidence. Thus, four levels were determined for the category of DROWSINESS: 1) 1 person in 10 reported some drowsiness (similar to placebo); 2) 3 persons in 10 reported drowsiness; 3) 4 persons in 10 reported drowsiness; and 4) 6 persons in 10 reported drowsiness (similar to antihistamines with the greatest sleep-inducement potential).

**Prescription status:** This was the easiest category to define by levels. A product was simply designated as being available with or without a prescription. Facts and Comparisons (1986) was used for the identification of prescription status for any products selected to be represented by hold-out profiles.

**Interaction:** A review of the scientific literature, regarding drug interactions of antihistamines, suggested that the major problems in this area were with depressant drugs, including alcohol and
tranquilizers. For this reason, the description of the drug interaction category and related levels, were limited to interactions with alcohol and tranquilizers. Studies of these interactions, are abstracted in Table 7.

Unfortunately, there was little agreement between studies in the type of psychomotor performance test to be used, or the scales used to measure such performance. Further, no clear comparison was made between the tests used and important criteria outside of the laboratory, such as driving performance or safety in the workplace. Because of difficulties in translating the results of these laboratory experiments to parametric level descriptions for respondents to understand, it was decided to use a dichotomous description of levels for the category of INTERACTION. If scientific evidence suggested such an interaction, as was the case for diphenhydramine, then it could be described by a "Yes" for interaction with alcohol or sedatives. Conversely, evidence of no interaction, as with terfenadine, would be identified as "No" for interaction.

"Additive depressant effects" may be a better term to use than "interaction." In the true sense of the word, interaction would suggest some type of multiplicative reduction in performance if antihistamines were mixed with alcohol or tranquilizers. The literature does not make it clear, however, whether such an interactive effect, in the true sense of the term, occurs.
<table>
<thead>
<tr>
<th>SOURCE</th>
<th>CONCLUSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns and Moskowitz (1980)</td>
<td>Diphenhydramine appeared to exhibit additive effect on reduction in task performance.</td>
</tr>
<tr>
<td>Moser et al. (1978)</td>
<td>Terfenadine exhibits no effect on performance when combined with alcohol. Diphenhydramine worsens performance in alcohol combination.</td>
</tr>
<tr>
<td>Landauer &amp; Milner (1971)</td>
<td>No interaction between alcohol and antihistamines; antihistamines alone did not sig. reduce performance.</td>
</tr>
<tr>
<td>Linnoila (1973)</td>
<td>Meclastine showed additive effects on psychomotor performance when combined with alcohol; even more marked interaction was seen in alcohol/diphenhydramine combination.</td>
</tr>
<tr>
<td>Milner and Landauer; Chiles (in Landauer &amp; Milner, 1971)</td>
<td>Reported that phenothiazines and diphenhydramine have been known to potentiate the sedative effects of alcohol on driving skills. Chlorpheniramine also is known to reduce performance with alcohol.</td>
</tr>
<tr>
<td>Hughes and Forney (1964)</td>
<td>Diphenhydramine worsened performance in combination with alcohol on some tests.</td>
</tr>
</tbody>
</table>
Duration: The product feature which seemed to best represent importance to the consumer, in terms of duration, was the number of times that the product needed to be taken on a daily basis. The possible levels for duration were suggested by an examination of Facts of Comparisons (1986). Products contained within this reference were generally recommended to be dosed two, three or four times per day. However, one non-sedating antihistamine product, astemizole, which may be approved for use in the U.S. market, has a half-life of 104 hours, and is dosed only once daily. Because of the potential of this product for national availability, as well as the increased emphasis by manufacturers on sustained-release formulations, it was decided to choose a once-a-day level even though no product currently carries such dosing recommendations.

Thus, three levels were chosen for duration: 1) four times daily; 2) two times daily; and 4) once a day. Dosing of three times daily was felt to be adequately captured within this range, even though it was not included.

Dryness: This adverse effect, although included as a category, has a relatively low incidence of occurrence. In one study the following incidences were subject-reported, on the basis of over 2,000 individuals studied: placebo (2.2%), terfenadine (2.6%), dexchlor. (2.7%), chlor. (4.5%), clemastine (4.6%) (Barlow et al., 1982). Sorkin and Heel (1985) reported incidence values of: terfenadine (2 to 5%), placebo (4%), and other antihistamines (3 to 8%).
For the purposes of this study dichotomous levels of "yes" and "no" were chosen to describe the category of whether a product caused some temporary dryness of the nose, mouth and eyes. In reality, however, application of the "yes" level to represent a particular product would have to be carefully considered, because the incidences of dryness are so low.

Selection of Instrumentation Technique

Previous studies of contingent valuation had used personal interviews more often than any other technique for data collection (see Chapter II, "Review of the Literature"). However, despite some problems noted, the mail questionnaire has been used in several applications of the technique.

It was decided to use a mail questionnaire technique in this study for three reasons. First, as in the recreational diver study (Roberts et al., 1985), intercept interviews would be extremely difficult and time-consuming if the goal of the study was to screen allergy sufferers. This was of major importance because it was estimated that 20% or fewer subjects, in the general public, would have allergic rhinitis. Thus, four of every five subjects screened would be of no use in data analysis for the testing of hypotheses.

Secondly, existing populations where allergy sufferers are highly concentrated, would, if used, introduce some potential bias problems. One alternative considered for a personal interview technique was a medical clinic department for allergy sufferers. This plan was rejected, however, because it seemed likely that the sample would be biased
in favor of physician-treated, prescription-product users. Further, the sample was likely to consist of more serious allergy cases and a more narrow range of product use (because only a few physicians would treat patients in such a clinic) than would be the case if the sample was chosen from other populations.

Third, the study of a mail questionnaire application in contingent valuation provides a means of examining the use of this type of instrument for future studies. Dillman (1978) provides a strong argument for the benefits of mail and telephone surveys from the standpoint of external validity and interviewer bias. Thus, application of the mail survey in this study provides a means of assessing the limits of alternatives to the personal interview in contingent valuation research. Studying use of the mail questionnaire, alone, should provide some contribution to the field of explicit utility valuation research.

Development of First Questionnaire

The beginning of this chapter dealt with a discussion of the various dimensions used as a basis for variable selection in this study. In this section it will be shown how these dimensions were operationalized into items included in the first questionnaire.

Once the specific categories and levels had been defined for attitudinal-utility and contingent valuations, the next task was the development of the questionnaire for a pilot group of allergy sufferers. The questionnaire format was designed to include seven major sections: 1) History of Allergy Disease; 2) Estimated Cost of Treating Allergy Symptoms; 3) Contingent Valuation for Avoidance of the Disease
State of Allergic Rhinitis; 4) Importance Ratings for Product Categories; 5) Utility Ratings for Product Attribute Levels; 6) Utility and Contingent Ratings for Full-Profile Combinations of Levels and 7) Demographic Characteristics.

Initial questionnaire development became an iterative process of construction of descriptions and questions within this seven section format, review by other experts, and subsequent revision. Two drafts, in sequence, were submitted to four reviewers who were familiar with utility assessment, contingent valuation and basic questionnaire design. Reviewers suggested a number of changes in detail after each draft was reviewed. The third draft took into consideration all these changes and was the one which was submitted to the pilot group (see Appendix C). Specific items included within the pilot test questionnaire are described below, according to each of the seven sections of the questionnaire.

History of Allergy Disease: This section was entitled "Section I - Allergy," in the pilot test questionnaire. In the first question respondents were asked an open-ended question regarding substances to which they might have been allergic. This was included for the sake of introducing the topic of allergy and was designed to encourage subjects to begin responding by use of an interesting and easy-to-answer opening question, as suggested by Dillman (1978). The second question served as an initial screen of allergy by asking subjects to indicate whether they had experienced allergy symptoms in the previous six months. A six month time frame was chosen because it would have captured, by the
time of the final questionnaire mailing, the grass pollen season of the summer months. It was initially suggested that subjects be asked to telescope as far back as one year, to include the tree allergy season. However, it was thought that a six month recall would be as long as could safely be remembered by subjects. Therefore, only subjects who circled "YES" to having experienced one case of allergy during the past six months, were operationally considered be allergy sufferers. Individuals who circled "NO" were told to go directly to the demographics section at the end of the questionnaire. Other than demographics, no other information was studied for non-sufferers of allergy.

The second screening question asked subjects to indicate the bodily site of allergy symptom occurrence for the six month time frame. This question was used as a final screen of those allergy sufferers who had failed to have symptoms at sites indicative of allergic rhinitis. Thus, allergy sufferers who failed to circle bodily sites of eye, ears, nose and throat, were considered, operationally, not to have allergic rhinitis. These subjects were told to go directly to the demographics section; no other information was analyzed for allergy sufferers who did not, operationally, report allergic rhinitis symptoms.

For those allergic rhinitis sufferers who cleared the two screening questions, other questions were asked regarding the following areas: 1) severity of allergy symptoms; 2) seasonal nature of the disease; 24

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23 The six month period included the months of June through November or early December of 1986, depending on when the questionnaire was received; the summer was characterized by particularly high pollen counts in central Ohio.

24 Ricketti (1985) and other medical writers choose to define two types of allergic rhinitis, which are identified by the cyclical nature of
3) whether subjects are currently under a physician's care for the disease; and 4) specific medications that subjects used to treat their allergy or allergies.

**Estimated Cost of Treating Allergy Symptoms:** In this section subjects were asked to list perceived costs associated with treating their allergic rhinitis during the past six months. Various items, such as medication and physician visits, were listed as possible expense categories. However, four categories were left open for subjects to fill in if any other cost categories were not included in the list. Subjects were asked to sum the column of expenses listed, and were also asked to indicate the percentages of each expense category that were paid by the subject, and percentages paid by insurance.

**Contingent Valuation to Avoid the Disease State of Allergic Rhinitis:** This section was simply described in the questionnaire as "Section III - Willingness to Pay (WTP)." Subjects were given a description of those factors which might have an impact in a valuation decision regarding the allergic rhinitis disease itself. Subjects were then queried as to their contingent valuation to avoid all symptoms of allergic rhinitis for a six month time period, like the period for which subjects were previously asked to recall. An open-ended response request, similar to that used in the Thompson et al. (1984) study, was employed. For the purpose of determining changes in CV response for different levels of allergic rhinitis health status, subjects were asked similar questions for contingent conditions of allergy severity that were described as "twice as bad" and "half as bad" as those truly symptoms experienced: seasonal and perennial allergic rhinitis.
experienced during the same six month period. As a reliability check on family income, subjects were asked to frame their valuation response to one of the questions also in terms of the number of hours to be worked at their job to earn the contingent amount.

**Importance Ratings for Product Categories:** This section, entitled "Section IV - Antihistamine Features," explained the concept of the feature category to respondents and asked them to rate each of the seven categories on a seven-point, unipolar Likert scale of importance. This section was included for use in derivation of an expression of the two-step self-explicated model for each respondent.\(^{25}\)

**Utility Ratings for Product Attribute Levels:** This section is entitled, "Section V - Examples of Antihistamine Features." Each of the eighteen levels, grouped according to their respective categories, were listed in this section of the questionnaire. The concept of attribute levels was explained to respondents. Subjects were then asked to rate each level on a nine-point, bipolar Likert scale of desirability (attitude-utility). To maintain ease-of-response, levels were arranged within each category description such that progressive changes were uni-directional.

**Utility and Contingent Ratings for Full-Profile Combinations of Levels:** This was designated, "Section VI - Full Profile Evaluation," in the questionnaire. The hypothetical market was described in this section as being represented by a number of product profiles containing

\(^{25}\) This expression can be found in Equation 2, Chapter I, "Introduction to the Study."
various levels of each category. In all, 19 product profiles were presented. Subjects were asked, through open-ended questions, to give their perceived contingent valuation for the right to have been able to use each of the products for the last six months. In response to the same profiles, respondents were told to rate each product on the same desirability scale used in the individual attribute level section.

Green (1974) has described and suggested the use of orthogonal factorial designs as a means of determining main effects of individual factors in conjoint analysis. An asymmetric orthogonal array was used to create 16 of the 19 full-product profiles; the remaining three products were designated as hold-outs, and were described to represent three commonly-used antihistamines. The specific orthogonal design used in this study was formulated according to a basic plan suggested by Addelman (1962), and is presented in Table 8. The specific products, referenced in the table, correspond to the product names used in both pilot and final questionnaires. The numerical values used to describe levels, in the table, correspond in an ascending direction, to the manner in which the levels were presented in Section V of the questionnaire.

The holdout products were placed at various points in the sequence of product descriptions. Specifically, Holdout Product "Chlorpheniramine 8 mg.," was represented by Product B. Holdout Product "Seldane 60 mg.," was designated as Product I. Finally, Holdout Product "Benadryl 25 mg.," was represented by full-profile product 0.
Table 8

ORTHOGONAL DESIGN USED FOR FULL PRODUCT PROFILES

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>DROWSINESS</th>
<th>DURATION</th>
<th>ONSET</th>
<th>INTERACTION</th>
<th>RX</th>
<th>DRYNESS</th>
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<tr>
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<td>1</td>
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</tbody>
</table>

Holdout products are coded as (2, 2, 3, 1, 2, 1, 1), (1, 2, 2, 2, 1, 2, 2) and (4, 3, 3, 1, 2, 1, 1) for Products B, I and O respectively.
Demographic Characteristics: Because demographic questions were to be limited to the minimal number required, only five were asked. The questions were designed to measure: 1) Gender; 2) Age; 3) Number of years employed at the University; 4) Presence of existing asthma; and 5) Gross family income. The asthma question was asked, because a previous study had suggested a high correlation between asthma and allergic rhinitis (Opinion Research Corp., 1984). Respondents in the pilot study were not asked to answer the demographic questions, however. Because confidentiality was not possible, it was decided to ask respondents to comment on the difficulty of answering these questions, but not to answer them directly.

Two other questions were penciled onto the final page of the questionnaire. Subjects were asked to comment on any problems that they might have had with the survey. Secondly, in order to assess the time investment required of subjects, pilot test respondents were asked to report how long they thought it would take someone to fill out the questionnaire.

Pilot Test
Six of the original allergy sufferer panel members agreed again to participate in the study, and returned pilot test questionnaires. In addition, six respondents who were customers of a local community pharmacy, were successfully screened for allergic rhinitis by a pharmacist, and recruited into the pilot test. Ideally, it would have been better to use respondents from the University population for the pilot study. However, the number of persons who would need to have been screened
(assuming a 50% response), to achieve 12 returned questionnaires, would have been in excess of 100 persons. Thus, it was hoped that the 12 individuals actually chosen for the pilot study would be sufficiently diverse, capable and motivated to identify those potential problems which a University sample might otherwise have found. Comments made by pilot study respondents are summarized in Table 9.

The major problems identified are briefly discussed:

1. **Subjects may not correctly be able to transfer the WTP amount from Q-2, page 4 to page 9.** This would result in some uncertainty in analysis insofar as the reference WTP would not be clearly known. However this was found to be very difficult to change. The sequence of questions was carefully planned to ease difficulty of response. A change in the sequence of sections was not deemed sufficient to justify the need for reducing this ambiguity.

2. **A subject may not notice or might be confused by the percentage categories for Q-8 in the COI section.** This was believed to be more of a problem with the specific sample chosen than with the question. According to Rupp (1986), who has done some work in this area, the percentage categories were believed to be adequate for the both types of health insurance plans available to full-time employees of the University.

3. **"Found it hard to pick a certain amount of money."** This may be a problem of responding to an open-ended question. However, it may instead be a problem of the hypothetical market. In any case, this is a problem probably due to the CV methodology, and thus, cannot be addressed without changing the study methodology.

4. **Took too long to complete.** This, unfortunately is unavoidable, given the nature of the orthogonal factorial design. However, other researchers (Akaah & Korgaonkar, 1983; Rosko, DeVita, McKenna & Walker, 1985) have used a similar number of profiles, yet have not identified this to be a problem.

5. **"Writing is too small."** Dillman has studied print size in questionnaires, and has reported that print of this reduced size should be adequate.

6. **Would assign a lower value of CV for a product unable to be "tested."** This is a function of the ex ante nature of the CV technique. This cannot be fixed in the study without adding contingent ex ante scenarios. This would entail a in-depth study of decision-making that is beyond the scope of the mail questionnaire.
Table 9
PILOT TEST RESPONDENT COMMENTS AND NOTES

<table>
<thead>
<tr>
<th>RESPONDENT</th>
<th>COMMENTS/NOTES*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergy Panelist #1</td>
<td>No problems identified by subject; did not correctly transfer correct $ amount from page 4 to page 9.; 1 hour to complete.</td>
</tr>
<tr>
<td>Allergy Panelist #2</td>
<td>No problems identified by subject; response for Q-8. &quot;% paid by you&quot; was answered as an absolute dollar amount; 1 hour to complete.</td>
</tr>
<tr>
<td>Allergy Panelist #3</td>
<td>No problems identified by respondent; 10 to 15 minutes to complete.</td>
</tr>
<tr>
<td>Allergy Panelist #4</td>
<td>No problems identified; 15 minutes to complete.</td>
</tr>
<tr>
<td>Allergy Panelist #5</td>
<td>&quot;Actually my allergy to ragweed is so uncomfortable that I would pay almost any amount for relief. I found it hard to pick a certain amount of money. I would on second though pay more than I had found in the booklet;&quot; 1 hour to complete.</td>
</tr>
<tr>
<td>Allergy Panelist #6</td>
<td>Complained that took a long time to complete; 1 hour to complete.</td>
</tr>
<tr>
<td>Pharmacy Shopper #1</td>
<td>&quot;The writing is a little small;&quot; Wants a usage period for full-profile valuation for &quot;one box&quot; of product; 35 minutes to complete.</td>
</tr>
<tr>
<td>Pharmacy Shopper #2</td>
<td>No problems identified; 45 minutes to complete.</td>
</tr>
<tr>
<td>Pharmacy Shopper #3</td>
<td>Subject said that would pay more for a product if she found it worked after she stated her initial WTP; 20 minutes to complete.</td>
</tr>
<tr>
<td>Pharmacy Shopper #4</td>
<td>Qualified number of hours worked in Section III as being within 28% tax bracket; Apparently liked one of the hypothetical products and wanted to know if it actually existed; 45 minutes to complete.</td>
</tr>
<tr>
<td>Pharmacy Shopper #5</td>
<td>No problems reported; 30 minutes to complete.</td>
</tr>
</tbody>
</table>
| Pharmacy Shopper #6         | "Too hypothetical and I tried to follow my logic in reasoning for justifying my answer. The
many choices became confusing - so I just guessed on the basis of relief, dryness and drowsiness;" Total cost reported in Q-8. summed incorrectly; 30 minutes to complete.

*The review of each respondent's completed questionnaire is unremarkable, and is assumed to be unproblematic except when noted in this column.

7. **Tax effect.** This could be corrected to some extent by emphasizing the before-tax meaning of the questions.

8. "Too hypothetical." Again, a potential problem of the contingent valuation technique. However, the products offered are types of ones with which most subjects are familiar in the marketplace. This should be an advantage over CV studies of non-marketed goods (Randall, 1986).

9. **COI was added incorrectly to obtain a sum.** This was also a problem observed in a study of pharmacists, who were asked to sum some income statement figures (Pathak, 1985). This was felt to be difficult to avoid, but could introduce some problems for analysis.

**Development of Second Questionnaire**

The final questionnaire used in this study is reproduced in Appendix D.

**Changes in Questionnaire Format**

As a result of the pilot test, very few changes were identified that required some alteration for the final questionnaire. Most of the actual changes that were made for the study instrument were done so at the suggestion of the four reviewers, who seemed to have a wealth of never-ending suggestions for change. Several changes, although minor, were made for the final questionnaire:

1. The emblem on the cover of the questionnaire was changed from the University emblem to the College of Pharmacy seal. This was done
to better identify the study sponsors, and to serve as a more novel illustration.

2. The responses to the four questions in Section III were made into uppercase characters, to add consistency to Dillman's (1978) technique of having questions in lower case, and responses in upper case characters.

3. The product category names in Section VI were made into upper case characters, for better emphasis.

4. Page and question number identification of the reference WTP value was underscored on page 9 as an aid in clarifying the value referenced.

5. The contingent response for each profile included the additional description of "FOR SIX MONTHS USE," to minimize ambiguity about the usage conditions.

6. On page 15, the College of Pharmacy emblem was removed, because reviewers felt that the existing layout suggested that the questionnaire ended at this point.

7. The demographics section was changed considerably, to better reflect variables needed for analysis of attribute relationships.
   a. "Number of years employed at OSU" was removed. This was of no apparent value for analysis.
   b. "Level of education was added" to determine whether educational background was related to item response and consistency.
   c. "Health Insurance Plans" was added to determine whether a relationship existed between the specific health plan and contingent valuation responses.
   d. "Time required to complete questionnaire" was added, because it appeared, from the pilot test, that individuals who spent more time responding, had more "consistent" answers.

8. To give the questionnaire a more professional texture and appearance, the outer cover was changed from white paper to gray card.
Physical Characteristics of the Final Questionnaire

Efforts were made to follow Dillman's (1978) Total Design Method (TDM) whenever possible. However, strict adherence to the Method was not found to be wise in many cases.

The final questionnaire consisted of twenty pages of print, from front to back. Each of the original pages was reduced from 8.5" x 11" format, at 78% reduction, to fit onto half-lengths of 8.5" x 14" sheets. Using this technique, 4 original pages were reduced to fit onto the front and back of single sheets of 8.5" x 14" paper. Thus, the twenty original pages were reduced to create five, double-sided sheets of 8.5" x 14" paper. This allowed the pages to be collated in such a way that the sheets could be stacked and folded once to reveal a booklet format.

The inner four sheets of 8.5" x 14" paper consisted of 20 lb. mimeo stock. Dillman (1978) recommends a heavier, 16 lb. paper, but this was not available in this size. The outer cover consisted of gray card measuring 8.5" x 14". The five sheets forming the booklet were simply folded, and stapled twice. Placing the return address on the outside cover, and including a sealing sticker, was sufficient to require that the respondent simply seal and drop the questionnaire into Campus mail. Despite Dillman's recommendation to have all questionnaires printed, it was found that sufficient experimentation with the A.B. Dick #369 offset machine produced output of a quality similar to that of a good Xerox copy.
DATA COLLECTION

Sampling

The target population of interest was discussed at length in Chapter I, "Introduction to the Study." The target population was defined as all faculty and staff members at the Ohio State University who suffer from allergic rhinitis. This target population was restricted to an experimentally-accessible population of full-time regularly-employed faculty and staff members, as defined by the University Office of Personnel Services. Further, the experimentally-accessible population was restricted to employees primarily connected with the Columbus campus. It was decided to take a simple random sample of the experimentally-accessible population in order to test the hypotheses.

Because the primary goal of this study was to measure the magnitude of correlation coefficients between the utility scores and contingent valuations for the product profiles (Hypothesis One), this was used as one of the bases for determining sample size. Akaah and Korgaonkar (1983) measured the correlations between model predictions and observed product utility ratings for each of the five utility models used in this study. They found mean correlation values ranging from .2383 to .9702. The necessary sample sizes needed to find each of these correlation values as being significantly greater than zero was calculated. Thus, using the statistical test for Hypothesis One, the following expression for sample size was derived:

\[
 n = \frac{t_{a/m}^2 \times s^2}{\bar{x}_r}
\]
Because correlation coefficients were transformed to Fisher Z-values, the significant value of $\bar{x}_r = .2383$ becomes Fisher's $Z = .2427$. Likewise, the upper value of $\bar{x}_r = .9702$ is equivalent to Fisher's $Z = 2.0923$. For the transformed values, the best estimate of $s = 1$, because the distribution of Fisher's $Z$ is normalized. The $\alpha$-value was set at .05, and as defined in Hypothesis One, $m = 15$. Substituting, we find for $\bar{x}_r = .2383$,

$$n = \frac{(t_{0.00333})^2}{1} \frac{1}{(0.2427)^2}$$

(8)

An assumption was made that $n$ would be sufficiently large such that $t$ would approximate a $Z$ distribution. Thus, $t^2$ becomes $(2.72)^2$, and we have:

$$n = 125.6.$$  

(9)

For $X_r = .9702$ the same equation was used, except the square of 2.0923 was substituted in the denominator. For this upper value, the required sample size was only $n = 1.7$. Because it was estimated (Opinion Research Corp., 1984) that the percentage of subjects having allergic rhinitis is only 18% of the total population, the required allergic rhinitis sufferer sample sizes found above were divided by 0.18 to find $n = 700$ and $9.4$ unscreened sample units needed, from the University population at large, for the lower and upper correlation values, respectively.

As a further test of the required sample size needed for this study, it was decided that the percentage estimate of allergic rhinitis
sufferers found in this study should be obtained within 20% above or below the true value, at 95% probability. Because the best estimate of the true percentage of allergic rhinitis sufferers in the population is 18% (OPR, 1984), ± 20% error translated to .18 ± .036. The required sample size was calculated as follows:

\[ n = \frac{t_{\alpha/2}^2 \cdot p \cdot q}{d^2} \]  

Substituting into this equation, we have:

\[ n = \frac{(1.96)^2 \cdot .18 \cdot .82}{(.036)^2} \]  

Thus, we find \( n = 437.51 \). This would, of course, be the required \( n \) of an unscreened sample of the University population at large.

The largest, and therefore most conservative of the three estimates above, \( n = 700 \) for an unscreened sample of subjects, was then used as the chosen value for actual sample size selection. The determination of sample size needed for the final mailing is shown in Table 10.

The experimentally-accessible population was estimated by the Office of Personnel Services as approximately 15,000 employees. Although the actual mailing sample constitutes about 13% of the population, no large sample adjustment was made in the statistics used in this study.

The Office of Personnel Services used a SAS program to generate a frame and mailing labels, for a simple random sample of these 15,000 employees. No particular group of subjects that could be stratified by
Table 10

SAMPLE SIZE FOR MAILING

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sample size of allergy sufferers needed to show ( \bar{x} \geq 0.2383 ) as significant value</td>
<td>126</td>
</tr>
<tr>
<td>2. Sample size needed from experimentally-accessible population {assuming 18% of population are allergy sufferers (Opinion Research Corp., 1984)}</td>
<td>700</td>
</tr>
<tr>
<td>3. Assuming 40% response rate</td>
<td>1,750</td>
</tr>
<tr>
<td>4. Assuming 5% frame error; Mailing required</td>
<td>1,842</td>
</tr>
<tr>
<td>5. Actual Mailing</td>
<td>2,000</td>
</tr>
</tbody>
</table>

the Office of Personnel Services was of use for this study. Therefore, stratification was not performed.

**Questionnaire Administration**

Application was made to, and permission was granted by the Human Subjects Review Committee of the University to administer the questionnaire to the University sample. In addition, the requirement for written informal consent was waived by the committee. The administration of the final questionnaire is described in terms of three areas: 1) Initial mailing; 2) Follow-up; and 3) Coding of Data.

---

26 A copy of the waiver is shown in Appendix C, "Action of the Review Committee."
Initial Mailing

The cover letter which accompanied the questionnaire is reproduced in Appendix D. The cover letter was offset on the A.B. Dick #369 using bonded College of Pharmacy letterhead stock to produce a professional appearance. However, each letter was not personalized with the name of the respondent nor with a hand-written signature, as Dillman (1978) recommends. Instead, a hand-written or stenciled note of the single word "Thanks" was affixed to the cover of each questionnaire.

Dillman (1978) discusses the use of a token gift to accompany a questionnaire. The logic behind this technique is that the presentation of such a gift may instill a feeling of trust with the respondent, who feels obligated to respond as a means of returning the favor. In this study, every respondent received a ball-point pen gift along with the questionnaire, cover letter, sticking seal, and thank-you note. Also, it was hoped that the inclusion of the pen would also stimulate subjects to respond because all of the materials necessary for completion and return mailing were contained within the packet mailed to them.

Every questionnaire was stamped with individual identification code numbers. These were cross-referenced with Xeroxed pages of the mailing labels. The reasons for the code number were made clear to respondents in the cover letter. Fortunately, only one person returned a questionnaire in which the code number was intentionally removed.

The University Department of Personnel Services provided two identical sets of randomly-generated mailing labels. Surprisingly, two of the sampled respondents were committee
the covers of 7.5" x 10.5" envelopes. Each of the 2,000 labeled envelopes was marked with a stamped return address, was sorted, and was mailed through the free Campus mail system of the University. It appeared that delivery was made within two working days, in most cases examined.

Follow-up
Approximately two weeks after mailing, reminder postcards were sent to each respondent. The postcards were offset onto 8.5" x 11" gray card (four to a card), and were cut and labeled with addresses. Like the questionnaire, no stamp was necessary, except for the 75 off-campus addresses, which were sent metered U.S. mail.

Questionnaire Response
Response parameters are shown in Table 11. The overall response rate was 45.75% of the 2,000 questionnaires mailed. Of the 915 respondents, 27.21% were identified, by responses to Q-1 to Q-5 of the questionnaire, as being probable allergic rhinitis sufferers. This is in excess of the 18% allergic rhinitis sufferer rate found in a national study by Opinion Research Corp. (1984).

members of this study.

28 However, approximately 75 of these needed to be processed through the U.S. Postal System, as well, because of off-campus addresses.

29 A reproduction of the postcard is shown in Appendix D, "Reminder Postcard."
Table 11

QUESTIONNAIRE RESPONSE PARAMETERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Actual Mailing</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>2. Number of questionnaires (with responses) returned</td>
<td>915</td>
<td>45.75%</td>
</tr>
<tr>
<td>3. Number of questionnaires (with no responses) returned</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>4. Number of questionnaires designated as undeliverable</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>5. Number of subjects identified as allergic rhinitis sufferers</td>
<td>249</td>
<td>27.21%</td>
</tr>
</tbody>
</table>
The median number of days, between mailing and return of the questionnaire (turnaround period), was identified for allergic rhinitis sufferers as being eight days. Allergic rhinitis sufferers were classified as "early" respondents if the turnaround period was eight days or less, and as "late" respondents, otherwise. As a check on possible non-return bias, responses to several health status and demographic variables were compared between "late" (who were hypothesized to represent non-returners) and "early" respondents. No statistically significant differences were found for responses between turnaround groups, for any of the demographic or health status variables. The statistics used, and the results found in this analysis are shown in detail in Appendix E.

Coding of Data

Returned questionnaires were stamped with the date of return, for use in analysis of non-response bias. This date, the respondent identification number and the question responses were coded and entered in a data files on the College of Pharmacy system. Comments written into the margins or the open page of the questionnaire (p. 17) were not included in coding or analysis for the computer, but are discussed in Chapter V, "Conclusions." Responses to the open-ended questions of Q-1, Q-7 and Q-78 were translated by the coder and were described in the data file by a small number of nominal values assigned to each of these three questions.
Assessment of Reliability

Reliability of the instrument used in this study was analyzed in three ways. First, in order to test the reliability of the data employed in deriving regression equations for utility and contingent valuation association, three hold-out product profiles were included. Thus, unreliability in either the utility scales, or in the orthogonal profile scales used to calibrate the regression model, would be likely to produce a low correlation when the model was used to predict hold-out valuations. Thus, Hypotheses Four and Five serve as a test of this reliability.

Secondly, the reliability of responses to the contingent valuation questions for complete avoidance of allergic rhinitis was tested. This test consisted of analyzing the correlation coefficients between responses to the three contingent valuation questions in this section. Presumably, a high valuation on one item would be associated with high valuations of the other two items, if responses were reliable. Analysis of this reliability is shown in Chapter IV, "Analysis of Data and Results."

Thirdly, internal consistency was checked on the importance scale of the seven attribute categories. Cronbach's Alpha was used to measure the reliability for this dimension of importance.
Assessment of Bias

In Chapter II, "Review of the Literature," several sources of possible bias were listed for both contingent valuation methodology and the use of the mail questionnaire as an instrumentation technique. Potential sources of bias, which may affect interpretation of the results of this study, were addressed, and are discussed at length in Chapter V, "Conclusions."

STATEMENT OF HYPOTHESES

The hypotheses to be tested were discussed briefly in Chapter I, "Introduction to the Study." Each of the five hypotheses are restated in this section. The statistical analyses used to test each hypothesis are also discussed in this section.

Hypothesis One

The hypothesis to be tested is stated in research form as:

There is a positive relationship between each of the following measures of utility and the contingent valuation measures for the set of orthogonal product profiles:

a. Unweighted self-explicated utility scores.
b. Weighted self-explicated utility scores.
c. Additive Huber-hybrid utility scores.
d. Addilog Huber-hybrid utility scores.
e. Multiplicative Huber-hybrid utility scores.

Contingent valuation research has suggested that attitudinal utility measures, being ex ante measures like contingent valuation, should be positively related to contingent values (Randall, 1983). Utility scores were calculated for each the 16 orthogonal product profiles, for
Five sets of utility scores were thus obtained per usable questionnaire, one set for each of the five utility models. The contingent valuation ratings for the same 16 product profiles were also used to create a set of observations. Thus, for every usable questionnaire, the data matrices of interest can be described as in Table 12.

**Table 12**

**DATA MATRICES FOR ORTHOGONAL DESIGN**

\[ U = \begin{bmatrix}
U_{11} & U_{12} & U_{13} & U_{14} & U_{15} \\
U_{21} & U_{22} & U_{23} & U_{24} & U_{25} \\
U_{31} & U_{32} & U_{33} & U_{34} & U_{35} \\
U_{41} & U_{42} & U_{43} & U_{44} & U_{45} \\
U_{51} & U_{52} & U_{53} & U_{54} & U_{55}
\end{bmatrix} \quad C = \begin{bmatrix}
C_1 \\
C_2 \\
C_3 \\
C_4 \\
C_5 \\
C_x
\end{bmatrix} \]

\[ U_{xy} = \text{utility score for product } x, \text{ model } y; \quad C_x = \text{contingent valuation for product } x; \quad (x = 1, \ldots, 16; \ y = 1, \ldots, 5). \]

The research hypothesis was addressed by studying the relationship of each column of Matrix U in Table 12 with Vector C. Ordinary Least Squares was used to obtain the five correlation coefficients per usable

30 Utility scores for models "a" and "b" in the research hypothesis were calculated deterministically. However, a stochastic solution had to be found to derive utility scores from models "c", "d" and "e". Using Akaah and Korgaonkar's (1983) methodology, multiple regression analysis was used to obtain predicted utility scores for each product profile.
questionnaire. To test for the presence of a positive relationship in each of the five comparisons, for the sample as a whole, the positive magnitude of the mean correlation of each of the five utility models with the dependent contingent valuation was evaluated. In statistical form, the hypothesis is stated as:

\[ H_0: \mu_{\rho i} = 0 \quad (i = 1, \ldots, 5) \]

\[ H_A: \mu_{\rho i} > 0 \quad (i = 1, \ldots, 5) \]

where \( \mu_{\rho} = \begin{bmatrix} \mu_{\rho 1} \\ \mu_{\rho 2} \\ \mu_{\rho 3} \\ \mu_{\rho 4} \\ \mu_{\rho 5} \end{bmatrix} \)

The distribution of the parent population of correlation values may be skewed if \( \mu_{\rho i} \neq 0 \) (Hopkins & Glass, 1978). Rather than making an a posteriori assessment of the departure from this normality assumption, it was decided to transform the data to an approximation of normality, prior to analysis, because the distribution of correlation values has been well-specified by Fisher. Fisher's Z was used to transform values of \( r \) for hypothesis testing; the inverse of this function was used to transform the calculated confidence intervals from Fisher Z's to \( r \) values.

The Bonferroni test for simultaneous comparison of means (Johnson and Wichern, 1982) was used to test the hypothesis. This test was used
in place of Hotelling's $T^2$ because the total number of comparisons planned and made in the mean vector, $\mu_p$, was small enough to yield shorter confidence intervals using Bonferroni than would $T^2$. The equa-tional form of the confidence intervals obtained is shown in Table 13.

Table 13

CONFIDENCE INTERVAL FOR HYPOTHESIS ONE

\[ z_i > \bar{x}_{zi} - t_{n-1,\alpha/m} \sqrt{\frac{s_{ii}}{n}} \]

where $\bar{x}_{zi} =$ Mean value of Fisher Z transformations of individual subject correlation coefficients ($i = 1,...,5$).

$n =$ Number of usable questionnaires

$m =$ Number of comparisons made within the vector of means.

$s_{ii} =$ Variance of individual subject Fisher Z's

$t_{n-1,\alpha/m} =$ Bonferroni description of upper end of (100$\alpha$) percentile of $t_{n-1}$ distribution.

Experimentwise error was held to a value of $\alpha \leq .05$. Because both Hypotheses One and Two make comparisons of means from the same vector, $\mu_p$, above, it became necessary to adjust the total number of comparisons, $m$, such that $m = 15$, for both hypotheses.31

---

31 Five comparisons were made in Hypothesis One; ten were made in Hypothesis Two.
Hypothesis Two

The research form of this hypothesis was stated as:

The strengths of relationship between utility measures and contingent valuation measures differ between the five models for the set of orthogonal product profiles.

Akaah and Korgaonkar (1983) found significantly greater prediction for Huber-hybrid models than for self-explicated ones, in predicting holdout utility ratings. However, the theoretical foundations for an improvement in prediction by one type of model over another are not strongly based; this relationship has not yet been studied in contingent valuation research. Therefore, unlike Hypothesis One, no direction was stated for the testing of Hypothesis Two.

The same vector tested in Hypothesis One, $\mu_p$, was studied in Hypothesis Two. In this case, all possible pairwise comparisons were made between the means within the vector, rather than with a numeric range of values of $\leq 0$, as was the case in Hypothesis One. The statistical hypothesis is stated as:

$$H_0: \mu_{p_i} - \mu_{p_j} = 0 \quad (i, j = 1, \ldots, 5; i \neq j)$$

$$H_A: \mu_{p_i} - \mu_{p_j} \neq 0$$

where $\mu_p = \begin{bmatrix} \mu_{p1} \\
\mu_{p2} \\
\mu_{p3} \\
\mu_{p4} \\
\mu_{p5} \end{bmatrix}$
All comparisons thus made, were in reality made between dependent samples because each of the five correlation coefficients were drawn from the same individuals. Because comparisons were dependent, covariance between correlation measures had to be included in adjustment for the length of confidence intervals. The equational form of the statistical test for significance is stated in Table 14.

The Bonferroni test was used again in place of $T^2$, for the same reasons cited in the discussion of Hypothesis One. Because Hypothesis Two is an extension of Hypothesis One (Both make comparisons within the same mean vector, $\mu_\rho$), the value for $m$, in Table 14, was set at 15.
Table 14
CONFIDENCE INTERVAL FOR HYPOTHESIS TWO

\[
\mu_{zi} < x_{zi} - x_{zj} + t_{n-1,\alpha/2m} \frac{\sqrt{s_{ii}^2 + 2s_{ij} + s_{jj}^2}}{n}
\]

and

\[
\mu_{zi} > x_{zi} - x_{zj} - t_{n-1,\alpha/2m} \frac{\sqrt{s_{ii}^2 + 2s_{ij} + s_{jj}^2}}{n}
\]

where

- \( x_{zi} \) = Mean value of Fisher Z's for individual subject correlation coefficients \((i = 1, \ldots, 5)\).
- \( x_{zj} \) = Mean value of Fisher Z's for individual subject correlation coefficients \((j = 1, \ldots, 5)\).
- \( n \) = Number of usable questionnaires
- \( m \) = Number of comparisons made within the vector of means.
- \( s_{jj}, s_{ii} \) = Variances of individual subject Fisher Z's
- \( s_{ij} \) = Covariance between individual subject Fisher Z's
- \( t_{n-1,\alpha/2m} \) = Bonferroni description of upper and lower ends of \((100\alpha)\) percentile of \( t_{n-1} \) distribution.
Hypothesis Three

This hypothesis was stated in research form as:

There is a relationship between socioeconomic variables, including income, and contingent valuation ratings.

Thompson et al. (1984) studied the relationship of a number of patient attribute variables with contingent valuation to avoid the disease of arthritis. In order to make a comparison of results of the Thompson et al. study with those of this work, many of the attribute variables studied in Hypothesis Three were suggested by the arthritis study. Although a number of contingent valuation ratings were obtained in this study, the contingent valuation of interest in Hypothesis Three is that for avoidance of all symptoms of allergy like those experienced by subjects for six months prior to receipt of the questionnaire. The statistical hypothesis is stated as:

$$H_0: b_1 = 0$$

$$H_A: b_1 \neq 0$$

for the model: $CV$ for avoidance of allergy rhinitis $= b_1 X + b_0$

where $X$ = 1 Allergy Severity

2 Cyclicality of Symptoms

3 Cost-of-Illness

4 Sex

5 Age

6 Asthma

7 Income

8 Education

9 Highest CV Bid for a Product Profile
Nine models were constructed: one for each of the independent variables, \( X \). Ordinary Least Squares was used to derive measures of the regression equation slopes, \( b_i \), for each of the independent variables, \( X \). For allergy severity, cost-of-illness, age and highest CV bid, interval scaling was presumed and the statistical model was one of simple linear regression (\( i = 1 \)). The remaining variables were assumed to be of ordinal or nominal character and were therefore fit into the regression model by dummy-coding (\( i \geq 1 \), depending on the number of levels of the variable).

The purpose of this hypothesis was to explore the relationships of individual attributes with the dependent variable of contingent valuation. Because high multicollinearity is likely to exist between many of the variables, construction of a multiple regression model would require an examination of the inter-relationships between attributes, in explanation of the dependent variable. This is of interest for future analyses of the data, but was felt to be beyond the scope of the present investigation. Thus, Hypothesis Three is merely exploratory; the covariance between attributes was not analyzed. Further, in concert with this exploratory premise, no direction was hypothesized for the slope of the relationships.

An F-test of the coefficients of determination was used for significance testing in each of the nine models examined. This statistic was used because dummy coding of several of the variables produced multiple regression models for these variables. The F-test used is shown in Table 15.
Table 15

TEST OF SIGNIFICANCE FOR HYPOTHESIS THREE

\[ F = \frac{r^2 / k}{(1 - r^2) / \{n - (k + 1)\}} \]

where  
\( r^2 = \) Sample coefficient of determination for each model.
\( n = \) Number of observations.
\( k = \) Number of parameters in each model.

Hypothesis Four

In order to test the strength of the utility models in predicting contingent valuation for products not used to calibrate the models, three hold-out product profiles were included in addition to the sixteen orthogonal product profiles. The research hypothesis is stated as such:

There is a positive relationship between measures of contingent valuation predicted by utility models and actual contingent valuation for the set of hold-out product profiles.

Because three predicted/actual pairs of contingent valuation measures was derived from every usable questionnaire, the product pairs were aggregated for n usable questionnaires to yield a total of n x 3 observations. Because contingent valuations, but not utility scores were compared, the results could be aggregated without the requirement of developing correlation values within individual subjects, as was done
in Hypotheses One and Two. The null form of the statistical hypothesis is:

\[ H_0: \rho_1 = 0 \]

\[ H_A: \rho_1 > 0 \]

where

\[ \rho = \begin{bmatrix} \rho_1 \\ \rho_2 \\ \rho_3 \\ \rho_4 \\ \rho_5 \end{bmatrix} \]

for the model:

\[ CV_{\text{actual}} = b_1 CV_{\text{predicted}} + b_0 \]

This hypothesis was tested for each of the three hold-out product profiles. Thus, we have three sub-hypotheses that comprise Hypothesis Four.

A one-tailed hypothesis was used for the same reasons stated in Hypothesis One; a positive relationship has been suggested by contingent valuation theory. The significance of each of the five correlation values was tested by using Fisher's Z test (Hopkins and Glass, 1978). The critical Z value used to test the significance of the five correlation values was adjusted using Bonferroni. The equational form of the test of significance is shown in Table 16.
Table 16

FISHER'S Z TEST FOR HYPOTHESIS FOUR

\[\text{Obtained } z = \frac{Z_{r}}{1/\sqrt{n-3}}\]

\[\text{Critical } z = Z_{\alpha/m}\]

\(Z_{\alpha/m}\) is a Bonferroni adjustment for the upper end of the \((100\alpha)\) percentile of the \(Z\) distribution \((m = 15, \text{ the total number of comparisons made within the vector, } \rho, \text{ for each hold-out product})\). The units of analysis, \(n\), were the number of usable questionnaires.

Hypothesis Five

This hypothesis is an extension of Hypothesis Four. In research form, Hypothesis Five was stated as:

There is a difference in the strengths of correlation between the five utility models in the prediction of hold-out product profile contingent values.

The research hypothesis is stated in statistical form as:

\(H_0: \rho_i - \rho_j = 0 \quad (i, j = 1, \ldots, 5; i \neq j)\)

\(H_A: \rho_i - \rho_j \neq 0\)

where

\[
\rho = \begin{bmatrix}
\rho_1 \\
\rho_2 \\
\rho_3 \\
\rho_4 \\
\rho_5
\end{bmatrix}
\]

for the model:

\(CV(\text{actual}) = b_1 CV(\text{predicted}) + b_0\)
Again, this hypothesis consisted of three sub-hypotheses, one for each of the three hold-out products. Fisher's Z for pairwise comparisons of dependent samples was used in this case, because covariance became a factor in comparisons between correlation coefficients within the vector \( p \) (Glass, p. 313, 1970). The statistical test for significance is shown in Table 17. A Bonferroni adjustment was again made to control experimentwise error to \( \leq \alpha \).

Table 17

**Fisher's Z Test for Hypothesis Five**

\[
\text{Obtained } z = \frac{\sqrt{n} \ (r_{xy} - r_{xz})}{\sqrt{(1 + r_{xy})^2 + (1 - r_{xz})^2 - 2r_{yz}^3 - \{(2r_{yz} - r_{xy}r_{xz})(1 - r_{xy}^2 - r_{xz}^2 - r_{yz}^2)\}}}
\]

\[
\text{Critical } z = Z_{\alpha/2m}
\]

\( Z_{\alpha/2m} \) is a Bonferroni adjustment for the upper and lower ends of the \((100\alpha)\) percentile of the Z distribution. Although three observations were obtained per questionnaire, \( n \) = the number of questionnaires because these were the units of analysis.
CHAPTER IV

ANALYSIS OF DATA AND RESULTS

The statistical hypotheses discussed in Chapter, III, "Methodology and Design," are restated in this Chapter. Further, the results of the statistical analyses and significance tests are discussed for each of the five hypotheses. A summary of reliability analysis is also included.

COMPUTER RESOURCES

The Statistical Analysis System (1982) was used to assist in data analysis. Packaged statistical procedures (e.g. regression, correlation) were used whenever possible. However, in many cases (e.g. Z-transformations, Cronbach's alpha) test statistics had to be derived through the programming of functional or matrix statements.

MISSING DATA

Analysis of Hypotheses One, Two, Four and Five required that the utility measures for individual product attributes and full product profiles had to be complete -- any missing values would ordinarily necessitate deletion of an entire observation from least squares analysis. Initial inspection of the data revealed several observations that were clearly
unusable. However, quite a few observations would otherwise have been usable, but for nonresponse on one or two utility items. All respondents who were identified as allergic rhinitis sufferers were classified as either unusable or potentially-usable for analysis of the four hypotheses above. The results of this classification are shown in Table 18.

Table 18

CLASSIFICATION OF ALLERGIC RHINITIS SUFFERERS BY ANTIHISTAMINE USE

<table>
<thead>
<tr>
<th>Non-users of antihistamine products</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondents</td>
<td>81</td>
<td>100</td>
</tr>
<tr>
<td>Potentially-usable</td>
<td>56</td>
<td>69</td>
</tr>
<tr>
<td>Unusable</td>
<td>25</td>
<td>31</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Users of antihistamine products</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondents</td>
<td>168</td>
<td>100</td>
</tr>
<tr>
<td>Potentially-usable</td>
<td>143</td>
<td>85</td>
</tr>
<tr>
<td>Unusable</td>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>

Non-users were identified as such if no antihistamine drug products were listed in Q-7 of the questionnaire. Respondents were identified as users if one or more antihistamine drug products (single-entity or combination) were listed in Q-7.

From Table 18 it can be seen that nonusers of antihistamine products had an unusable rate that was twice as high as that of users. This observation may be explained in part by the comments of many nonuser
respondents that such questions were irrelevant to them, because they would never use antihistamine drugs. For these reasons, it was decided to exclude nonusers of antihistamines from analysis of Hypotheses One, Two, Four and Five. This left a total of 143 potentially usable subjects.

In total, 31 utility response items had been left blank by the 143 potentially usable subjects. Because this number of omissions was less than .5% of the total number of responses, it was decided that these missing data could be replaced by imputation. Missing utility values were replaced with mean responses drawn from the potentially usable sample at large. Although such imputation is certainly not ideal for the types of analyses performed in the four hypotheses, it was expected that the effect of this noise on the conclusions would be extremely slight, due to the small number of imputations required. Imputation was restricted to independent variables; no attempt was made to impute any missing values for the dependent measures of contingent values.

HYPOTHESIS ONE

The positive magnitude of each of the five mean correlation coefficients of utility scores, with contingent valuations, was examined.

The statistical hypothesis is stated as:

32 Although exclusion of this group would restrict conclusions that might otherwise be drawn for "potential" users of antihistamine products.
\[ H_0: \mu_{p1} = 0 \quad (i = 1, \ldots, 5) \]
\[ H_A: \mu_{p1} > 0 \quad (i = 1, \ldots, 5) \]

where \( \mu_p = \begin{bmatrix} \mu_{p1} \\ \mu_{p2} \\ \mu_{p3} \\ \mu_{p4} \\ \mu_{p5} \end{bmatrix} \)

As expected, correlation values obtained from individual subjects produced a highly skewed distribution for each utility model. Frequency polygons of the distributions of sample r's are shown in Figure 4. Each frequency polygon shows a distinct negative skewness due to high positive correlations produced by each of the five models.

As planned, the data was transformed to an approximation of normality by converting correlation coefficients, obtained for each observation, to Fisher's Z values.\(^{33}\) The Z-transformed sample distributions showed a remarkable improvement in skewness, although three of the transformed distributions appeared to be somewhat platykurtic. Frequency polygons of the Z-transformed sample distributions are shown in Figure 5.

The mean and covariance matrices of the Z-transformations were obtained for each of the five utility models. These are represented in Table 19. Each of the means of the Z-values were tested for

\[^{33}\text{Where, } Z = .5 \ln \{(1+r)/(1-r)\}. \text{ To avoid confusion between Fisher's Z values and the } z \text{ from a standard normal distribution, Fisher's value will be hereafter designated by a capital } Z, \text{ while the latter will be represented by the lower case } z.\]
UNWEIGHTED SELF-EXPLICATED MODEL

N 143
MEAN 0.559464
STD DEV 0.213514
SKÉWNESS -1.81973
KURTOSIS 5.15849

BAR CHART
0.9+***** 8
.************************** 73
.************************** 37
.****** 16
.** 4
.* 4

-0.5+* 1

* MAY REPRESENT UP TO 2 COUNTS

WEIGHTED SELF-EXPLICATED MODEL

N 143
MEAN 0.573207
STD DEV 0.23566
SKÉWNESS -1.99438
KURTOSIS 6.43684

BAR CHART
0.9+***** 11
.************************** 73
.************************** 35
.****** 14
0.14+** 3
.*** 5
.* 1

-0.7+* 1

* MAY REPRESENT UP TO 2 COUNTS

Figure 4: DISTRIBUTIONS OF SAMPLE R'S FOR EACH UTILITY MODEL
Figure 4 (continued)

**ADDITIVE HUBER-HYBRID MODEL**

\[
\begin{align*}
N &= 143 \\
\text{MEAN} &= 0.745789 \\
\text{STD DEV} &= 0.179545 \\
\text{SKEWNESS} &= -1.87866 \\
\text{KURTOSIS} &= 4.80015
\end{align*}
\]

**STEM LEAF**

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</tr>
</thead>
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<tr>
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<tr>
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<td>10</td>
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<tr>
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<td>5</td>
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<tr>
<td>4</td>
<td>33</td>
<td>2</td>
</tr>
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<td>3</td>
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<td>1</td>
</tr>
<tr>
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<td>0 002</td>
<td>3</td>
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</tbody>
</table>

---|---|---|
MULTIPLY STEM.LEAF BY 10**-01

**ADDILOG HUBER-HYBRID MODEL**

\[
\begin{align*}
N &= 143 \\
\text{MEAN} &= 0.739244 \\
\text{STD DEV} &= 0.178731 \\
\text{SKEWNESS} &= -1.7454 \\
\text{KURTOSIS} &= 4.15358
\end{align*}
\]

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<tr>
<td>7</td>
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<td>4</td>
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<td>3</td>
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<td>3</td>
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<td>2</td>
<td>7</td>
<td>1</td>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>0</td>
<td>007</td>
<td>3</td>
</tr>
</tbody>
</table>

---|---|---|
MULTIPLY STEM.LEAF BY 10**-01
Figure 4 (continued)

MULTIPLICATIVE HUBER-HYBRID MODEL

N 143
MEAN 0.712807
STD DEV 0.18538
SKEWNESS -1.44857
KURTOSIS 2.73843

STEM LEAF

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<td>00000111111122222333334445666777888999999</td>
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<tr>
<td></td>
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<td>006</td>
</tr>
</tbody>
</table>

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MULTIPLY STEM.LEAF BY 10**-01

significance greater than zero by calculating confidence intervals. The resulting five confidence intervals are produced in Table 20. Only a lower bound estimate is provided, because Hypothesis One is a directional test. Additionally, the 95% level of confidence was calculated by using a Bonferroni critical value for \( m = 15 \) comparisons. Thus, the experimentwise error was held to a level of .05 for all comparisons shown in Table 20.

For more practical interpretation of these results, the inverse of the Fisher's transformation (i.e. log values converted back to raw scores), was used to convert the confidence intervals shown in Table 20.
### UNWEIGHTED SELF-EXPLICATED MODEL

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<thead>
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<tbody>
<tr>
<td><strong>N</strong></td>
<td><strong>143</strong></td>
</tr>
<tr>
<td><strong>MEAN</strong></td>
<td><strong>0.676155</strong></td>
</tr>
<tr>
<td><strong>STD DEV</strong></td>
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</tr>
<tr>
<td><strong>SKEWNESS</strong></td>
<td><strong>-0.656414</strong></td>
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<tr>
<td><strong>KURTOSIS</strong></td>
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**STEM LEAF**

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<td>12 0789</td>
</tr>
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<td>10 00236267</td>
</tr>
<tr>
<td>8 000111222344445668899901222333456668</td>
</tr>
<tr>
<td>6 011234444567990000111112255566666777789</td>
</tr>
<tr>
<td>4 001114466778999900144567799999</td>
</tr>
<tr>
<td>2 66902468889</td>
</tr>
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<td>0 8909</td>
</tr>
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<td>-0 8200</td>
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<tr>
<td>-4 6</td>
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**MULTIPLY STEM.LEAF BY 10****-01**

### WEIGHTED SELF-EXPLICATED MODEL

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<tbody>
<tr>
<td><strong>N</strong></td>
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<tr>
<td><strong>MEAN</strong></td>
<td><strong>0.706941</strong></td>
</tr>
<tr>
<td><strong>STD DEV</strong></td>
<td><strong>0.338646</strong></td>
</tr>
<tr>
<td><strong>SKEWNESS</strong></td>
<td><strong>-0.955119</strong></td>
</tr>
<tr>
<td><strong>KURTOSIS</strong></td>
<td><strong>3.10277</strong></td>
</tr>
</tbody>
</table>

**STEM LEAF**

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<thead>
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<tbody>
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<td>16 3</td>
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<td>14</td>
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<td>12 05157</td>
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<tr>
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<tr>
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<tr>
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<td>-2 0</td>
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</tr>
<tr>
<td>-6</td>
</tr>
<tr>
<td>-8 0</td>
</tr>
</tbody>
</table>

---

**MULTIPLY STEM.LEAF BY 10****-01**

---

**Figure 5:** DISTRIBUTIONS OF Z-VALUES FOR EACH UTILITY MODEL
Figure 5 (continued)

**ADDITIVE HUBER-HYBRID MODEL**

N 143
MEAN  1.07107
STD DEV 0.394722
SKEWNESS -0.0461681
KURTOSIS 0.477377

**STEM LEAF**

| 16 | 044686 |
| 14 | 02457990123356 |
| 12 | 00111334469122234567999 |
| 10 | 0012223445667788901111334556788889 |
|  8 | 0122577889123344444589 |
|  6 | 111167112333467888899 |
|  4 | 349345799 |
|  2 | 744 |
|  0 | 002 |

---

MULTIPLY STEM.LEAF BY 10**-01

**ADDILOG HUBER-HYBRID MODEL**

N 143
MEAN  1.05511
STD DEV 0.399186
SKEWNESS 0.227668
KURTOSIS 1.28168

**STEM LEAF**

| 13 | 35 |
| 24 | 9 |
|  2 | 2 |
| 20 | 7 |
| 18 | 227 |
| 16 | 0580 |
| 14 | 04456688901135567 |
| 12 | 000222235556678892445699 |
| 10 | 2335667779990000111233344678899 |
|  8 | 1111135678899000123346667899 |
|  6 | 0022468001124578899 |
|  4 | 179144555 |
|  2 | 744 |
|  0 | 007 |

---

MULTIPLY STEM.LEAF BY 10**-01
to correlation coefficients. The results of this re-transformation are shown in Table 21. The mean vector of correlation coefficients, as represented in the statistical hypothesis, does not contain zero for any of the five models. Thus, at a 95% level of confidence, the null hypothesis for Hypothesis One is rejected. We conclude, with the probability of Type I error = .05, that all of the five models have correlation values greater than zero.

---

34 The formula used was \( r = (e^Z - e^{-Z})/(e^Z + e^{-Z}) \).
### Table 19
**MEAN AND COVARIANCE MATRICES FOR Z-TRANSFORMATIONS**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>N</th>
<th>MEAN</th>
<th>STD DEV</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
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</thead>
<tbody>
<tr>
<td>UNWTD SELF</td>
<td>143</td>
<td>.676155</td>
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<td>-.564048</td>
<td>1.577853</td>
</tr>
<tr>
<td>WTD SELF</td>
<td>143</td>
<td>.706941</td>
<td>.3386457</td>
<td>-.896926</td>
<td>1.625710</td>
</tr>
<tr>
<td>ADDITIVE HH</td>
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<td>1.071068</td>
<td>.3947217</td>
<td>0</td>
<td>2.208601</td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>143</td>
<td>1.055109</td>
<td>.3991855</td>
<td>0</td>
<td>2.587845</td>
</tr>
<tr>
<td>MULTIPL HH</td>
<td>143</td>
<td>.994771</td>
<td>.4066454</td>
<td>0</td>
<td>3.015266</td>
</tr>
</tbody>
</table>

#### COVARIANCE MATRIX

<table>
<thead>
<tr>
<th></th>
<th>UNWTD SELF</th>
<th>WTD SELF</th>
<th>ADDITIVE HH</th>
<th>ADDILOG HH</th>
<th>MULTIPL HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SELF</td>
<td>.0904887</td>
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<td>.0439787</td>
<td>.0442758</td>
<td>.0379832</td>
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<tr>
<td>WTD SELF</td>
<td>.0925662</td>
<td>.114681</td>
<td>.0521214</td>
<td>.0511343</td>
<td>.0442492</td>
</tr>
<tr>
<td>ADDITIVE HH</td>
<td>.0439787</td>
<td>.0521214</td>
<td>.155805</td>
<td>.152732</td>
<td>.151316</td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>.0442758</td>
<td>.0511343</td>
<td>.152732</td>
<td>.159349</td>
<td>.159253</td>
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<tr>
<td>MULTIPL HH</td>
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<td>.0442492</td>
<td>.151316</td>
<td>.159253</td>
<td>.16536</td>
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</table>

### Table 20
**CONFIDENCE INTERVALS FOR MEAN Z-VALUES - HYPOTHESIS ONE**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>LOWER BOUND*</th>
<th>MEAN</th>
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<tbody>
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<td>UNWTD SELF</td>
<td>.607733</td>
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</tr>
<tr>
<td>WTD SELF</td>
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<tr>
<td>ADDITIVE HH</td>
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<td>ADDILOG HH</td>
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<td>MULTIPL HH</td>
<td>.902276</td>
<td>.994771</td>
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</table>

*(95% Level of Confidence for simultaneous intervals.)*
Table 21

CONFIDENCE INTERVALS FOR CORRELATION COEFFICIENTS -
HYPOTHESIS ONE

<table>
<thead>
<tr>
<th>MODEL</th>
<th>LOWER BOUND*</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SELF</td>
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<tr>
<td>MULTIPL HH</td>
<td>.717405</td>
<td>.759389</td>
</tr>
</tbody>
</table>

*(95% Level of Confidence for simultaneous intervals.)*

HYPOTHESIS TWO

As an extension of Hypothesis One, all possible pairwise differences between the mean correlation coefficients, for the five models, were compared. The statistical form of Hypothesis Two is stated as:

\[
H_0: \mu_{p_1} - \mu_{p_j} = 0 \quad (i, j = 1, \ldots, 5; i \neq j)
\]

\[
H_A: \mu_{p_1} - \mu_{p_j} \neq 0
\]

where \( \mu_p = \begin{bmatrix} \mu_{p1} \\ \mu_{p2} \\ \mu_{p3} \\ \mu_{p4} \\ \mu_{p5} \end{bmatrix} \)

Again, each of the individual subject correlation coefficients was converted to Z-values, yielding the same mean and covariance matrix shown
in Table 19. Using the Bonferroni test represented in Table 14, 95% confidence intervals were found for each the ten possible pairwise comparisons of means of Z-values. These results are shown in Table 22. From this table it can be seen that all pairwise differences for means of Z-values were significantly different from zero, with the exception of unweighted/weighted self-explicated model and additive/addilog Huber Hybrid model comparisons. Re-transformation of the lower bounds, differences of means, and upper bounds of the Z-values to correlation coefficients produced the results shown in Table 23.

Table 22

CONFIDENCE INTERVALS FOR Z-VALUES - HYPOTHESIS TWO

<table>
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<th>DIFFERENCE OF MEANS</th>
<th>UPPER BOUND</th>
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<td>-.030786</td>
</tr>
<tr>
<td>use - addtv</td>
<td>*</td>
<td>-.49241</td>
<td>-.39491</td>
</tr>
<tr>
<td>use - addlg</td>
<td>*</td>
<td>-.47735</td>
<td>-.37895</td>
</tr>
<tr>
<td>use - mult</td>
<td>*</td>
<td>-.42253</td>
<td>-.31862</td>
</tr>
<tr>
<td>wse - addtv</td>
<td>*</td>
<td>-.46403</td>
<td>-.36413</td>
</tr>
<tr>
<td>wse - addlg</td>
<td>*</td>
<td>-.44971</td>
<td>-.34817</td>
</tr>
<tr>
<td>wse - mult</td>
<td>*</td>
<td>-.39506</td>
<td>-.28783</td>
</tr>
<tr>
<td>addtv - addlg</td>
<td>NS</td>
<td>-.0081601</td>
<td>.015959</td>
</tr>
<tr>
<td>addtv - mult</td>
<td>*</td>
<td>.0429411</td>
<td>.076297</td>
</tr>
<tr>
<td>addlg - mult</td>
<td>*</td>
<td>.0410405</td>
<td>.060338</td>
</tr>
</tbody>
</table>

* = Significant, NS = Not Significant, at 95% Level of Confidence for simultaneous intervals. use = Unweighted Self-Explicated; wse = Weighted Self-Explicated; addtv = Additive Huber-Hybrid; addlg = Addilog Huber-Hybrid; mult = Multiplicative Huber-Hybrid.
Table 23
CONFIDENCE INTERVALS FOR CORRELATION COEFFICIENTS -
HYPOTHESIS TWO

<table>
<thead>
<tr>
<th>MODEL</th>
<th>LOWER BOUND</th>
<th>DIFFERENCE OF MEANS</th>
<th>UPPER BOUND</th>
</tr>
</thead>
<tbody>
<tr>
<td>use - wse</td>
<td>NS</td>
<td>-.065376</td>
<td>-.030776</td>
</tr>
<tr>
<td>use - addtv</td>
<td>*</td>
<td>-.45613</td>
<td>-.37559</td>
</tr>
<tr>
<td>use - addlg</td>
<td>*</td>
<td>-.44412</td>
<td>-.3618</td>
</tr>
<tr>
<td>use - mult</td>
<td>*</td>
<td>-.39906</td>
<td>-.30825</td>
</tr>
<tr>
<td>wse - addtv</td>
<td>*</td>
<td>-.43336</td>
<td>-.34884</td>
</tr>
<tr>
<td>wse - addlg</td>
<td>*</td>
<td>-.42166</td>
<td>-.33475</td>
</tr>
<tr>
<td>wse - mult</td>
<td>*</td>
<td>-.37572</td>
<td>-.28014</td>
</tr>
<tr>
<td>addtv - addlg</td>
<td>NS</td>
<td>-.0081599</td>
<td>.0159576</td>
</tr>
<tr>
<td>addtv - mult</td>
<td>*</td>
<td>.0429147</td>
<td>.0761493</td>
</tr>
<tr>
<td>addlg - mult</td>
<td>*</td>
<td>.0410175</td>
<td>.0602649</td>
</tr>
</tbody>
</table>

* = Significant, NS = Not Significant, at 95% Level of Confidence for simultaneous intervals. use = Unweighted Self-Explicated; wse = Weighted Self-Explicated; addtv = Additive Huber-Hybrid; addlg = Addilog Huber-Hybrid; mult = Multiplicative Huber-Hybrid.

From the results shown in Table 23, we conclude at a 95% level of confidence that the null hypothesis may be rejected in eight of the ten comparisons, but we fail to reject the null hypothesis for the two comparisons mentioned above: 1) use - wse; and 2) addtv - addlg. Because the confidence intervals were adjusted to reflect all comparisons made in both Hypotheses One and Two, the probability of Type I error = .05 holds for both hypotheses, considered as a single experiment.

The results of the pairwise comparisons are illustrated in Figure 6. In this figure, a significant difference between models is represented...
by the presence of an arrow joining the two models. If a pairwise com-
parison was not significant, no arrow was drawn. The direction of the
arrow specifies the direction of the of pairwise significant differ-
ence. If one model had a significantly greater correlation than
another, then the arrow points to the model which had the higher corre-
lation value.

Figure 6: ILLUSTRATION OF PAIRWISE COMPARISON RESULTS - HYPOTHESIS TWO

Thus, it can be seen in Figure 6 that the self-explicated models,
while not statistically different from each other, were outperformed by
each of the Huber-Hybrid models. Although mean correlation values
obtained for the Additive and Addilog Huber-Hybrid models are not sta-
tistically different, both models had significantly higher mean corre-
lations than the Multiplicative Huber-Hybrid model.
**HYPOTHESIS THREE**

The effect of selected demographic and health state attribute variables on the dependent variable of contingent valuation to avoid allergic rhinitis for six months, was measured. The statistical hypothesis is stated as:

\[ H_0: \beta_1 = 0 \]

\[ H_A: \beta_1 \neq 0 \]

for the model: \( CV \) for avoidance of allergic rhinitis = \( \beta_1 X + \beta_0 \)

where

- \( X = 1 \) Allergy Severity
- \( 2 \) Cyclicality of Symptoms
- \( 3 \) Cost-of-Illness
- \( 4 \) Sex
- \( 5 \) Age
- \( 6 \) Asthma
- \( 7 \) Income
- \( 8 \) Education
- \( 9 \) Highest CV Bid for a Product Profile

Hypotheses One and Two were restricted to allergic rhinitis sufferers who had reported use of at least one antihistamine product during the past six months. This same restriction was applied to sampling units chosen to test the independent variable in Hypothesis Three of "maximum CV for an antihistamine product." However, all remaining tests of Hypothesis Three included all usable subjects who were designated as allergic rhinitis sufferers, without regard to antihistamine use.
The results of simple linear regression models for variables that were presumed to be intervally-scaled are presented in Table 24. From this table it can be seen that the linear relationship, with the dependent variable of contingent valuation, is significant (α = .05) for the following independent variables: 1) "time of year when allergy is worst" severity; 2) "entire year" severity; 3) cost-of-illness; and 4) maximum CV for an antihistamine product. No significant relationship (α = .05) was found for age (Table 24) or any of the other demographic variables analyzed, as shown in Table 25.

For both types of allergy severity, contingent valuation to avoid allergic rhinitis was associated in a positive manner with increasing allergy severity. Cost-of-Illness and "Maximum CV for an antihistamine" were also associated, in a positive linear manner, with individuals' contingent valuation to avoid the disease state of allergic rhinitis.

The remaining independent variables in Hypothesis Three were presumed to be ordinally or nominally-scaled. For these variables, it was necessary to dummy-code the various levels associated with each, prior to regression analysis. The mean values of each level, as well as the sample beta values that were found by dummy coding (Mean CV - $\hat{b}_0$), are presented in Table 25. Only "cyclicality of symptoms" was found to be significantly (α = .05) related in a linear manner with contingent valuation to avoid allergic rhinitis. The mean contingent valuation

---

35 This relationship may appear to be negative from a quick glance of Table 24. However, it should be realized that a lower numerical rating of allergy severity indicates greater allergy severity, i.e. 1 = "bothers me a great deal," 5 = "bothers me not at all."
Table 24

SIMPLE LINEAR REGRESSION - HYPOTHESIS THREE

---------------------------------

ALLERGY SEVERITY
"During the time of the year when my allergy is worst"

MODEL: CV = -104.387 (Allergy severity rating) + 467.118

N = 214  R-SQUARE = .0765
F = 17.552  PROB > F = .0001

ALLERGY SEVERITY
"During the entire year"

MODEL: CV = -139.316 (ALLERGY SEVERITY RATING) + 677.024

N = 211  R-SQUARE = .0969
F = 22.418  PROB > F = .0001

COST-OF-ILLNESS

MODEL: CV = .925754 (Amount spent on allergic rhinitis) + 84.496991

N = 199  R-SQUARE = .3029
F = 85.615  PROB > F = .0001

AGE

MODEL: CV = 4.860561 (Age in years) + 17.221297

N = 218  R-SQUARE = .0130
F = 2.838  PROB > F = .0935

MAXIMUM CV FOR AN ANTIHISTAMINE PRODUCT

MODEL: CV = 1.099344 (Maximum CV) + 114.763

N = 141  R-SQUARE = .1278
F = 20.376  PROB > F = .0001

---------------------------------
rating for the "allergy all/nearly all of the year" group (perennial sufferers) was more than twice as large as for the "allergy comes and goes" (seasonal) group. No significant ($\alpha = .05$) linear relationship was Existence of Asthma.
### Table 25

**REGRESSION OF DUMMY-CODED VARIABLES - HYPOTHESIS THREE**

<table>
<thead>
<tr>
<th>CYCLICALITY OF SYMPTOMS</th>
<th>n</th>
<th>Mean CV</th>
<th>Mean CV - $b_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Allergy comes and goes&quot;</td>
<td>128</td>
<td>130.789</td>
<td>0</td>
</tr>
<tr>
<td>&quot;Allergy all/nearly all of year&quot;</td>
<td>89</td>
<td>292.472</td>
<td>161.683</td>
</tr>
<tr>
<td>F = 8.32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-SQUARE = .037246</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROB &gt; F = .0043</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEX</th>
<th>n</th>
<th>Mean CV</th>
<th>Mean CV - $b_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>129</td>
<td>168.287</td>
<td>0</td>
</tr>
<tr>
<td>Male</td>
<td>90</td>
<td>235.133</td>
<td>66.847</td>
</tr>
<tr>
<td>F = 1.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-SQUARE = .006421</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROB &gt; F = .2376</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASTHMA</th>
<th>n</th>
<th>Mean CV</th>
<th>Mean CV - $b_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>30</td>
<td>228.833</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>188</td>
<td>190.989</td>
<td>-37.844</td>
</tr>
<tr>
<td>F = .22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-SQUARE = .001005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROB &gt; F = .6417</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INCOME</th>
<th>Gross Family Income (1985)</th>
<th>n</th>
<th>Mean CV</th>
<th>Mean CV - $b_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $5,000</td>
<td>2</td>
<td>25.000</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>$5,000 to $9,999</td>
<td>8</td>
<td>125.250</td>
<td>100.250</td>
<td></td>
</tr>
<tr>
<td>$10,000 to $17,499</td>
<td>27</td>
<td>85.926</td>
<td>60.926</td>
<td></td>
</tr>
<tr>
<td>$17,500 to $24,999</td>
<td>28</td>
<td>185.250</td>
<td>160.250</td>
<td></td>
</tr>
<tr>
<td>$25,000 to $34,999</td>
<td>42</td>
<td>143.929</td>
<td>118.929</td>
<td></td>
</tr>
<tr>
<td>$35,000 to $49,999</td>
<td>48</td>
<td>282.083</td>
<td>257.083</td>
<td></td>
</tr>
<tr>
<td>$50,000 to $69,999</td>
<td>44</td>
<td>205.341</td>
<td>180.341</td>
<td></td>
</tr>
<tr>
<td>$70,000 to $100,000</td>
<td>18</td>
<td>309.278</td>
<td>284.278</td>
<td></td>
</tr>
<tr>
<td>Over $100,000</td>
<td>2</td>
<td>62.500</td>
<td>37.500</td>
<td></td>
</tr>
<tr>
<td>F = .86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-SQUARE = .031683</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROB &gt; F = .5521</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 25 (continued)

<table>
<thead>
<tr>
<th>Highest Educational Level Completed</th>
<th>n</th>
<th>Mean CV</th>
<th>Mean CV - $b_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some High School</td>
<td>2</td>
<td>45.000</td>
<td>0</td>
</tr>
<tr>
<td>High School Graduation</td>
<td>12</td>
<td>95.417</td>
<td>50.417</td>
</tr>
<tr>
<td>Some College</td>
<td>42</td>
<td>314.881</td>
<td>269.881</td>
</tr>
<tr>
<td>College Graduation</td>
<td>43</td>
<td>148.721</td>
<td>103.721</td>
</tr>
<tr>
<td>Post-Graduate College</td>
<td>120</td>
<td>183.467</td>
<td>138.467</td>
</tr>
</tbody>
</table>

$F = 1.30$  
PROB $> F = .2709$

R-SQUARE = .023731

HYPOTHESIS FOUR

This hypothesis provided a check on the validity of the utility models to predict contingent valuations for market-basket products. Desirability ratings of individual attributes (and importance ratings for the weighted model) were imputed into the five utility models, previously derived for Hypotheses One and Two, to obtain individual subject utility scores for each of the three hold-out product profiles. Predicted contingent valuations were then obtained for the three hold-out products of each individual, by using the beta values obtained from the individual models of regression of orthogonal product contingent valuations.

36 For the Huber-Hybrid models, the same parameters of the Huber-Hybrid least-squares equation, which had been derived from the orthogonal profiles for each individual, were used to calculate utility scores from individual product attribute data. Overall profile utility ratings for hold-out products were not included in this calculation, because this would have required re-calibration of each Huber-Hybrid least-squares equation.
Correlations were then obtained, by holdout product, between the predicted contingent valuations, and the actual CV assigned by subjects to each hold-out product. These correlations (which are underscored), as well as those found between predicted values of the five models, are shown in Table 26. Correlations between actual and predicted contingent values ranged from .79 to .94, for all of the hold-out products.

The means of each of the predicted values were calculated, by model, for each of the holdout products (see Table 27). For hold-out products, "Chlorpheniramine 8mg." and "Seldane 60 mg.," the actual contingent valuation means exceeded the predicted contingent valuation means of each utility model. However, for "Benadryl 25mg." the converse was found. In this case, the actual contingent valuation mean was less than the each of the predicted ones. It can be seen from this table, that both actual and contingent values are negatively skewed.

Hypothesis Four is a directional test of significance. The statistical hypothesis is:

\[ H_0: \rho_i = 0 \]
\[ H_A: \rho_i > 0 \]

where
\[
\rho = \begin{bmatrix}
\rho_1 \\
\rho_2 \\
\rho_3 \\
\rho_4 \\
\rho_5 \\
\end{bmatrix}
\]

for the model: \[
CV\text{ (actual)} = b_1 CV\text{ (predicted)} + b_0
\]
Table 26

CORRELATION COEFFICIENTS - HOLDOUT PRODUCTS

<table>
<thead>
<tr>
<th>HOLDOUT PRODUCT B - &quot;Chlorpheniramine 8 mg.&quot;</th>
<th>N = 141</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE WSE ADDTV ADDLG MULT ACTUAL</td>
<td></td>
</tr>
<tr>
<td>USE 1.00000 0.98648 0.93930 0.93250 0.91606 0.90102</td>
<td></td>
</tr>
<tr>
<td>WSE 0.98648 1.00000 0.94054 0.93033 0.91395 0.89080</td>
<td></td>
</tr>
<tr>
<td>ADDTV 0.93930 0.94054 1.00000 0.99394 0.98236 0.84316</td>
<td></td>
</tr>
<tr>
<td>ADDLG 0.93250 0.93033 0.99394 1.00000 0.98673 0.84398</td>
<td></td>
</tr>
<tr>
<td>MULT 0.91606 0.91395 0.98236 0.98673 1.00000 0.81889</td>
<td></td>
</tr>
<tr>
<td>ACTUAL 0.90102 0.89080 0.84316 0.84398 0.81889 1.00000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOLDOUT PRODUCT I - &quot;Seldane 60 mg.&quot;</th>
<th>N = 143</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE WSE ADDTV ADDLG MULT ACTUAL</td>
<td></td>
</tr>
<tr>
<td>USE 1.00000 0.99193 0.95141 0.95380 0.95885 0.87285</td>
<td></td>
</tr>
<tr>
<td>WSE 0.99193 1.00000 0.93849 0.94042 0.94759 0.84989</td>
<td></td>
</tr>
<tr>
<td>ADDTV 0.95141 0.93849 1.00000 0.99791 0.99555 0.93965</td>
<td></td>
</tr>
<tr>
<td>ADDLG 0.95380 0.94042 0.99791 1.00000 0.99734 0.93692</td>
<td></td>
</tr>
<tr>
<td>MULT 0.95885 0.94759 0.99555 0.99734 1.00000 0.92326</td>
<td></td>
</tr>
<tr>
<td>ACTUAL 0.87285 0.84989 0.93965 0.93692 0.92326 1.00000</td>
<td></td>
</tr>
</tbody>
</table>
Table 26 (continued)

HOLDOUT PRODUCT 0 - "Benadryl 25mg."

N = 142

<table>
<thead>
<tr>
<th></th>
<th>USE</th>
<th>WSE</th>
<th>ADDTV</th>
<th>ADDLG</th>
<th>MULT</th>
<th>ACTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE</td>
<td>1.00000</td>
<td>0.96051</td>
<td>0.87403</td>
<td>0.86597</td>
<td>0.88007</td>
<td>0.79487</td>
</tr>
<tr>
<td>WSE</td>
<td>0.96051</td>
<td>1.00000</td>
<td>0.83563</td>
<td>0.81529</td>
<td>0.83451</td>
<td>0.80298</td>
</tr>
<tr>
<td>ADDTV</td>
<td>0.87403</td>
<td>0.83563</td>
<td>1.00000</td>
<td>0.99470</td>
<td>0.99579</td>
<td>0.87820</td>
</tr>
<tr>
<td>ADDLG</td>
<td>0.86597</td>
<td>0.81529</td>
<td>0.99470</td>
<td>1.00000</td>
<td>0.99351</td>
<td>0.89037</td>
</tr>
<tr>
<td>MULT</td>
<td>0.88007</td>
<td>0.83451</td>
<td>0.99579</td>
<td>0.99351</td>
<td>1.00000</td>
<td>0.86788</td>
</tr>
<tr>
<td>ACTUAL</td>
<td>0.79487</td>
<td>0.80298</td>
<td>0.87820</td>
<td>0.89037</td>
<td>0.86788</td>
<td>1.00000</td>
</tr>
</tbody>
</table>

---

USE = Unweighted Self-Explicated; WSE = Weighted Self-Explicated; ADDTV = Additive Huber-Hybrid; ADDLG = Addilog Huber-Hybrid; MULT = Multiplicative Huber-Hybrid; ACTUAL = Actual Contingent Valuation.

An obtained z value was calculated from the Z-transformations of the underscored correlation coefficients found in Table 26. The results are shown in Table 28. From the table it is clear that each obtained z value is significant (α = .05). Thus it is concluded that each of the correlation coefficients of actual/predicted continent values are significantly greater than zero, at 95% confidence.
Table 27
MEAN CONTINGENT VALUATIONS BY MODEL - HOLDOUT PRODUCTS

<table>
<thead>
<tr>
<th>HOLDOUT PRODUCT B - &quot;Chlorpheniramine 8 mg.&quot;</th>
<th>VARIABLE</th>
<th>N</th>
<th>MEAN</th>
<th>STD DEV</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE</td>
<td>141</td>
<td>47.7612519</td>
<td>70.3645381</td>
<td>0.295031</td>
<td>590.016300</td>
<td></td>
</tr>
<tr>
<td>WTD SE</td>
<td>141</td>
<td>42.8209185</td>
<td>62.6896642</td>
<td>-0.432951</td>
<td>509.901500</td>
<td></td>
</tr>
<tr>
<td>ADDITIVE HH</td>
<td>141</td>
<td>38.2111320</td>
<td>59.7680837</td>
<td>-14.535600</td>
<td>461.780200</td>
<td></td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>141</td>
<td>38.2915641</td>
<td>58.3119246</td>
<td>-10.691800</td>
<td>434.538800</td>
<td></td>
</tr>
<tr>
<td>MULTIPLIC HH</td>
<td>141</td>
<td>37.5181304</td>
<td>55.3550936</td>
<td>-11.559200</td>
<td>368.616400</td>
<td></td>
</tr>
<tr>
<td>ACTUAL</td>
<td>141</td>
<td>61.8085106</td>
<td>95.0255541</td>
<td>0</td>
<td>700.000000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOLDOUT PRODUCT I - &quot;Seldane 60 mg.&quot;</th>
<th>VARIABLE</th>
<th>N</th>
<th>MEAN</th>
<th>STD DEV</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE</td>
<td>143</td>
<td>56.8298460</td>
<td>88.677122</td>
<td>-0.295434</td>
<td>549.483100</td>
<td></td>
</tr>
<tr>
<td>WTD SE</td>
<td>143</td>
<td>57.7174666</td>
<td>92.051547</td>
<td>-0.149913</td>
<td>646.714500</td>
<td></td>
</tr>
<tr>
<td>ADDITIVE HH</td>
<td>143</td>
<td>60.1616417</td>
<td>92.921796</td>
<td>-0.824561</td>
<td>584.335600</td>
<td></td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>143</td>
<td>59.9243556</td>
<td>90.875933</td>
<td>-0.673036</td>
<td>547.163800</td>
<td></td>
</tr>
<tr>
<td>MULTIPLIC HH</td>
<td>143</td>
<td>57.2984165</td>
<td>87.110611</td>
<td>-1.133170</td>
<td>526.285600</td>
<td></td>
</tr>
<tr>
<td>ACTUAL</td>
<td>143</td>
<td>70.4965035</td>
<td>122.446877</td>
<td>0</td>
<td>700.000000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOLDOUT PRODUCT O - &quot;Benadryl 25mg.&quot;</th>
<th>VARIABLE</th>
<th>N</th>
<th>MEAN</th>
<th>STD DEV</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE</td>
<td>142</td>
<td>33.0805357</td>
<td>54.1745817</td>
<td>-65.213200</td>
<td>427.883600</td>
<td></td>
</tr>
<tr>
<td>WTD SE</td>
<td>142</td>
<td>36.0459794</td>
<td>52.4369988</td>
<td>-21.085800</td>
<td>338.885300</td>
<td></td>
</tr>
<tr>
<td>ADDITIVE HH</td>
<td>142</td>
<td>37.1338719</td>
<td>73.9363343</td>
<td>-56.748700</td>
<td>646.783000</td>
<td></td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>142</td>
<td>33.4745133</td>
<td>71.8888119</td>
<td>-63.070500</td>
<td>618.054900</td>
<td></td>
</tr>
<tr>
<td>MULTIPLIC HH</td>
<td>142</td>
<td>36.4997915</td>
<td>76.1632073</td>
<td>-45.566800</td>
<td>687.640900</td>
<td></td>
</tr>
<tr>
<td>ACTUAL</td>
<td>142</td>
<td>31.6091549</td>
<td>59.6268871</td>
<td>0</td>
<td>300.00</td>
<td></td>
</tr>
</tbody>
</table>

For each of the variables except ACTUAL, the statistics included in this table are for predicted contingent values.
Table 28

TESTS OF SIGNIFICANCE - HYPOTHESIS FOUR

HOLDOUT PRODUCT B - "Chlorpheniramine 8 mg."

<table>
<thead>
<tr>
<th>Model</th>
<th>Correlation Coefficient</th>
<th>N</th>
<th>Z-transformation</th>
<th>Obtained z</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE</td>
<td>0.90102</td>
<td>141</td>
<td>1.47761</td>
<td>17.3580 *</td>
</tr>
<tr>
<td>WTD SE</td>
<td>0.89080</td>
<td>141</td>
<td>1.42579</td>
<td>16.7492 *</td>
</tr>
<tr>
<td>ADDITIVE HH</td>
<td>0.84316</td>
<td>141</td>
<td>1.23201</td>
<td>14.4728 *</td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>0.84398</td>
<td>141</td>
<td>1.23485</td>
<td>14.5062 *</td>
</tr>
<tr>
<td>MULTIPLIC HH</td>
<td>0.81889</td>
<td>141</td>
<td>1.15344</td>
<td>13.5498 *</td>
</tr>
</tbody>
</table>

HOLDOUT PRODUCT I - "Seldane 60 mg."

<table>
<thead>
<tr>
<th>Model</th>
<th>Correlation Coefficient</th>
<th>N</th>
<th>Z-transformation</th>
<th>Obtained z</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE</td>
<td>0.87285</td>
<td>143</td>
<td>1.34492</td>
<td>15.9134 *</td>
</tr>
<tr>
<td>WTD SE</td>
<td>0.84989</td>
<td>143</td>
<td>1.25576</td>
<td>14.8583 *</td>
</tr>
<tr>
<td>ADDITIVE HH</td>
<td>0.93965</td>
<td>143</td>
<td>1.73505</td>
<td>20.5294 *</td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>0.93692</td>
<td>143</td>
<td>1.71223</td>
<td>20.2593 *</td>
</tr>
<tr>
<td>MULTIPLIC HH</td>
<td>0.92326</td>
<td>143</td>
<td>1.61068</td>
<td>19.0578 *</td>
</tr>
</tbody>
</table>

HOLDOUT PRODUCT O - "Benadryl 25mg."

<table>
<thead>
<tr>
<th>Model</th>
<th>Correlation Coefficient</th>
<th>N</th>
<th>Z-transformation</th>
<th>Obtained z</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE</td>
<td>0.79487</td>
<td>142</td>
<td>1.08452</td>
<td>12.7863 *</td>
</tr>
<tr>
<td>WTD SE</td>
<td>0.80298</td>
<td>142</td>
<td>1.10695</td>
<td>13.0507 *</td>
</tr>
<tr>
<td>ADDITIVE HH</td>
<td>0.87820</td>
<td>142</td>
<td>1.36784</td>
<td>16.1266 *</td>
</tr>
<tr>
<td>ADDILOG HH</td>
<td>0.89037</td>
<td>142</td>
<td>1.42371</td>
<td>16.7853 *</td>
</tr>
<tr>
<td>MULTIPLIC</td>
<td>0.86788</td>
<td>142</td>
<td>1.32442</td>
<td>15.6147 *</td>
</tr>
</tbody>
</table>

* = Significant, NS = Not Significant, at 95% Level of Confidence for simultaneous intervals. Critical value of $z = z_{a/m} = 2.72; \ a = .05, m = 15.$
HYPOTHESIS FIVE

Five comparisons were made from the vector of correlation coefficients in Hypothesis Four, for each holdout product. Ten additional comparisons were, per product, from the same vector in Hypothesis Four. To hold experimentwise error to \( \alpha = .05 \), the critical value was adjusted in both hypotheses such that all comparisons made in Hypotheses Four and Five hold simultaneously at 95% confidence, when each holdout product is considered one-at-a-time. The statistical hypothesis for Hypothesis Five is stated as:

\[
H_0: \rho_i - \rho_j = 0 \quad (i, j = 1, \ldots, 5; i \neq j)
\]

\[
H_A: \rho_i - \rho_j \neq 0
\]

where

\[
\rho = \begin{bmatrix}
\rho_1 \\
\rho_2 \\
\rho_3 \\
\rho_4 \\
\rho_5 
\end{bmatrix}
\]

for the model:

\[
CV(\text{actual}) = b_1 \cdot CV(\text{predicted}) + b_0
\]

All pairwise comparisons between model correlations were made and are shown in Table 29. The results of these simultaneous comparisons of correlation coefficients are represented as illustrations in Figure 7. The explanation of the nature of the relationships designated by the arrows is the same as it was for Figure 6. Thus, for "Chlorpheniramine 8 mg.," for example, we see that both self-explicated models, while not statistically outperforming each other, had higher correlations than each of the Huber-Hybrid models. Further, it is seen that, although no
difference was found between the Additive Huber-Hybrid and the other Huber-Hybrid models, the Multiplicative Huber-Hybrid had a significantly lower correlation than did the Addilog Huber-Hybrid model.

For "Seldane 60 mg.," the results are quite different. Both of the self-explicated models are outperformed by each of the Huber-Hybrid models. However, the unweighted self-explicated model had a significantly higher correlation than the weighted model. Although no statistical difference was found between the Additive and Addilog Huber-Hybrid models, both had significantly higher correlations than the Multiplicative Huber-Hybrid model.

In the comparisons of correlation coefficients for "Benadryl 25mg.," no statistical difference was found for self-explicated models. The unweighted self-explicated model was outperformed by all of the Huber-Hybrid models, although only the Additive and Addilog Huber-Hybrid models had statistically higher correlation values than the weighted self-explicated model. The only significant difference between Huber-Hybrid models was a higher correlation measure for Addilog Huber-Hybrid, when compared to Multiplicative Huber-Hybrid.
Table 29
TEST OF SIGNIFICANCE - HYPOTHESIS FIVE

HOLDOUT PRODUCT B - "Chlorpheniramine 8 mg."

<table>
<thead>
<tr>
<th>Model Differences</th>
<th>Obtained z</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE - WTD SE</td>
<td>1.64553</td>
</tr>
<tr>
<td>UNWTD SE - ADDITIVE HH</td>
<td>3.74774</td>
</tr>
<tr>
<td>UNWTD SE - ADDILOG HH</td>
<td>3.57625</td>
</tr>
<tr>
<td>UNWTD SE - MULTIPL HH</td>
<td>4.24993</td>
</tr>
<tr>
<td>WTD SE - ADDITIVE HH</td>
<td>3.17253</td>
</tr>
<tr>
<td>WTD SE - ADDILOG HH</td>
<td>2.94756</td>
</tr>
<tr>
<td>WTD SE - MULTIPLIC HH</td>
<td>3.75864</td>
</tr>
<tr>
<td>ADDITIVE HH - ADDILOG HH</td>
<td>-0.16528</td>
</tr>
<tr>
<td>ADDITIVE HH - MULTIPLIC HH</td>
<td>2.64122</td>
</tr>
<tr>
<td>ADDILOG HH - MULTIPLIC HH</td>
<td>3.04389</td>
</tr>
</tbody>
</table>

HOLDOUT PRODUCT I - "Seldane 60 mg."

<table>
<thead>
<tr>
<th>Model Differences</th>
<th>Obtained z</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE - WTD SE</td>
<td>3.7773</td>
</tr>
<tr>
<td>UNWTD SE - ADDITIVE HH</td>
<td>-4.9441</td>
</tr>
<tr>
<td>UNWTD SE - ADDILOG HH</td>
<td>-4.8652</td>
</tr>
<tr>
<td>UNWTD SE - MULTIPL HH</td>
<td>-4.2048</td>
</tr>
<tr>
<td>WTD SE - ADDITIVE HH</td>
<td>-5.3581</td>
</tr>
<tr>
<td>WTD SE - ADDILOG HH</td>
<td>-5.2905</td>
</tr>
<tr>
<td>WTD SE - MULTIPLIC HH</td>
<td>-4.8629</td>
</tr>
<tr>
<td>ADDITIVE HH - ADDILOG HH</td>
<td>1.4374</td>
</tr>
<tr>
<td>ADDITIVE HH - MULTIPLIC HH</td>
<td>4.5463</td>
</tr>
<tr>
<td>ADDILOG HH - MULTIPLIC HH</td>
<td>4.7249</td>
</tr>
</tbody>
</table>
Table 29 (continued)

HOLDOUT PRODUCT 0 - "Benadryl 25mg."

<table>
<thead>
<tr>
<th>Model Differences</th>
<th>Obtained z</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNWTD SE - WTD SE</td>
<td>-0.5807 NS</td>
</tr>
<tr>
<td>UNWTD SE - ADDITIVE HH</td>
<td>-3.5592 *</td>
</tr>
<tr>
<td>UNWTD SE - ADDILOG HH</td>
<td>-3.9588 *</td>
</tr>
<tr>
<td>UNWTD SE - MULTIPL HH</td>
<td>-3.1928 *</td>
</tr>
<tr>
<td>WTD SE - ADDITIVE HH</td>
<td>-3.0214 *</td>
</tr>
<tr>
<td>WTD SE - ADDILOG HH</td>
<td>-3.3871 *</td>
</tr>
<tr>
<td>WTD SE - MULTIPLIC HH</td>
<td>-2.5972 NS</td>
</tr>
<tr>
<td>ADDITIVE HH - ADDILOG HH</td>
<td>-2.8249 NS</td>
</tr>
<tr>
<td>ADDITIVE HH - MULTIPLIC HH</td>
<td>2.6032 NS</td>
</tr>
<tr>
<td>ADDILOG HH - MULTIPLIC HH</td>
<td>4.1938 *</td>
</tr>
</tbody>
</table>

* = Significant, NS = Not Significant, at 95% Level of Confidence for simultaneous intervals. Critical value of $z = z_{\alpha/2m} = 2.93$; $\alpha = .05$, $m = 15$. 
HOLDOUT PRODUCT B - "Chlorpheniramine 8 mg."

![Diagram showing pairwise comparison results for Chlorpheniramine 8 mg.]

HOLDOUT PRODUCT I - "Seldane 60 mg."

![Diagram showing pairwise comparison results for Seldane 60 mg.]

HOLDOUT PRODUCT O - "Benadryl 25mg."

![Diagram showing pairwise comparison results for Benadryl 25mg.]

**Figure 7:** ILLUSTRATION OF PAIRWISE COMPARISON RESULTS - HYPOTHESIS FIVE
ADDITIONAL ANALYSIS

Although plans were made in the original study proposal to compare willingness-to-pay with willingness-to-accept for allergic rhinitis, operational problems caused this question to be dropped from the questionnaire. However, measures of contingent valuation (compensating surplus) were obtained for each usable subject for three levels of allergic rhinitis health status: 1) allergic rhinitis symptoms similar to those experienced by the subject for the six months prior to the study; 2) allergic rhinitis symptoms twice as bad as those experienced; and 3) allergic rhinitis symptoms half as bad as those experienced.

Although these measures were not included in a formal hypothesis, an analysis of these measures was performed. For every individual reporting a set of three nonzero contingent values, the natural log was taken of each value. The gain score of the logarithm of the "as bad" CV minus the log of the "half as bad" CV was calculated for each useable respondent. Further, the gain score of the natural log of the "twice as bad" CV minus the log of the "as bad" CV was obtained for the same respondents. The two sets of gain scores were then aggregated and compared by means of a paired t-test. The results of the this test are shown in Table 30. From Table 30 it can be seen that the first gain score was significantly greater than the second gain score. From this test, we can conclude, at 95% confidence, that the relationship between changes in contingent values is not directly logarithmic.

37 Eligible subjects were those who were identified as being allergic rhinitis sufferers.
Table 30

PAIRED T-TEST - GAINS OF LOG-CONTINGENT VALUES

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>N</th>
<th>MEAN</th>
<th>STD DEV</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAIN1</td>
<td>179</td>
<td>.803467</td>
<td>.7102119</td>
<td>-1.368276</td>
<td>4.605170</td>
</tr>
<tr>
<td>GAIN2</td>
<td>179</td>
<td>.650818</td>
<td>.5507955</td>
<td>-1.609438</td>
<td>3.912023</td>
</tr>
</tbody>
</table>

COVARIANCE MATRIX

<table>
<thead>
<tr>
<th></th>
<th>GAIN1</th>
<th>GAIN2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAIN1</td>
<td>.504401</td>
<td>-.031242</td>
</tr>
<tr>
<td>GAIN2</td>
<td>-.031242</td>
<td>.303376</td>
</tr>
</tbody>
</table>

\[ \rho_{12} = -.07987 \]

Obtained \( t^* = -2.1892 \) (Gain2 - Gain1)

Critical \( t = t_{0.025, 178} \sim z_{0.025} = 1.96 \)

Gain1 = \( \log ("as bad" \ CV) - \log ("half as bad" \ CV) \)

Gain2 = \( \log ("twice as bad" \ CV) - \log ("as bad" \ CV) \).

*From t-test for dependent groups (Glass & Stanley, 1970, p. 300).

ASSESSMENT OF RELIABILITY

Reliability was assessed by three methods: 1) through Hold-out product validation; 2) by correlations between responses on contingent valuation questions for the three levels of allergic rhinitis health status; and 3) through measurement of Cronbach's Alpha for the importance of attribute categories dimension. The first method, hold-out product validation, was discussed in Hypotheses Four and Five.

The second method, correlations between contingent valuation questions, was applied by measuring the magnitude of correlations between the three responses to the allergic rhinitis contingent valuation
questions. The correlation matrix thus obtained for all allergic rhinitis sufferers who answered each of the three CV questions is shown in Table 31. From the table, it can be seen that correlations between the three CV responses ranged from $p = .86$ to $p = .94$.

Table 31

|                      | CORRELATION COEFFICIENTS / PROB > |R| UNDER H0:RHO=0 | N = 219 |
|----------------------|-----------------------------------|-----------------|---------|
|                      | WTPHALF  | WTP1   | WTP2   | WTPHALF | WTP1   | WTP2   | WTPHALF | WTP1   | WTP2   | WTPHALF | WTP1   | WTP2   |
| WTPHALF             | 1.00000 | 0.86012| 0.86908| 0.00000 | 0.0001 | 0.0001 | 0.00000 | 0.0001 | 0.0001 |
| WTP1                | 0.86012 | 1.00000| 0.93895| 0.0001  | 0.0000 | 0.0001 | 0.00000 | 0.0001 | 0.0001 |
| WTP2                | 0.86908 | 0.93895| 1.00000| 0.0001  | 0.0001 | 0.0000 |

The third method was an assessment of the reliability of the importance dimension for the seven attribute categories. Cronbach's Alpha was equal to .405786 for the seven-item dimension of importance.
SUMMARY

Contingent valuation, as a measurement of the value of a commodity or benefit has many applications in various non-health care areas; however applications of this technique to health care has occurred only recently. The focus of this study was upon validity assessment of a contingent valuation measure of antihistamine products used for the relief of the disease state of allergic rhinitis.

To assess this relationship, it was necessary to develop a conceptual understanding of criteria that could have been compared with contingent valuation measures. Randall et al. (1983) have argued that the relationship between contingent valuation (an ex ante measure) and actual purchase behavior (an ex post measure) is unclear, because the individual, at the former state, has an information set which may vary considerably from that which is present after a purchase decision has been made. Thus, it was decided to compare the relationship between an attitudinal utility measure, which is also ex ante, with the contingent valuation measure. Moreover, five mathematical utility models were studied to assess possible relationships between these two ex ante measures.
FINDINGS

The hypotheses tested (in research form) and the results of the analysis are as follows:

1. There is a positive relationship between each of the following measures of utility and the contingent valuation measures for the set of orthogonal product profiles:

   a. Unweighted self-explicated utility scores.
   b. Weighted self-explicated utility scores.
   c. Additive Huber-hybrid utility scores.
   d. Addilog Huber-hybrid utility scores.
   e. Multiplicative Huber-hybrid utility scores.

   Mean values of intra-individual correlation coefficients were found to be .589, .609, .790, .784, and .759 for the Unweighted Self-Explicated, Weighted Self-Explicated, Additive Huber-Hybrid, Addilog Huber-Hybrid, and Multiplicative Huber-Hybrid models, respectively. The null form of this hypothesis was rejected at with an experimentwise error of .05. Thus, it was concluded that each of the models correlation values was significantly greater than zero.

2. The strengths of relationship between utility measures and contingent valuation measures differ between the five models for the set of orthogonal product profiles.

   The null form of this hypothesis was rejected for eight of the ten possible pairwise comparisons. The self-explicated models had mean correlation values which were not significantly different from each other. However, both of the self-explicated models had significantly lower mean correlations than each of the
Huber-Hybrid models. The Addilog and Additive Huber-Hybrid models were not significantly different, although the Multiplicative model had a significantly lower mean correlation than the other Huber-Hybrid models.

3. There is a relationship between socioeconomic variables, including income, and contingent valuation ratings.

None, of four demographic measures (sex, age, income or education) tested, was found to be significantly linearly related to the contingent valuation measure to avoid allergic rhinitis for six months ($\alpha = .05$). All disease-related variables, i.e. allergy severity, cyclicity of symptoms, cost-of-illness, and highest bid for an antihistamine product profile, were found to be significantly related to CV for six months avoidance of allergic rhinitis. Asthma was not significantly related to the dependent variable.

4. There is a positive relationship between measures of contingent valuation predicted by utility models and actual contingent valuation for the set of hold-out product profiles.

The linear relationship between actual and contingent valuations predicted by the utility models was studied for three holdout products. For "Chlorpheniramine 8 mg.,” the sample correlation values were .901, .891, .843, .844, and .819 for the Unweighted Self-Explicated, Weighted Self-Explicated, Additive Huber-Hybrid, Addilog Huber-Hybrid and Multiplicative Huber-Hybrid models, respectively. For "Seldane 60 mg.,” the sample correlation values
were .872, .850, .940, .940, and .923 for the same models, respectively. For "Benadryl 25mg," the same respective sequence of sample correlations was .795, .803, .878, .890, and .868. All model correlations were found to be significantly greater than zero (experimentwise error per product equal to .05), for each holdout product.

5. There is a difference in the strengths of correlation between the five utility models in the prediction of hold-out product profile contingent values.

For "Chlorpheniramine 8mg.," no significant difference was found between self-explicated models. However, both self-explicated models had significantly higher correlations than each of the Huber-Hybrid ones. Addilog and Additive Huber-Hybrid model correlations were not significantly different. The Multiplicative Huber-Hybrid model had a significantly lower correlation than the Addilog Huber-Hybrid model. For "Seldane 60mg.," both of the self-explicated model correlations were significantly lower than the Huber-Hybrid models. However, the unweighted self-explicated model had a significantly higher correlation than the weighted model. Although no statistical difference was found between the Additive and Addilog Huber-Hybrid models, both had significantly higher correlations than the Multiplicative Huber-Hybrid model. For "Benadryl 25mg.," no statistical difference was found for self-explicated models. The unweighted self-explicated model was outperformed by all of the Huber-Hybrid models, although only the
Additive and Addilog Huber-Hybrid models had statistically higher correlation values than the weighted self-explicated model. The only significant difference between Huber-Hybrid models was a higher correlation measure for Addilog Huber-Hybrid, when compared to Multiplicative Huber-Hybrid.

**DISCUSSION OF RESULTS**

**Missing Data**

For non-users of antihistamine drugs, a non-usable rate of 31% was found for antihistamine product contingent valuation products. However, hypothesis testing focused upon respondents who indicated some use of antihistamine drugs in the six months prior to the study. For this group, the non-usable rate was less than half that of the former group, approximately 15%. These non-usable rates are less than ideal and introduce the possibility of some non-response bias into the results. However, this non-response was less than that which was anticipated. Thompson et al. (1984) found a non-usable rate of 73% for contingent valuation questions for the disease state of arthritis, in personal interviews. The fact that the non-usable rate in the present study was only 15% (for the major group of interest) is encouraging, especially because the mail questionnaire was used.

The reasons for non-response on these items for antihistamine users are not clear, but the length of the questionnaire was likely to have been a major factor. Several subjects complained that the number of product profiles was too great; an unfortunate consequence of the
orthogonal coding plan. A few individuals stated that it was extremely difficult to answer the contingent valuation questions; they did not know what they would be willing to pay for the products. This may be a function of the hypothetical market, or the open-ended CV question format. Many of these same individuals responded to the utility measures, while leaving the contingent valuation questions blank.

**Contingent Valuation of Orthogonal Products**

Analysis of the mean correlation coefficients, for the individualized utility function/CV measures of orthogonal product profiles, revealed very high correlations, particularly for the Huber-Hybrid models. The Multiplicative, Addilog and Additive Huber-Hybrid models explained 58%, 61%, and 62% of the variance (on average), of the dependent antihista­mine product contingent valuations, respectively. Although the correlation coefficients were high for the unweighted and weighted self-explicated models, the percentage of variance explained for these models was 35% and 37%, respectively. Thus, it seems that the additional information provided by the inclusion of utility measures, for the full product profiles, contributes to the explanatory power of the model. Several possible explanations can be suggested.

First, self-explicated ratings might seem less realistic to the respondent than would full product profile descriptions. Responses to these items may therefore, have less reliability because of difficulty by the subject to conceptualize isolated individual attributes.

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38 However, a counter-argument may be made that a high number of product profiles would, ceteris paribus, lead to higher instrument reliability, at least for those subjects who chose to respond to the contingent valuation questions.
A second explanation of these results could be due to the artifact that product attributes may be perceived by the subject to be related, and hence, considerable interaction may exist between perceptions of attributes. The Huber-Hybrid models, however, may have reduced the effect of attribute interaction by re-adjusting the beta weights of individual attributes to reflect these inter-attribute relationships.

An interesting point to note is the significantly lower performance of the Multiplicative Huber-Hybrid model in comparison to the Additive and Addilog ones. Although the practical significance of this difference is not great (explanation drop of 4%), this finding is contrary to prior expectations. Akaah and Korgaonkar (1983) had found slightly better explanation for the multiplicative model. The findings of the present study, in this regard, find no evidence that one or more of the product categories act as "screening" variables. Huber, Sahney and Ford (1969) posited that the Multiplicative model would have greater explanation in such a case.

**Contingent Valuation of Holdout Products**

Probably the most encouraging finding of this study was seen in the analysis of hold-out products. Although the correlation analysis was made across individuals, for each holdout product, it was believed that such an analysis was appropriate, because predicted contingent values were based upon individual utility/CV functions. For the holdout product, "Chlorpheniramine 8mg.," the contingent valuations predicted by the unweighted self-explicated model explained 81% of the variance of the actual contingent valuations assigned, by subjects, to the product
description. For "Seldane 60mg.,” 88% of the variance was explained by the Additive Huber-Hybrid model. For "Benadryl 25 mg.," the Addilog and Additive Huber-Hybrid models explained 79% and 77% of the variance, respectively.

Although, in line with the findings of the orthogonal products, the Addilog Huber-Hybrid model showed superior performance for two of the holdout products, it is uncertain why the the self-explicated models outperformed each of the Huber-Hybrid ones for "Chlorpheniramine."

**Subject Attribute Variables**

A study of the linear association between attribute variables of respondents (demographic and allergic rhinitis disease state), revealed some interesting findings. Of the four demographic variables examined (sex, age, income, and education), none showed a significant linear relationship with contingent valuation to avoid allergic rhinitis for six months. Thompson et al. (1984) had used CV for relief of arthritis, as a percentage of income, as the dependent variable in their study. Thus, it is difficult to make comparisons. However, as in the present study, no significant linear relationships were found with demographic variables reported in Thompson et al.'s work. 39

Findings for disease-related attribute variables were as follows:

1. Allergy severity, for both "entire year," and "the time of the year when my allergy is worst," was positively associated with CV for allergic rhinitis avoidance. However, this relationship was not very strong; less than 10% of the variance was explained for each type of allergy severity.

39 However, education was found to be positively associated with contingent valuation in Thompson et al.'s work.
2. As expected, cost-of-illness was significantly related with CV to avoid allergic rhinitis. In this case, 30% of the variance was explained by the regression equation.

3. Maximum CV for an antihistamine product was also significant, but in this case only 13% of the variance was explained.

4. Cyclicality of symptoms was significantly related to CV. For this health state variable, individuals indicating perennial-type allergies had contingent valuations more than twice as large as seasonal sufferers. This was expected. However, the percentage of variance explained by this relationship is small; only 4% of the variance in the CV measure is explained.

5. Asthma was not significantly related to CV for six month allergic rhinitis avoidance. This is surprising, because it was posited, prior to analysis, that asthmatics would be willing to pay more for relief of allergy conditions that aggravate their asthma, than would allergy sufferers without this concurrent respiratory disease.

Other Findings

Originally, it was planned to ask subjects to evaluate both willingness-to-pay and willingness-to-accept dimensions of the disease state of allergic rhinitis. However, operational difficulties caused the three allergic rhinitis disease questions to be stated in terms of willingness-to-pay (equivalent surplus), only. A test of the relationship of changes in log-adjusted contingent valuations for disease states, resulted in rejection of the null hypothesis of no difference. As a consequence of this test, it was concluded that the the three contingent valuation ratings were not directly logarithmically related. This finding suggests that some other possible solution, including a linear one, may explain the changes in contingent valuation ratings for the avoidance of allergic rhinitis. The possibility exists that the data may be noisy. Another possible explanation is that the wording of questions may have influenced the results.
Reliability

The holdout product evaluations served as a test of both reliability and validity. The high correlations obtained with each of the hold-out products tend to support an argument for high reliability of the contingent valuation measures for the holdout products. Further, the high correlations obtained were also a function of utility ratings in both the full product and individual product attribute sections. Reliability of these measures would be a necessary pre-condition for a non-spurious finding of high correlations with predicted/actual contingent valuation measures. Secondly, high correlations (r = .86 to .94) found between measures of contingent valuation, for the three levels of allergic rhinitis avoidance, support an argument for high reliability of contingent valuation measures in this dimension. Thirdly, reliability assessment of the importance dimension resulted in Cronbach's Alpha equal to .405786. This was extremely low, in comparison to the other findings of reliability, and suggests the possibility of unreliability in the scale. High random error in this scale may have contributed to the relatively poor performance of the weighted self-explicated models. Additionally, previous studies in marketing research have shown that an importance dimension often contributes little or no explanation to attitudinal evaluations of market goods (Rupp, 1986; Sheth and Talarzyk, 1972; Wilkie and Pessemier, 1973).
POTENTIAL SOURCES OF BIAS/LIMITATIONS

Hypothetical Bias

Obviously, in a contingent valuation study using a mail questionnaire to elicit CV bids for a goods similar to those available in the marketplace, the possibility exits that subjects may perceive the study scenario to be unrealistic. This may lead to unreliability in the contingent valuation measures obtained. However, the high reliability found for the contingent valuation measures would tend to provide support against hypothetical bias. This problem may have been a cause of non-response for allergic rhinitis sufferers who were not antihistamine users.

Information Bias

This form of bias may have been a limitation of this study in terms of external validity. The product profiles included in this study, were, of necessity, limited to single-entity antihistamines (although it is clear that many other product alternatives are available to allergy sufferers in the marketplace). This was probably a major reason for the exclusion of non-antihistamine users from study results; a few respondents stated that they would have liked to have some non-antihistamine alternatives available in the questionnaire. Thus, it is clear that results of the study must be limited in scope to antihistamine products, and for the most part, antihistamine users.

The sequencing of items in the questionnaire may have had an effect on responses, since alternate forms of the questionnaire were not used.
Implications of this potential format bias, for the predictive ability of the utility models, need to be evaluated in future research.

The types of categories, levels chosen, and period of product use did not appear to pose a problem with respondents. Few comments were made in this regard in both the pilot test and in the final survey. However, at least one respondent indicated that in order to make the questions more realistic, the period of use should have been limited to a product trial period. This appears to be a valid criticism of the design used in this study. In general, product purchasers have alternatives available that permit a much shorter product-use period than the six-month period in the questionnaire.

**Strategic Bias**

There was no evidence of this form of bias. However, this was not specifically tested. If a respondent had felt that the study results may have led to higher prices for some of the products listed, a "free-rider" problem may have forced the contingent valuations downward. However, the opposite situation may also have occurred if subjects felt that some of the antihistamine products were highly desirable, but not available in the marketplace, and hence, rated them more highly than otherwise, to encourage such product development.

**Starting Point Bias**

An open-ended question format was used in this study for all contingent valuation questions. Fortunately, the probable severity of this form of bias is lower than for alternative techniques, such as iterative
bidding. Thus, this may be a major strong point of the particular design used in this study.

Further, the mean CV predicted for holdout products was lower than the actual CV, for two of the holdout products. However, the predicted mean value exceed the actual mean value in the third case. This would support an argument against a bias in the contingent valuation measurement.

Vehicle Bias
The hypothetical payment vehicle was kept to a simple description. Subjects were told that payment for products would have to come from their income or savings, and were asked to act as if they had no health insurance. Whether this was the payment situation actually perceived by each subject is unknown. Major health insurance coverage was available as an employment benefit to nearly every subject. For this reason, an association between insurance coverage and CV bid could not be examined as a check on this form of bias. However, the out-of-pocket scenario, if actually perceived by subjects as such, would provide greater strength against vehicle bias inherent in financing mechanisms limiting alternative spending options, such as taxation.

Sampling Bias
The target population in this study was limited to full-time employees of the University. Although, demographic effects, such as education and income were not found to be significantly related to CV for avoidance of allergic rhinitis, a greater variability in these demographic
attributes in other target populations may have resulted in different conclusions. Due to the selection of subjects via the random selection process, the present study had an advantage, in terms of external validity, over some studies of CV or utility assessment, which used convenience sampling techniques. However, the customary caveat remains: the reader must interpret any conclusions that are drawn from this study with caution, in attempting to make inferences to other target populations.

RECOMMENDATIONS FOR FUTURE RESEARCH

Recommendations for future studies of contingent valuation research in health care, based upon the experiences of the researcher in this study, are as follows:

1. Randall et al. (1983) have suggested the importance of socio-psychological research into the decision-making processes involved in contingent valuation research. This need cannot be more emphasized. Much of previous CV research focused upon obtained CV bids, and their applications to public policy decisions. Unfortunately, the validity of many of these valuations was not assessed, and one may question the utility of these study results for public policy. Hence, it is recommended that more basic research in theory development of contingent valuation methodology be undertaken.

2. The schools of contingent valuation research and explicit utility assessment have shown tremendous growth in recent years. However, this present study is one of the few examples of attempts to bridge theoretical concepts from both schools. Contingent valuation research may provide a means of overcoming some of the practical limitations of the explicit utility school (e.g. aggregation of data), while explicit utility research can provide some of the needed theoretical foundations for contingent valuation assessment. The potential for major research in bridging this gap is unlimited.

3. Many potential applications of contingent valuation to health care are evident. The results of the present study are encouraging, and suggest that future health research in this area, particularly
for applications of CV to low-mortality disease conditions, may be quite fruitful.

4. The WTP/WTA dilemma continues to pose a problem for both health care and non-health care research. Research thus far in this area, has led many to conclude that the answer to the choice of compensating or equivalent measures is far from simple - traditional hypothetical explanations are not borne out in practice. Applications of psychometric theory, to consumer decision-making processes, may provide some insight into the problem.

5. The interaction of product or service attributes is an area worthy of further investigation. Explicit utility theory has explored some of the effects of various assumptions of attribute independence, but strong empirical research is lacking. The results of this study suggest that such assumptions should not be taken lightly. More work can be done to develop empirically-tested models that control for possible interactive attribute effects.
Appendix A

PHARMACIST PANEL
Important points to consider in the selection of potential categories are the following:

1. The products of interest in this study will be limited to single-entity antihistamines used to treat allergic rhinitis, both perennial and seasonal. For definitions and background information on perennial and seasonal allergic rhinitis, consult the Ricketti reference, "Allergic Rhinitis," enclosed in this packet. All other drug classes, combination products, and disease states will not be considered in this study.

2. The objective of this round is to develop a list of attribute categories which may be important to potential or actual purchasers, when making decisions about the selection of antihistamines to treat allergic rhinitis. This study will be restricted to consumers over 18 years of age. Therefore we won't consider product features which are relevant only to children. The term, attribute category, as I have defined it, is "one of the types of features which are characteristic of a product. For a pharmaceutical product, attribute categories may include dosage form, dosing interval, color, taste, indications, etc."

3. Categories in which a variance exists between antihistamine products are of particular interest in this study. For example, the attribute category, "dosage form," has various attribute levels, including "capsule," "tablet," "syrup," "elixir" and "suppository." However, don't ignore categories that you feel may be important to the consumer, even if no apparent variance exists. For example, all antihistamines are similar in that no one product is very effective in treating nasal obstruction. If you feel that this item may be an important category for a potential consumer of antihistamines, then you would still want to include it in your list.

4. The eventual goal of this panel and the consumer panel is to develop a list of categories (as well as attribute levels, which will be discussed later) that parsimoniously capture the relevant criteria which potential purchasers use to evaluate an antihistamine product for the treatment of allergic rhinitis. Because of limitations on the size of the questionnaire to be used in this study, the eventual goal is to select approximately eight relevant categories.
5. Categories should be broad enough to permit parsimony but not so broad that the meaning is ambiguous. For example, the category, "safety and effectiveness," is broad but would be likely to be too ambiguous in meaning to the consumer to be of any use. Also, it would be difficult for this pharmacist panel to later classify a given antihistamine product on such a nebulous category scale.

6. You may list as many or as few categories as you like. I expect that we may get an average of 20 or so categories per pharmacist.

7. Ideally, I would like to develop a list of 30 to 50 categories from the results of rounds 1 and 2 of this panel. I am going to submit this list to a panel of 10 allergy sufferers and ask them to rate each in terms of importance. From the consumer panel results, I hope to narrow the list down to about eight categories. The pharmacist panel will then meet for a third round to develop a list of attribute levels (to be discussed later) for these selected categories.

8. On the next page is a profile that I have constructed to describe the class of drugs of antihistamines. I've gleaned the pages of Facts and Comparisons and the USP DI as well as several medical references to find as much information as I could for the use of antihistamines in allergic rhinitis for adults. Obviously, like product packaging information, this list is going to contain quite a bit of information of little clinical or decision-making relevance. I've constructed this list to serve merely as an aid to help you review, in your mind, attributes that are characteristic of antihistamines. Please don't feel restricted by this list in choosing any attribute categories that you feel may be important to potential purchasers. Your prior knowledge of customers and pharmaceuticals is the greatest asset that you bring to this study. You may, if you wish, use any other references to help you in eliciting categories.

9. In this round, all I ask of you is to list the categories that you select as being potentially important. You can list them on the pages provided. If you feel that you need more space to list additional items, simply attach additional sheets. You don't need to list attribute levels at this point. For example, "dosage form" would be quite adequate as an attribute category. You don't need to list the possible types of dosage forms that are available for antihistamines. Good Luck.
1. Antihistaminic activity varies
2. Resistance to beneficial effects (esp. after several weeks) is common but can be overcome by switching to other classes of antihistamines
3. Antiserotonin activity
4. Anticholinergic activity varies
5. Antipruritic activity
6. Sedative activity varies
7. Antiemetic effects vary; also antiemetic effect may mask appendicitis or toxicity of other drugs
8. Anti-vertigo activity
9. Anti-motion sickness activity
10. In general, are useful for sneezing, rhinorrhea and pruritus; less effective against nasal obstruction and eye symptoms
11. Sleep aid
12. Well absorbed following PO (all)
13. Onset - 15 minutes to 2 hours
14. Maximal effect varies (3 to 12 hours)
15. Duration of action varies (various half lives, sustained release forms)
16. Terfenadine and astemizole are highly selective for H receptors and are not readily displaced from the receptors (for longer durations of action)
17. More effective if taken continuously rather than prn
18. Intensity of action varies
19. Peak plasma varies
20. Half-life varies (5 to 25 hours)
21. Penetration of blood brain barrier varies
22. Protein binding varies, e.g.
   a. chlorpheniramine - 72%
   b. diphenhydramine - 98 to 99%
23. Dose varies
24. Dosing interval varies (every 4 hours to every day)
25. Dosage forms include capsules, tablets, suppositories, syrups and
   elixirs; various colors, shapes and flavors
26. Most chemical entities have generic substitutes; wide range of
   marketing companies
27. Available as Rx and OTC, depending upon chemical entity and
   strength
28. Various package sizes (few days to several month supply)
29. Various amounts of promotion and advertising for products
30. Metabolism is primarily hepatic, with some renal
31. Drug interaction with MAO inhibitors
32. Additive effects with alcohol, CNS depressants and anticholinergic s
33. Animal studies suggest that meclizine and cyclizine (chemically
   related to antihistamines) may have teratogenic potential
34. Nursing mothers (may inhibit lactation); may appear in breast milk
   and cause excitement or irritability in infant
35. T & P abuse
36. Adverse rxns - drowsiness* (but tends to decline with repeated use)
37. Adverse rxns - sedation*
38. Adverse rxns - dizziness*
39. Adverse rxns - disturbed coordination*
40. Adverse rxns - epigastric distress*-(esp. ethylenediamines)
41. Adverse rxns - Dry mouth*
42. Adverse rxns - thickening of bronchial secretions
43. Adverse rxns - trouble concentrating
44. Astemizole, terfenadine and oxatomide are newly developed antihistamines which have been shown to have drowsiness no greater than placebo
45. Blood dyscrasias and convulsions are among possible rare side effects
46. Anticholinergic effect, especially:
   a. blurred vision
   b. tachycardia
   c. constipation
47. SE more likely in elderly include:
   a. dizziness
   b. sedation
   c. syncope
   d. toxic confusional states
   e. hypotension
   f. phenothiazine SE

* These account for 90% of the side effects of antihistamines.
g. paradoxical hyperexcitability
h. dryness of mouth
i. urinary retention

48. Use with caution in narrow angle glaucoma
49. Use with caution in stenosing peptic ulcers or history of peptic ulcer disease
50. Use with caution in asthmatic attack
51. Use in caution with bladder neck obstruction or prostatic hypertrophy
52. Safety for use in pregnancy not established - use with caution
53. Not for use during third trimester of pregnancy
54. Caution while driving/mental alertness
55. Caution in patient with liver disease
56. Contraindications include:
   a. hypersensitivity to antihistamines
   b. urinary retention sensitive patients
   c. hyperthyroidism
   d. hypertension
   e. cardio-vascular disease
   f. breast CA
ATTRIBUTE CATEGORIES
Round 1 - RPh Panel

1. 

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15. 

16. 

- 7 -
As a result of the first round, we generated a list of categories that appears to be quite thorough, yet is of a reasonable enough size to be able to submit to the allergy sufferer panel. For this reason, we are fortunate enough to avoid having to narrow this list any further. We'll leave that for the consumer panel to do.

I have taken the list of categories, which you and the other pharmacists have provided, and have made several changes. I have combined similar items into single descriptions, to avoid redundancy. Also, I took a few single categories which I felt described two or more concepts, and broke them down, individually, into two or more categories. I have not consciously deleted any item that the pharmacist panel has provided.

One other major change, which I made, was to reword the categories, provided by the panel, from pharmacy and medical jargon, to a level of English that can be understood by my study sample. Since my study sample will consist of staff and faculty members here at OSU, try to consider the general level of comprehension of this group when evaluating my rewording of the pharmacist panel items.

All that I ask you to do in this round is to look over the list of categories below and make changes in any items that need to be reworded, keeping in mind the sample to which this eventually is to be directed. If you don't see one of your suggested categories below, or if you think of another category that should be added to the list, please indicate so. Thanks Again.

CATEGORY LIST

1. Appearance of product packaging (container box, bottle, labels)
2. Time required for drug to work at "peak" effectiveness
3. Advertisement on TV, magazines and newspapers
4. Package sizes available
5. Ability to take whenever needed
6. Whether product was once available by prescription only
7. Whether product is available with or without a prescription
8. Product is made by "generic" companies as well as brand name
9. Whether product is available as a tablet, capsule, liquid, etc.
10. How quickly the product works after being swallowed
11. Appearance of the drug to be taken
12. How long the product lasts before it has to be taken again
13. How good the product tastes
14. How easy the product is to swallow
15. Whether side effects disappear after a few days
16. Danger of taking an overdose of the product
17. Whether the product causes:
   a. Drowsiness and sedation
   b. Side effects other than drowsiness
   c. Dry mouth
   d. Constipation
   e. Dizziness
   f. Abdominal upset
   g. Blurred vision
   h. Difficulty in urinating
   i. General fuzziness
   j. Excessive dryness of the nasal passages
   k. Fast heart beat
18. Whether product is safe to take while pregnant
19. Whether product is safe to take while driving
20. Whether allergy symptoms get worse than before, after product is stopped
21. Effectiveness in containing all symptoms of allergic rhinitis
22. Can product be used for motion sickness
23. Can product be used to help you sleep
24. Does product become less effective over a period of time; does a resistance build up
25. How well product works to:
   a. stop sneezing
   b. dry runny nose
   c. stop nasal itching
   d. stop itchy eyes
   e. stop watery eyes

26. How safe is the product to take if you have hypertension

27. Contraindications, in general

28. Can product be used:
   a. if breast-feeding
   b. in females of child-bearing age
   c. if you have a thyroid condition
   d. if you have glaucoma

29. Danger of interaction of the product with:
   a. other medications
   b. alcohol
   c. other diseases
Appendix B

ALLERGY SUFFERER PANEL
Dear ,

Thanks for agreeing to take part in this study. When people think about scientific research at a college of pharmacy, they probably imagine things such as chemicals in test tubes, boiling flasks of solutions, and white lab mice. In our division of the college, we also study drugs. But, we do it in a different way. We study people’s attitudes and opinions about drugs to treat and prevent diseases. At this college, we realize that it’s just as important to understand the needs, wants and concerns of a patient as it is to understand the chemical structure of a newly-developed drug to treat that same patient. This is why we are doing this study. Particularly, we are trying to understand what people, who have allergies, value when considering whether to buy a particular antihistamine to treat these allergies. Your participation is especially valuable, since, as an allergy sufferer, you can show us what you feel is important to consider in our study.

Enclosed in this envelope is a short questionnaire which lists some points which we feel some consumers might consider when deciding whether to purchase an antihistamine. What we ask you to do is to show us which of these points you feel are important by rating each of the items. It will probably only take about 10 minutes or less to complete. Please think carefully about each choice, and answer all of the questions.

If you wish to comment on any questions, please feel free to use the space available or to attach additional stationery. Your answers and comments will be read, but your identity will be kept in strict confidence.

Also in this envelope, you should find a check for $5.00. This is your payment, in advance, for completing this first questionnaire. We will mail a second questionnaire within a couple of weeks. When you return the second questionnaire, we will quickly send you another payment of $5.00 for your time. Once again, we thank you for your invaluable service in this scientific study.
The deadline for receiving your answers is May 19, 1986. So, by this deadline, please return this questionnaire in the enclosed stamped envelope to us at the address below. If we can help you in any way, please feel free to call. We will be glad to reimburse you for any long distance calls that you have to make to us.

Thanks for your help.

Gregory Reardon, Doctoral Student  
Division of Pharmaceutical Administration  
500 W. 12th Avenue  
Columbus, OH 43210  
(614) 422-2038

Dev S. Pathak, Chairman  
Division of Pharmaceutical Administration  
(614) 422-0540
An antihistamine is a drug which is commonly used to treat symptoms of an allergy. To understand how an antihistamine works, it will help to see how an allergic reaction occurs. An allergen is an agent which starts the allergic reaction in a person. Common allergens are things such as grass or tree pollens. When an allergic person inhales an allergen into the nose, the person's body reacts by releasing a chemical known as histamine at the site of contact with the allergen. It is actually the human chemical, histamine, and not the allergen itself which causes the familiar symptoms of an allergy, such as sneezing, runny nose, nasal itching, etc. Antihistamine drugs act to prevent the allergic reaction from occurring by temporarily blocking the chemical histamine from reaching its intended sites of action in the nose and eyes, when an allergen is present.

There are more than one hundred antihistamine products on the market. If you have ever bought an antihistamine drug, you probably realize that there are many kinds of antihistamine products with many different features. What we want to find in this survey is how important many of these product features are to you. That is, if you were to buy an antihistamine product, we would like to understand what are the important features that you might look for, and also, which features might not be so important to you.

For each product feature shown below, please CIRCLE the number in the right hand column which best describes how important that feature would be to you, if you were going to buy an antihistamine product. For instance, if you felt that the "appearance of product packaging" was extremely important to you, you would circle the number "6" in the column below. But, if you felt that the "time required for the drug to work at 'peak' effectiveness" was of moderate or medium importance to you, you would circle "3" in the column below. If you thought that it was of no importance, you would circle "0", and so on.

<table>
<thead>
<tr>
<th>Question</th>
<th>No Importance</th>
<th>Extremely Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-1. Appearance of product packaging (box, bottle, labels, etc.)</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-2. Time required for drug to work at &quot;peak&quot; effectiveness</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-3. How much the product is advertised</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-4. Package sizes available</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>No Importance</td>
<td>Extremely Important</td>
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</tr>
<tr>
<td>Q-5. Ability to take whenever needed</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-6. Whether product was once available by prescription only</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-7. Does product require a prescription</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Q-8. Whether product is made by generic as well as brand-name companies</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Q-9. Whether product is available as a tablet, capsule, liquid, etc.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Q-10. How quickly the product works after being swallowed.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-11. Appearance of drug to be taken</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-12. How long product lasts before it has to be taken again</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-13. How good the product tastes</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-14. How easy the product is to swallow</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Q-15. Whether side effects fade away after a few days of taking the product.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Q-16. How bad the danger of taking an overdose of the product is</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Whether the product causes:</td>
<td></td>
<td></td>
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<tr>
<td>Q-17. Drowsiness</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Q-18. Sedation</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
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<tr>
<td>Q-19. Dry mouth</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-20. Constipation</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-21. Dizziness</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-22. Abdominal upset</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-23. Blurred vision</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Question Number</td>
<td>Question</td>
<td>Importance</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>Q-24</td>
<td>Difficulty in urinating</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-25</td>
<td>General &quot;fuzziness&quot; in the mind</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-26</td>
<td>Excessive dryness of nasal passages</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-27</td>
<td>Fast pulse</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-28</td>
<td>Whether product is safe to take while pregnant</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-29</td>
<td>Whether product is safe to take while driving</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-30</td>
<td>Whether allergy symptoms get worse than before the product was taken, after the product is stopped</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-31</td>
<td>How effective product is in stopping all symptoms of allergic rhinitis</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-32</td>
<td>Whether product can be used for motion sickness</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-33</td>
<td>Whether product can be used to help you sleep</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-34</td>
<td>Whether the product becomes less effective the more it is used</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-35</td>
<td>Stop sneezing</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-36</td>
<td>Dry runny nose</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-37</td>
<td>Stop nasal itching</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-38</td>
<td>Stop itchy eyes</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-39</td>
<td>Stop watery eyes</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Q-40</td>
<td>How safe the product is to take if you have high blood pressure</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>(Please Circle Number)</td>
<td>No Importance</td>
<td>Extremely Important</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>

Whether the product can be used:

Q-41. *If you are breast-feeding* 0 1 2 3 4 5 6
Q-42. *In females of child-bearing age* 0 1 2 3 4 5 6
Q-43. *If you have a thyroid condition* 0 1 2 3 4 5 6
Q-44. *If you have glaucoma* 0 1 2 3 4 5 6

Whether there is danger of interaction of the product with:

Q-45. *Other medications* 0 1 2 3 4 5 6
Q-46. *Alcohol* 0 1 2 3 4 5 6
Q-47. *Other diseases* 0 1 2 3 4 5 6

Are there any other product features that we didn't include above. If so, please write them below and rate each of your product features in the right hand column.

Q-48. 0 1 2 3 4 5 6
Q-49. 0 1 2 3 4 5 6
Q-50. 0 1 2 3 4 5 6
Q-51. 0 1 2 3 4 5 6
Are there any other comments that you would like to make? If so, please feel free to use the space below for anything that you would like to write. Thanks for completing this questionnaire.

<table>
<thead>
<tr>
<th>(Please Circle Number)</th>
<th>No Importance</th>
<th>Extremely Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-52.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-53.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-54.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
</tbody>
</table>

Gregory Reardon & Dev S. Pathak  
Ohio State Univ. College of Pharmacy  
500 W. 12th Av.  
Columbus, OH 43210  
(614) 422-2038
Appendix C

PILOT TEST QUESTIONNAIRE
October 28, 1986

Dear Allergy Panel Member,

Sorry about taking so long to mail the second part of my study to you. Thanks to the results of the first questionnaire that you filled out, I've been able to move into the final phase of my study. In this part of the study I ask you to again fill out a questionnaire. I will use the results from all of the panel member responses as a check on my questionnaire before mailing it to two thousand employees at Ohio State University.

I am trying to find out two things from your responses. First, I simply want to see whether I've made the questionnaire understandable enough for an allergy sufferer to fill out. Secondly, I want to find out from you whether there are any problems that need to be solved before the questionnaire goes out to the two thousand person sample. Please feel free to make any comments in the margins while you answer the questions.

I am now making plans for the printing of the final version of this questionnaire. Because of this, may I ask you to return this questionnaire as soon as possible? I'm sorry to burden you with this under such short notice, but if it's any consolation, I won't be bothering you with more of these damn questionnaires.

Once you complete the questionnaire, simply place it in the stamped return envelope and mail it back to me.

Thanks for your help.

(614) 422-2266

[Signature]
November 1, 1986

Dear Apothecary Shopper,

At the Ohio State University we are studying allergy sufferers' attitudes to various antihistamine drug products. If you have experienced at least one case of allergy which affected your nose, eyes, ears or throat in the last six months, then we would like to have you take part in this study. This study will take only 25 to 30 minutes of your time, and can be completed in your home or office.

The pharmacist will give you a packet which contains a survey questionnaire and a stamped-return envelope. Please read the questionnaire and answer each of the questions. We also need your comments. Since we plan to survey 2000 people in the next few weeks, you can make a major contribution to this study by letting us know if you feel that a particular question would be difficult for an average person to answer. Please feel free to write down any problems or feelings that you have about the questionnaire. We will look at your comments to improve the survey. All of your answers and comments will be kept confidential.

Please complete and mail the questionnaire as soon as possible since we need your answers and comments before we mail questionnaires to 2000 people. As soon as we receive your questionnaire, your participation in the study will be completed. Please include your return address. We will mail you $5.00 for your time.

Thanks for your help. If we can be of help to you, please call us at the number below.

Gregory Reardon
Assistant Professor
Division of Pharmaceutical Administration
College of Pharmacy
The Ohio State University
Columbus, OH 43210
(614) 292-1716

Dev S. Pathak
Professor & Associate Dean
Graduate & Research Studies
College of Pharmacy
The Ohio State University
Columbus, OH 43210
The purpose of this survey is to measure the value placed by allergy sufferers on various types of antihistamine drug products. Please answer all of the questions. If you wish to comment on any questions or qualify your answers, please feel free to use the space available in the margins. Your comments will be extremely useful in future revisions of this survey.

Thank you for your help.

Gregory Reardon  
Assistant Professor  
Division of Pharmaceutical Administration  
College of Pharmacy  
The Ohio State University  
Columbus, OH 43210  
(614) 422-1716

Dev S. Pathak  
Professor & Associate Dean  
Graduate & Research Studies  
College of Pharmacy  
The Ohio State University  
Columbus, OH 43210
Section I - Allergy

An allergy is a condition that may take a variety of forms. In the allergy process, a person becomes extremely sensitive to exposure to particular chemical substances, known as allergens. An allergen is an agent which starts the allergic reaction in a person. Depending upon the nature of the allergy, an allergen can take the form of such things as certain foods, drugs, soaps, cosmetics, animal hair or dander, plant pollens, or others. According to a recent study, it was estimated that over 50 million Americans have reported having allergic reactions to one or more of such allergens.

Q-1. Are there any substances or allergens to which you are, or suspect you are, allergic? If so, please list them below:

__________________________________________

__________________________________________

Q-2. To the best of your judgement, have you experienced at least one case of allergy during the last SIX months? (please circle one answer)

1 YES

2 NO

If you circled 2, please skip the next few pages and go directly to page 16.

Q-3. Since you experienced at least one case of allergy in the last six months, please CIRCLE the numbers below which describe where the symptoms of your allergy (such as itching, watery discharge, redness, sneezing, etc.) occurred during the last six months. (Please circle all numbers which apply)

1 EYES
2 EARS
3 NOSE
4 THROAT
5 CHEST
6 SKIN
7 OTHER AREA OF THE BODY

If you circled either 1, 2, 3 or 4 above then please go to Q-4.

If you did not circle either 1, 2, 3 or 4 above then please skip to page 16.
Q-4. How much does your allergy affect your lifestyle? (please circle one choice in each column)

A. DURING THE TIME OF THE YEAR WHEN MY ALLERGY IS WORST, IT BOTHERS ME:

   | 1 | A GREAT DEAL |
   | 2 | A LARGE AMOUNT |
   | 3 | A FAIR AMOUNT |
   | 4 | A LITTLE |
   | 5 | NOT AT ALL |

B. IN GENERAL, DURING THE ENTIRE YEAR, MY ALLERGY BOTHERS ME:

   | 1 | A GREAT DEAL |
   | 2 | A LARGE AMOUNT |
   | 3 | A FAIR AMOUNT |
   | 4 | A LITTLE |
   | 5 | NOT AT ALL |

Q-5. Which statement best describes the timing of your allergy symptoms? (please circle one choice)

   1. MY ALLERGY SEEMS TO COME AND GO, DEPENDING UPON THE SEASON.
   2. I EXPERIENCE SOME TYPE OF ALLERGY ALL, OR NEARLY ALL, OF THE YEAR.

Q-6. Have you visited or consulted with a physician about your allergy at some time during 1986? (please circle one choice)

   1. YES
   2. NO

Q-7. Please write the names of all medications, allergy shots and home remedies that you have taken for allergies during the LAST SIX MONTHS. If you cannot remember the name of a medication that you took, please describe as best you can what the medication looked like.

NAME OF MEDICATION

DID YOU RECEIVE THE PRODUCT
BY PRESCRIPTION? (please circle)

   A. ____________________________ YES NO
   B. ____________________________ YES NO
   C. ____________________________ YES NO
   D. ____________________________ YES NO
   E. ____________________________ YES NO
Section II - Estimated Cost of Treating Allergy Symptoms

The term, "allergic rhinitis," will appear several times in the text of this questionnaire. Allergic rhinitis is an immune system reaction (allergy) to an allergen that may result in a number of symptoms, including: a runny nose; nasal stuffiness; itchy eyes, nose, ears and throat; red, watery eyes; and sneezing. In this section, we would like you to estimate the total amount that has been spent on your allergic rhinitis for the LAST SIX MONTHS. Also, we would like you to estimate what percentage of this cost of your allergic rhinitis was paid by insurance, and what percentage was paid by you. Please fill in the blanks, where appropriate, in the box below:

<table>
<thead>
<tr>
<th>Q-8. ITEM</th>
<th>TOTAL COST</th>
<th>% PAID BY YOU</th>
<th>% PAID BY INSURANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Physician fees for allergic rhinitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Prescription medication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Non-prescription medication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Air conditioning and purification costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Travel costs due to allergic rhinitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Other Costs (please specify on blank lines):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Please add up the total for this column:</td>
<td></td>
<td></td>
<td>TOTAL COST</td>
</tr>
</tbody>
</table>
Section III - Willingness to Pay (WTP)

In this section we are interested in measuring how much allergic rhinitis affects your life. Consider the following:

- the amount of discomfort caused by your allergy.
- the drugs you might normally take for your allergy.
- visits to your doctor for your allergy.
- how your allergy affects your performance for work, school, family and other social activities and relationships.

One way to measure the effect which allergic rhinitis has on your life is to see how much you would be willing to pay to be free of this allergy condition. It may seem unbelievable, but imagine that you could have spent the last six months free from allergic rhinitis symptoms. For the remainder of this questionnaire, imagine that you have NO HEALTH INSURANCE. As such, the total out-of-pocket costs that you would have saved by not having allergic rhinitis would be the value for TOTAL COST on page 3, question B-K.

Taking all of the above into consideration, what is the MAXIMUM amount that you would be willing to pay to avoid allergic rhinitis symptoms like the ones that you have experienced during the past six months?

Remember that for every dollar that you would pay for total relief, you would have one dollar less to spend or save elsewhere. This would have to come from your income or savings.

Q-9. $________ (is the MOST I would pay for six months avoidance of allergic rhinitis symptoms)

This is your Willingness-to-Pay or "WTP." Later, we will ask you to consider your "WTP" value.

Q-10. How many hours do you think you would have to work at your job to earn enough money to pay the dollar amount in Q-9?

________ hours would have to be worked.

Now, assume that your allergy symptoms became TWICE as bad as those that you experienced during the past six months. What is the MOST that you would be willing to pay to avoid six months of symptoms that are TWICE as bad as those that you experienced?

Q-11. $________ (for six months avoidance of symptoms that are TWICE as bad)
What if these symptoms were only HALF as bad as those that you truly experienced for the past six months. What is the most that you would be willing to pay to avoid six months of symptoms that are only HALF as bad as those that you actually experienced?

Q-12. $ _____ (for six months avoidance of symptoms that are HALF as bad)

Section IV - Antihistamine Features

An antihistamine drug is one which relieves many of the symptoms of an allergy by temporarily blocking the effect of a chemical in the body, known as histamine, which is the major contributor to the allergic reaction. For most people who plan to select a particular product, such as an antihistamine, some product features are more important than others. In this section you are asked to rate the IMPORTANCE of each of the following antihistamine product features to you by circling the number that best describes your belief. The higher the number circled, the more important a certain product feature is to you.

<table>
<thead>
<tr>
<th>PRODUCT FEATURES</th>
<th>NO IMPORTANCE</th>
<th>EXTREMELY IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-13. RELIEF - How well the product works to relieve itchy/watery eyes, nasal itching and sneezing.</td>
<td>0 1 2 3 4 5 6</td>
<td>Please Circle</td>
</tr>
<tr>
<td>Q-14. DROWSINESS - Whether the product causes drowsiness.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-15. TAKEN - How often the product must be taken to work effectively.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-16. PRESCRIPTION STATUS - Whether the product requires a prescription.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-17. SPEED OF ACTION - How long the product takes to go to work to relieve symptoms.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-18. DRUG INTERACTION - Whether the product worsens the intoxicating effects of alcohol or tranquilizers.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td>Q-19. DRYNESS - Whether the product causes some temporary dryness of the nose, mouth and eyes.</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
</tr>
</tbody>
</table>
Section V - Examples of Antihistamine Features

In this section are found examples of features, associated with antihistamine products, which can be used to treat allergic rhinitis. Please rate your preference for each example by using the scale located to the right. The more that you LIKE an example of an antihistamine feature, the larger the PLUS number that you assign to it. The largest plus number is "+4." On the other hand, the more that you DISLIKE an example of a feature, the larger NEGATIVE number that you assign to it. The largest negative number is "-4." If you have no particular preference for an example, then you should assign it "0" on the scale.

The term, "placebo," will be mentioned several times. A placebo is nothing more than a tablet or capsule which contains no active ingredients. When an antihistamine drug is tested for effectiveness and side effects, a placebo is often used as a comparison.

**Examples**

<table>
<thead>
<tr>
<th>RELIEF</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well does the product work to relieve itchy/watery eyes, nasal itching and sneezing?</td>
<td></td>
<td>Please circle numbers below</td>
<td></td>
</tr>
<tr>
<td>Q-20. 4 out of 10 people reported good to excellent relief of these symptoms. This is similar to the degree of relief that people taking placebos experienced.</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>Q-21. 6 out of 10 people reported good to excellent relief of symptoms.</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>Q-22. 7 out of 10 people reported good to excellent relief of symptoms.</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
</tbody>
</table>

**Drowsiness**

Does the product cause drowsiness?

<table>
<thead>
<tr>
<th>DROWSINESS</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-23. 1 person in 10 reported drowsiness after taking this product. This rate of drowsiness is similar to what people given placebos experienced.</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>Q-24. 3 people in 10 reported drowsiness after taking.</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>Q-25. 4 people in 10 reported drowsiness after taking.</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>Q-26. 6 people in 10 reported drowsiness after taking.</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
</tbody>
</table>
TAKEN
In order to work most effectively, how often must the product be taken?

Q-27. once a day. .................. -4 -3 -2 -1 0 +1 +2 +3 +4
Q-28. two times daily. ............... -4 -3 -2 -1 0 +1 +2 +3 +4
Q-29. four times daily. ............... -4 -3 -2 -1 0 +1 +2 +3 +4

PRESCRIPTION STATUS
Does the product require a prescription?

Q-30. Yes - prescription required. .... -4 -3 -2 -1 0 +1 +2 +3 +4
Q-31. No - can be bought directly off the store shelf. .......... -4 -3 -2 -1 0 +1 +2 +3 +4

SPEED OF ACTION
How long, after taking the product, does it take to go to work to relieve symptoms?

Q-32. 30 minutes on average. ........... -4 -3 -2 -1 0 +1 +2 +3 +4
Q-33. 90 minutes on average. .......... -4 -3 -2 -1 0 +1 +2 +3 +4

DRUG INTERACTION
Does scientific evidence show that taking the product worsens the intoxicating effects of alcohol or tranquillizers?

Q-34. Yes - makes the intoxication worse. .. -4 -3 -2 -1 0 +1 +2 +3 +4
Q-35. No - has no effect on intoxication. .... -4 -3 -2 -1 0 +1 +2 +3 +4

DRYNESS
Does the product cause some temporary dryness of the nose, mouth and eyes?

Q-36. Yes. .......................... -4 -3 -2 -1 0 +1 +2 +3 +4
Q-37. No. ............................. -4 -3 -2 -1 0 +1 +2 +3 +4
Section VI - Full Product Evaluation

If you've ever gone shopping for allergy medicine, then you probably realize that there are many drug products on the market. In this section a number of hypothetical antihistamine drug products are described, in this way:

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Simply described as some letter of the alphabet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taken</td>
<td>How often the product has to be taken daily.</td>
</tr>
</tbody>
</table>
| Rx Needed?   | YES, if one needs a prescription to buy this product.  
              | NO, if one can buy the product without a prescription. |
| Speed        | On average, how long the product takes to go to work to relieve allergy symptoms. |
| Interaction? | YES, if the product worsens intoxication for one who has taken alcohol or tranquilizers.  
              | NO, if the product has no effect on alcohol or tranquilizers. |
| Cause dryness? | YES, if the product causes some dryness of the mouth, nose and eyes.  
                | NO, if the product has no dryness effect. |
| Relief       | How many people reported good to excellent relief of allergy symptoms. If this relief was the same as people taking a placebo experienced, this is noted. |
| Drowsiness   | How many people reported at least some drowsiness soon after taking the product. If this drowsiness was the same as people taking a placebo experienced, this was noted. |

Fig. 11.
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

**MY WTP IS:** $ __________

This is what you would pay for total relief. Instead of total relief, we are going to show examples of antihistamine products to you and ask you to evaluate them for treating your allergic rhinitis. Starting with Product A, please carefully read the description for each product and answer the two questions that appear to the right of each product description.

Please remember, that when you are asked how much you would have been willing to pay for a product, you should act as if you had NO HEALTH INSURANCE; payment would come from your income or savings. If, at some time you have a change of heart about an answer, please feel free to change it.

<table>
<thead>
<tr>
<th>Taken</th>
<th>Once a day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx needed?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Speed</td>
<td>30 minutes.</td>
</tr>
<tr>
<td>Interaction?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Cause dryness?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Relief</td>
<td>4 in 10 reported relief. (same as placebo)</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>1 in 10 reported drowsiness. (same as placebo)</td>
</tr>
</tbody>
</table>

**PRODUCT A**

-> Q-38. Using the WTP amount above as a reference only, what is the MAXIMUM amount of money that you would have been willing to pay for the use of Product A, during the LAST SIX MONTHS, if it was offered to you?

$ __________ (PLEASE WRITE $ AMOUNT)

-> Q-39. Please circle the number of the choice which best describes how you feel about Product A?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

<table>
<thead>
<tr>
<th>Taken</th>
<th>Twice a day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx needed?</td>
<td>No.</td>
</tr>
<tr>
<td>Speed</td>
<td>30 minutes.</td>
</tr>
<tr>
<td>Interaction?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Cause dryness?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Relief</td>
<td>7 in 10 reported relief.</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>3 in 10 reported drowsiness.</td>
</tr>
</tbody>
</table>

**PRODUCT B**

-> Q-40. If, instead of the previous product, this new product, Product B, was offered to you, what would you have been willing to pay for the use of Product B during the LAST SIX MONTHS?

$ __________ (PLEASE WRITE $ AMOUNT)

-> Q-41. Please circle the number of the choice which best describes how you feel about Product B?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

**MY WTP IS:**

<table>
<thead>
<tr>
<th>Taken</th>
<th>Four times a day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx needed?</td>
<td>Yes.</td>
</tr>
<tr>
<td><strong>PRODUCT</strong> Speed</td>
<td>90 minutes.</td>
</tr>
<tr>
<td>Interaction?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Cause dryness?</td>
<td>No.</td>
</tr>
<tr>
<td>Relief</td>
<td>7 in 10 reported relief.</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>1 in 10 reported drowsiness. (same as placebo)</td>
</tr>
</tbody>
</table>

- Q-42. Keeping in mind your WTP amount above, what is the MAXIMUM amount of money that you would have been willing to pay for the use of Product C during the LAST SIX MONTHS, if it was offered to you?

$______

(PLEASE WRITE $ AMOUNT)

- Q-43. Please circle the number of the choice which best describes how you feel about Product C?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

<table>
<thead>
<tr>
<th>Taken</th>
<th>Twice a day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx needed?</td>
<td>No.</td>
</tr>
<tr>
<td><strong>PRODUCT</strong> Speed</td>
<td>30 minutes.</td>
</tr>
<tr>
<td>Interaction?</td>
<td>No.</td>
</tr>
<tr>
<td>Cause dryness?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Relief</td>
<td>6 in 10 reported relief.</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>1 in 10 reported drowsiness. (same as placebo)</td>
</tr>
</tbody>
</table>

- Q-44. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product D during the LAST SIX MONTHS?

$______

- Q-45. Please circle the number of the choice which best describes how you feel about Product D?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

<table>
<thead>
<tr>
<th>Taken</th>
<th>Once a day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx needed?</td>
<td>No.</td>
</tr>
<tr>
<td><strong>PRODUCT</strong> Speed</td>
<td>30 minutes.</td>
</tr>
<tr>
<td>Interaction?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Cause dryness?</td>
<td>No.</td>
</tr>
<tr>
<td>Relief</td>
<td>6 in 10 reported relief.</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>3 in 10 reported drowsiness.</td>
</tr>
</tbody>
</table>

- Q-46. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product E during the LAST SIX MONTHS?

$______

- Q-47. Please circle the number of the choice which best describes how you feel about Product E?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
Takao

Twice a day.

Rx needed? Yes.

PRODUCT Speed 90 minutes. F

Interaction? No.

Cause dryness? Yes.

Relief 4 in 10 reported relief.

(same as placebo)

Drowsiness 3 in 10 reported drowsiness.

Q-48. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product F during the LAST SIX MONTHS?

$________ (PLEASE WRITE $ AMOUNT)

Q-49. Please circle the number of the choice which best describes how you feel about Product F?

EXTREME

DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Q-50. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product G during the LAST SIX MONTHS?

$________

Q-51. Please circle the number of the choice which best describes how you feel about Product G?

EXTREME

DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Q-52. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product H during the LAST SIX MONTHS?

$________

Q-53. Please circle the number of the choice which best describes how you feel about Product H?

EXTREME

DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

MY WTP IS: $______

**Q-54.** Keeping in mind your WTP amount above, what is the MAXIMUM amount of money that you would have been willing to pay for the use of Product I during the LAST SIX MONTHS?

$_______ (PLEASE WRITE $ AMOUNT)

**Q-55.** Please circle the number of the choice which best describes how you feel about Product I?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

**Q-56.** What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product J during the LAST SIX MONTHS?

$_______

**Q-57.** Please circle the number of the choice which best describes how you feel about Product J?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

**Q-58.** What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product K during the LAST SIX MONTHS?

$_______

**Q-59.** Please circle the number of the choice which best describes how you feel about Product K?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
Taken
Twice a day.
Rx needed? Yes.
Speed 90 minutes. PRODUCT L
Interaction? Yes.
Cause dryness? Yes.
Relief 6 in 10 reported relief.
Drowsiness 4 in 10 reported drowsiness.

Taken
Once a day.
Rx needed? Yes.
Speed 90 minutes. PRODUCT M
Interaction? No.
Cause dryness? No.
Relief 6 in 10 reported relief.
Drowsiness 6 in 10 reported drowsiness.

Taken
Twice a day.
Rx needed? No.
Speed 30 minutes. PRODUCT N
Interaction? Yes.
Cause dryness? Yes.
Relief 7 in 10 reported relief.
Drowsiness 6 in 10 reported drowsiness.

Q-60. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product L during the LAST SIX MONTHS?

$________ (PLEASE WRITE $ AMOUNT)

Q-61. Please circle the number of the choice which best describes how you feel about Product L?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Q-62. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product M during the LAST SIX MONTHS?

$________

Q-63. Please circle the number of the choice which best describes how you feel about Product M?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Q-64. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product N during the LAST SIX MONTHS?

$________

Q-65. Please circle the number of the choice which best describes how you feel about Product N?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

**MY WTP IS:**

<table>
<thead>
<tr>
<th>Taken</th>
<th>Rx needed?</th>
<th>Speed</th>
<th>Interaction?</th>
<th>Cause dryness?</th>
<th>Relief</th>
<th>Drowsiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 times a day</td>
<td>No.</td>
<td>30 min.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>7 in 10</td>
<td>6 in 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>reported relief.</td>
<td></td>
</tr>
</tbody>
</table>

> Q-66. Keeping in mind your WTP amount above, what is the MAXIMUM amount of money that you would have been willing to pay for the use of Product O during the LAST SIX MONTHS?

$_______ (PLEASE WRITE $ AMOUNT)

> Q-67. Please circle the number of the choice which best describes how you feel about Product O?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 EXTREME LIKE

<table>
<thead>
<tr>
<th>Taken</th>
<th>Rx needed?</th>
<th>Speed</th>
<th>Interaction?</th>
<th>Cause dryness?</th>
<th>Relief</th>
<th>Drowsiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twice a day</td>
<td>No.</td>
<td>90 min.</td>
<td>Yes.</td>
<td>No.</td>
<td>4 in 10</td>
<td>6 in 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>reported relief.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(same as placebo)</td>
<td></td>
</tr>
</tbody>
</table>

> Q-68. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product P during the LAST SIX MONTHS?

$_______

> Q-69. Please circle the number of the choice which best describes how you feel about Product P?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 EXTREME LIKE

<table>
<thead>
<tr>
<th>Taken</th>
<th>Rx needed?</th>
<th>Speed</th>
<th>Interaction?</th>
<th>Cause dryness?</th>
<th>Relief</th>
<th>Drowsiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twice a day</td>
<td>No.</td>
<td>90 min.</td>
<td>No.</td>
<td>No.</td>
<td>6 in 10</td>
<td>6 in 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>reported relief.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(same as placebo)</td>
<td></td>
</tr>
</tbody>
</table>

> Q-70. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product Q during the LAST SIX MONTHS?

$_______

> Q-71. Please circle the number of the choice which best describes how you feel about Product Q?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 EXTREME LIKE
> Q-72. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product R during the LAST SIX MONTHS?

$_____ (PLEASE WRITE $ AMOUNT)

> Q-73. Please circle the number of the choice which best describes how you feel about Product R?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

> Q-74. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product S during the LAST SIX MONTHS?

$_____ 

> Q-75. Please circle the number of the choice which best describes how you feel about Product S?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
Section VII - Demographics

Finally, we would like to ask you a few questions about yourself to help interpret the results.

Q-76. What is your sex? (please circle)
   1 FEMALE
   2 MALE

Q-77. What is your age?

______ YEARS

Q-78. How long have you been employed at OSU?

______ YEARS

Q-79. Do you have asthma? (please circle)
   1 YES
   2 NO

Q-80. What was your approximate gross family income in 1985? (please circle one choice)
   1 LESS THAN $5,000
   2 $5,000 TO $9,999
   3 $10,000 TO $17,499
   4 $17,500 TO $24,999
   5 $25,000 TO $34,999
   6 $35,000 TO $49,999
   7 $50,000 TO $69,999
   8 $70,000 TO $100,000
   9 OVER $100,000
Is there anything else that you would like to share about your allergy or the drugs used to treat it? If so, please feel free to make any comments that you feel may help us in understanding the disease of allergic rhinitis or drug therapy used to treat it.

We thank you for your contribution to this study.

Gregory Reardon and Dev S. Pathak
Division of Pharmaceutical Administration
The Ohio State University College of Pharmacy

Please seal this questionnaire and drop in CAMPUS mail.
Please return through CAMPUS mail to:

PROF GREGORY REARDON
500 W 12TH AVENUE
LLOYD M PARKS HALL
THE OHIO STATE UNIV
CAMPUS
Research Involving Human Subjects

ACTION OF THE REVIEW COMMITTEE

With regard to the employment of human subjects in the proposed research protocol:

86B0188 CONTINGENT VALUATION AND UTILITY MODELS FOR ECONOMIC EVALUATION OF PHARMACEUTICALS: A STUDY OF ANTIHISTAMINES, Dev S. Pathak, Gregory Reardon, Pharmacy

THE BEHAVIORAL AND SOCIAL SCIENCES REVIEW COMMITTEE HAS TAKEN THE FOLLOWING ACTION:

| X | APPROVED |
|   | DISAPPROVED |
|   | APPROVED WITH CONDITIONS* |
|   | X WAIVER OF WRITTEN CONSENT GRANTED |

* Conditions stated by the Committee have been met by the Investigator and, therefore, the protocol is APPROVED.

It is the responsibility of the principal investigator to retain a copy of each signed consent form for at least four (4) years beyond the termination of the subject's participation in the proposed activity. Should the principal investigator leave the University, signed consent forms are to be transferred to the Human Subjects Review Committee for the required retention period. This application has been approved for the period of one year. You are reminded that you must promptly report any problems to the Review Committee, and that no procedural changes may be made without prior review and approval. You are also reminded that the identity of the research participants must be kept confidential.

Date: November 21, 1986
Signed: [Signature]

(Chairperson)
Dear University Employee,

At the OSU College of Pharmacy, we are studying consumers' attitudes toward various antihistamine drug products. There are a wide variety of antihistamine products on the market, with many different features. Some products seem to be more highly valued by consumers than others, but different consumers may prefer different product features. Much is still unknown about these preferences. There is a great deal for scientists to learn about this area.

Through your participation, we can gain a better understanding of how and why individuals prefer some products to others. Hopefully, such research may someday lead to the design of pharmaceutical products which meet the needs of individuals in a better way than do existing products. If you would like to participate in our study, please read and answer the questions in the booklet. Your responses to the questions in the booklet will be extremely useful, whether you have an allergy or not. This study will take approximately 20 to 40 minutes of your time, and can be completed in your home or office.

On the front of the booklet is a stamped number. This is simply to identify where a returned question booklet came from. We will use the number to check your name off, on our mailing list, when your booklet is returned. Your name will never appear on the booklet and your identity will always be kept completely confidential.

You may return the booklet to us by simply sealing the booklet shut, and dropping the booklet in CAMPUS mail. No return envelope or postage is necessary.

If we can be of help to you, please call us at the number below or write to our campus address.

Gregory Reardon
Assistant Professor
Division of Pharmaceutical Administration
College of Pharmacy
The Ohio State University
Columbus, OH 43210
(614) 292-1716

Dev S. Pathak
Professor & Associate Dean
Graduate & Research Studies
College of Pharmacy
The Ohio State University
Columbus, OH 43210

November 26, 1966
ANTIHISTAMINES FOR ALLERGY SUFFERERS

The purpose of this survey is to measure the value placed by allergy sufferers on various types of antihistamine drug products. Please answer all of the questions. If you wish to comment on any questions or qualify your answers, please feel free to use the space available in the margins. Your comments will be extremely useful in future revisions of this survey.

Thank you for your help.

Gregory Reardon
Assistant Professor
Division of Pharmaceutical Administration
College of Pharmacy
The Ohio State University
Columbus, OH 43210
(614) 422-1716

Dev S. Pathak
Professor & Associate Dean
Graduate & Research Studies
College of Pharmacy
The Ohio State University
Columbus, OH 43210
Section I - Allergy

An allergy is a condition that may take a variety of forms. In the allergy process, a person becomes extremely sensitive to exposure to particular chemical substances, known as allergens. An allergen is an agent which starts the allergic reaction in a person. Depending upon the nature of the allergy, an allergen can take the form of such things as certain foods, drugs, soaps, cosmetics, animal hair or dander, plant pollens, or others. According to a recent study, it was estimated that over 50 million Americans have reported having allergic reactions to one or more of such allergens.

Q-1. Are there any substances or allergens to which you are, or suspect you are, allergic? If so, please list them below:

__________________________________________________________________________

__________________________________________________________________________

Q-2. To the best of your judgement, have you experienced at least one case of allergy during the last SIX months? (please circle one answer)

1  YES
2  NO

If you circled 2, please skip the next few pages and go directly to page 16.

Q-3. Since you experienced at least one case of allergy in the last six months, please CIRCLE the numbers below which describe where the symptoms of your allergy (such as itching, watery discharge, redness, sneezing, etc.) occurred during the last six months. (Please circle all numbers which apply)

1  EYES
2  EARS
3  NOSE
4  THROAT
5  CHEST
6  SKIN
7  OTHER AREA OF THE BODY

If you circled either 1, 2, 3 or 4 above then please go to Q-4.

If you did not circle either 1, 2, 3 or 4 above then please skip to page 16.
Q-4. How much does your allergy affect your lifestyle? (please circle one choice in each column)

A. DURING THE TIME OF THE YEAR WHEN MY ALLERGY IS WORST, IT BOTHERS ME:

<table>
<thead>
<tr>
<th></th>
<th>A GREAT DEAL</th>
<th>A LARGE AMOUNT</th>
<th>A FAIR AMOUNT</th>
<th>A LITTLE</th>
<th>NOT AT ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<td></td>
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<tr>
<td>4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. IN GENERAL, DURING THE ENTIRE YEAR, MY ALLERGY BOTHERS ME:

<table>
<thead>
<tr>
<th></th>
<th>A GREAT DEAL</th>
<th>A LARGE AMOUNT</th>
<th>A FAIR AMOUNT</th>
<th>A LITTLE</th>
<th>NOT AT ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
<td></td>
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<td></td>
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<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q-5. Which statement best describes the timing of your allergy symptoms? (please circle one choice)

1. MY ALLERGY SEEMS TO COME AND GO, DEPENDING UPON THE SEASON.
2. I EXPERIENCE SOME TYPE OF ALLERGY ALL, OR NEARLY ALL, OF THE YEAR.

Q-6. Have you visited or consulted with a physician about your allergy at some time during 1986? (please circle one choice)

1. YES
2. NO

Q-7. Please write the names of all medications, allergy shots and home remedies that you have taken for allergies during the LAST SIX MONTHS. If you cannot remember the name of a medication that you took, please describe as best you can what the medication looked like.

<table>
<thead>
<tr>
<th>NAME OF MEDICATION</th>
<th>DID YOU RECEIVE THE PRODUCT BY PRESCRIPTION? (please circle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>YES NO</td>
</tr>
<tr>
<td>B.</td>
<td>YES NO</td>
</tr>
<tr>
<td>C.</td>
<td>YES NO</td>
</tr>
<tr>
<td>D.</td>
<td>YES NO</td>
</tr>
<tr>
<td>E.</td>
<td>YES NO</td>
</tr>
</tbody>
</table>
Section II - Estimated Cost of Treating Allergy Symptoms

The term, "allergic rhinitis," will appear several times in the text of this questionnaire. Allergic rhinitis is an immune system reaction (allergy) to an allergen that may result in a number of symptoms, including: a runny nose; nasal stuffiness; itchy eyes, nose, ears and throat; red, watery eyes; and sneezing. In this section, we would like you to estimate the total amount that has been spent on your allergic rhinitis for the LAST SIX MONTHS. Also, we would like you to estimate what percentage of this cost of your allergic rhinitis was paid by insurance, and what percentage was paid by you. Please fill in the blanks, where appropriate, in the box below:

<table>
<thead>
<tr>
<th>Q-8. ITEM</th>
<th>TOTAL COST</th>
<th>% PAID BY YOU</th>
<th>% PAID BY INSURANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Physician fees for allergic rhinitis. . . . . . .</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Prescription medication. . .</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Non-prescription medication. . . .</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Air conditioning and purification costs. . .</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Travel costs due to allergic rhinitis. . .</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Other Costs (please specify on blank lines):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Please add up the total for this column &gt;------&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL COST
Section III - Willingness to Pay (WTP)

In this section we are interested in measuring how much allergic rhinitis affects your life. Consider the following:

- the amount of discomfort caused by your allergy.
- the drugs you might normally take for your allergy.
- visits to your doctor for your allergy.
- how your allergy affects your performance for work, school, family and other social activities and relationships.

One way to measure the effect which allergic rhinitis has on your life is to see how much you would be willing to pay to be free of this allergy condition. It may seem unbelievable, but imagine that you could have spent the last six months free from allergic rhinitis symptoms. For the remainder of this questionnaire, imagine that you have NO HEALTH INSURANCE. As such, the total out-of-pocket costs that you would have saved by not having allergic rhinitis might have been comparable to your TOTAL COST on page 3, question B-K.

Taking all of the above into consideration, what is the MAXIMUM amount that you would be willing to pay to avoid allergic rhinitis symptoms like the ones that you have experienced during the past six months?

Remember that for every dollar that you would pay for total relief, you would have one dollar less to spend or save elsewhere. This would have to come from your income or savings.

Q-9. $   (IS THE MOST I WOULD PAY FOR SIX MONTHS AVOIDANCE OF ALLERGIC RHINITIS SYMPTOMS)

This is your Willingness-to-Pay or "WTP." Later, we will ask you to consider your "WTP" value.

Q-10. How many hours do you think you would have to work at your job to earn enough money to pay the dollar amount in Q-9?

________ HOURS WOULD HAVE TO BE WORKED.

Now, assume that your allergy symptoms became TWICE as bad as those that you experienced during the past six months. What is the MOST that you would be willing to pay to avoid six months of symptoms that are TWICE as bad as those that you experienced?

Q-11. $   (FOR SIX MONTHS AVOIDANCE OF SYMPTOMS THAT ARE TWICE AS BAD)
What if these symptoms were only HALF as bad as those that you truly experienced for the past six months. What is the most that you would be willing to pay to avoid six months of symptoms that are only HALF as bad as those that you actually experienced?

Q-12. $ ________ (FOR SIX MONTHS AVOIDANCE OF SYMPTOMS THAT ARE HALF AS BAD)

Section IV - Antihistamine Features

An antihistamine drug is one which relieves many of the symptoms of an allergy by temporarily blocking the effect of a chemical in the body, known as histamine, which is the major contributor to the allergic reaction. For most people who plan to select a particular product, such as an antihistamine, some product features are more important than others. In this section you are asked to rate the importance of each of the following antihistamine product features to you by circling the number that best describes your belief. The higher the number circled, the more important a certain product feature is to you.

<table>
<thead>
<tr>
<th>PRODUCT FEATURES</th>
<th>NO IMPORTANCE</th>
<th>EXTREMELY IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-13. RELIEF - How well the product works to relieve itchy/watery eyes, nasal itching and sneezing.</td>
<td>0 1 2 3 4 5 6</td>
<td>Please Circle</td>
</tr>
</tbody>
</table>
Section V - Examples of Antihistamine Features

In this section are found examples of features, associated with antihistamine products, which can be used to treat allergic rhinitis. Please rate your preference for each example by using the scale located to the right. The more you LIKE an example of an antihistamine feature, the larger the PLUS number that you assign to it. The largest plus number is "+4." On the other hand, the more that you DISLIKE an example of a feature, the larger NEGATIVE number that you assign to it. The largest negative number is "-4." If you have no particular preference for an example, then you should assign it "0" on the scale.

The term, "placebo," will be mentioned several times. A placebo is nothing more than a tablet or capsule which contains no active ingredients. When an antihistamine drug is tested for effectiveness and side effects, a placebo is often used as a comparison.

EXAMPLES

<table>
<thead>
<tr>
<th>RELIEF</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well does the product work to relieve itchy/watery eyes, nasal itching and sneezing?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-20. 4 out of 10 people reported good to excellent relief of these symptoms. This is similar to the degree of relief that people taking placebos experienced.</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-21. 6 out of 10 people reported good to excellent relief of symptoms.</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-22. 7 out of 10 people reported good to excellent relief of symptoms.</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DROWSINESS</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the product cause drowsiness?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-23. 1 person in 10 reported drowsiness after taking this product. This rate of drowsiness is similar to what people given placebos experienced.</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-24. 3 people in 10 reported drowsiness after taking.</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-25. 4 people in 10 reported drowsiness after taking.</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-26. 6 people in 10 reported drowsiness after taking.</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TAKEN**
In order to work most effectively, how often must the product be taken?

<table>
<thead>
<tr>
<th>Question</th>
<th>Frequency</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-27</td>
<td>Once a day</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-28</td>
<td>Two times daily</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-29</td>
<td>Four times daily</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PRESCRIPTION STATUS**
Does the product require a prescription?

<table>
<thead>
<tr>
<th>Question</th>
<th>Requirement</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-30</td>
<td>Yes - prescription required</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-31</td>
<td>No - can be bought directly off the store shelf</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SPEED OF ACTION**
How long, after taking the product, does it take to go to work to relieve symptoms?

<table>
<thead>
<tr>
<th>Question</th>
<th>Time</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-32</td>
<td>30 minutes</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-33</td>
<td>90 minutes</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DRUG INTERACTION**
Does scientific evidence show that taking the product worsens the intoxicating effects of alcohol or tranquilizers?

<table>
<thead>
<tr>
<th>Question</th>
<th>Effect</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-34</td>
<td>Yes - makes the intoxication worse</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-35</td>
<td>No - has no effect on intoxication</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DRYNESS**
Does the product cause some temporary dryness of the nose, mouth and eyes?

<table>
<thead>
<tr>
<th>Question</th>
<th>Dryness</th>
<th>EXTREMELY DISLIKE</th>
<th>NEUTRAL</th>
<th>EXTREMELY LIKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-36</td>
<td>Yes</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-37</td>
<td>No</td>
<td>-4 -3 -2 -1 0 +1 +2 +3 +4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section VI - Full Product Evaluation

If you've ever gone shopping for allergy medicine, then you probably realize that there are many drug products on the market. In this section a number of hypothetical antihistamine drug products are described, in this way:

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>Simply described as some letter of the alphabet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAKEN</td>
<td>How often the product has to be taken daily.</td>
</tr>
<tr>
<td>RX NEEDED?</td>
<td>YES, if one needs a prescription to buy this product. NO, if one can buy the product without a prescription.</td>
</tr>
<tr>
<td>SPEED</td>
<td>On average, how long the product takes to go to work to relieve allergy symptoms.</td>
</tr>
<tr>
<td>INTERACTION?</td>
<td>YES, if the product worsens intoxication for one who has taken alcohol or tranquilizers. NO, if the product has no effect on alcohol or tranquilizers.</td>
</tr>
<tr>
<td>CAUSE DRYNESS?</td>
<td>YES, if the product causes some dryness of the mouth, nose and eyes. NO, if the product has no dryness effect.</td>
</tr>
<tr>
<td>RELIEF</td>
<td>How many people reported good to excellent relief of allergy symptoms. If this relief was the same as people taking a placebo experienced, this is noted.</td>
</tr>
<tr>
<td>DROWSINESS</td>
<td>How many people reported at least some drowsiness soon after taking the product. If this drowsiness was the same as people taking a placebo experienced, this was noted.</td>
</tr>
</tbody>
</table>
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

MY WTP IS: $ 

This is what you would pay for total relief. Instead of total relief, we are going to show examples of antihistamine products to you and ask you to evaluate them for treating your allergic rhinitis. Starting with Product A, please carefully read the description for each product and answer the two questions that appear to the right of each product description.

Please remember, that when you are asked how much you would have been willing to pay for a product, you should act as if you had NO HEALTH INSURANCE; payment would come from your income or savings. If, at some time you have a change of heart about an answer, please feel free to change it.

<table>
<thead>
<tr>
<th>Taken</th>
<th>Once a day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx needed?</td>
<td>Yes</td>
</tr>
<tr>
<td>Speed</td>
<td>30 minutes.</td>
</tr>
<tr>
<td>Interaction?</td>
<td>Yes</td>
</tr>
<tr>
<td>Cause dryness?</td>
<td>Yes</td>
</tr>
<tr>
<td>Relief</td>
<td>4 in 10 reported relief. (same as placebo)</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>1 in 10 reported drowsiness. (same as placebo)</td>
</tr>
</tbody>
</table>

PRODUCT A

$ (PLEASE WRITE $ AMOUNT)

FOR SIX MONTHS USE

Q-38. Using the WTP amount above as a reference only, what is the MAXIMUM amount of money that you would have been willing to pay for the use of Product A, during the LAST SIX MONTHS, if it was offered to you?

Q-39. Please circle the number of the choice which best describes how you feel about Product A?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Q-40. If, instead of the previous product, this new product, Product B, was offered to you, what would you have been willing to pay for the use of Product B during the LAST SIX MONTHS?

Q-41. Please circle the number of the choice which best describes how you feel about Product B?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

MY WTP IS: $______

$______ (PLEASE WRITE $ AMOUNT)
FOR SIX MONTHS USE

$______ (PLEASE WRITE $ AMOUNT)
FOR SIX MONTHS USE

$______ (PLEASE WRITE $ AMOUNT)
FOR SIX MONTHS USE

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
- Q-48. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product F during the LAST SIX MONTHS?

$_______ (PLEASE WRITE $ AMOUNT)

- Q-49. Please circle the number of the choice which best describes how you feel about Product F?

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

- Q-50. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product G during the LAST SIX MONTHS?

$_______

- Q-51. Please circle the number of the choice which best describes how you feel about Product G?

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

- Q-52. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product H during the LAST SIX MONTHS?

$_______

- Q-53. Please circle the number of the choice which best describes how you feel about Product H?

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

MY WTP IS: $ _ _ _ _ _ _ _ (PLEASE WRITE $ AMOUNT)

Q-54. Keeping in mind your WTP amount above, what is the MAXIMUM amount of money that you would have been willing to pay for the use of Product I during the LAST SIX MONTHS?

$ _______ (PLEASE WRITE $ AMOUNT)

Q-55. Please circle the number of the choice which best describes how you feel about Product I?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Q-56. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product J during the LAST SIX MONTHS?

$ _______

Q-57. Please circle the number of the choice which best describes how you feel about Product J?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Q-58. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product K during the LAST SIX MONTHS?

$ _______

Q-59. Please circle the number of the choice which best describes how you feel about Product K?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
<table>
<thead>
<tr>
<th>Taken</th>
<th>Twice a day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx needed?</td>
<td>Yes</td>
</tr>
<tr>
<td>Speed</td>
<td>90 minutes.</td>
</tr>
<tr>
<td>Interaction</td>
<td>Yes.</td>
</tr>
<tr>
<td>Cause dryness?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Relief</td>
<td>6 in 10 reported relief.</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>4 in 10 reported drowsiness.</td>
</tr>
</tbody>
</table>

**Q-60.** What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product L during the LAST SIX MONTHS?

$________ (PLEASE WRITE $ AMOUNT)

**Q-61.** Please circle the number of the choice which best describes how you feel about Product L?

<table>
<thead>
<tr>
<th>Relief</th>
<th>Drowsiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in 10 reported relief.</td>
<td>4 in 10 reported drowsiness.</td>
</tr>
</tbody>
</table>

| EXTREME DISLIKE | -4 -3 -2 -1 0 +1 +2 +3 +4 EXTREME LIKE |

**Q-62.** What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product M during the LAST SIX MONTHS?

$________

**Q-63.** Please circle the number of the choice which best describes how you feel about Product M?

<table>
<thead>
<tr>
<th>Relief</th>
<th>Drowsiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in 10 reported relief.</td>
<td>6 in 10 reported drowsiness.</td>
</tr>
</tbody>
</table>

| EXTREME DISLIKE | -4 -3 -2 -1 0 +1 +2 +3 +4 EXTREME LIKE |

**Q-64.** What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product N during the LAST SIX MONTHS?

$________

**Q-65.** Please circle the number of the choice which best describes how you feel about Product N?

<table>
<thead>
<tr>
<th>Relief</th>
<th>Drowsiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 in 10 reported relief.</td>
<td>6 in 10 reported drowsiness.</td>
</tr>
</tbody>
</table>

| EXTREME DISLIKE | -4 -3 -2 -1 0 +1 +2 +3 +4 EXTREME LIKE |
For your reference, please write down your willingness-to-pay (WTP) amount from page 4, Q-9.

**MY WTP IS:**

$________

**For Product O:**
- Taken: Four times a day.
- Rx needed?: No.
- Speed: 30 minutes.
- Interaction?: Yes.
- Cause dryness?: Yes.
- Relief: 7 in 10 reported relief.
- Drowsiness: 6 in 10 reported drowsiness.

-> **Q-66.** Keeping in mind your WTP amount above, what is the MAXIMUM amount of money that you would have been willing to pay for the use of Product O during the LAST SIX MONTHS?

$________ (PLEASE WRITE $ AMOUNT)

-> **Q-67.** Please circle the number of the choice which best describes how you feel about Product O?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

**For Product P:**
- Taken: Twice a day.
- Rx needed?: No.
- Speed: 90 minutes.
- Interaction?: Yes.
- Cause dryness?: No.
- Relief: 4 in 10 reported relief. (same as placebo)
- Drowsiness: 5 in 10 reported drowsiness.

-> **Q-68.** What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product P during the LAST SIX MONTHS?

$________

-> **Q-69.** Please circle the number of the choice which best describes how you feel about Product P?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

**For Product Q:**
- Taken: Twice a day.
- Rx needed?: No.
- Speed: 90 minutes.
- Interaction?: No.
- Cause dryness?: No.
- Relief: 6 in 10 reported relief.
- Drowsiness: 1 in 10 reported drowsiness. (same as placebo)

-> **Q-70.** What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product Q during the LAST SIX MONTHS?

$________

-> **Q-71.** Please circle the number of the choice which best describes how you feel about Product Q?

EXTREME DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
Taken
Once a day.
Rx needed?
No.
Speed 90 minutes.
Interaction?
No.
Cause dryness?
Yes.
Relief 7 in 10 reported relief.
Drowsiness 4 in 10 reported drowsiness.

$________ (PLEASE WRITE $ AMOUNT)
FOR SIX MONTHS USE

-> Q-72. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product R during the LAST SIX MONTHS?

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

Taken
Four times a day.
Rx needed?
Yes.
Speed 30 minutes.
Interaction?
No.
Cause dryness?
Yes.
Relief 6 in 10 reported relief.
Drowsiness 6 in 10 reported drowsiness.

-> Q-73. Please circle the number of the choice which best describes how you feel about Product R?

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE

-> Q-74. What is the MAXIMUM amount of money that you would have been willing to pay for the use of Product S during the LAST SIX MONTHS?

$________

-> Q-75. Please circle the number of the choice which best describes how you feel about Product S?

EXTREME
DISLIKE -4 -3 -2 -1 0 +1 +2 +3 +4 LIKE
Section VII - Demographics

Finally, we would like to ask you a few questions about yourself to help interpret the results.

Q-76. What is your sex? (please circle)
   1 FEMALE
   2 MALE

Q-77. What is your age?
   _____ YEARS

Q-78. Please list any health insurance plans in which you are enrolled:

Q-79. Do you have asthma? (please circle)
   1 YES
   2 NO

Q-80. What was your approximate gross family income in 1985? (please circle one choice)
   1 LESS THAN $5,000
   2 $5,000 TO $9,999
   3 $10,000 TO $17,499
   4 $17,500 TO $24,999
   5 $25,000 TO $34,999
   6 $35,000 TO $49,999
   7 $50,000 TO $69,999
   8 $70,000 TO $100,000
   9 OVER $100,000

Q-81. Please circle the choice that best describes the educational level which you have completed?
   1 SOME ELEMENTARY SCHOOL
   2 ELEMENTARY SCHOOL GRADUATION
   3 SOME HIGH SCHOOL
   4 HIGH SCHOOL GRADUATION
   5 SOME COLLEGE
   6 COLLEGE GRADUATION
   7 POST-GRADUATE COLLEGE EDUCATION

Q-82. How many minutes did it take to fill out this booklet?
   APPROXIMATELY ________ MINUTES
Is there anything else that you would like to share about your allergy or the drugs used to treat it? If so, please feel free to make any comments that you feel may help us in understanding the disease of allergic rhinitis or drug therapy used to treat it.

We thank you for your contribution to this study.

Gregory Reardon and Dev S. Pathak
Division of Pharmaceutical Administration
The Ohio State University College of Pharmacy

Please seal this questionnaire and drop in CAMPUS mail.
Please return through CAMPUS mail to:

PROF GREGORY REARDON
500 W 12TH AVENUE
LLOYD M PARKS HALL
THE OHIO STATE UNIV
CAMPUS
REMINDER POSTCARD

December 17, 1986

In the past few weeks a questionnaire was sent to you which concerned the value of antihistamine drug products to treat allergy. Your name was drawn from a random sample of all full-time University employees.

If you have already completed and returned the questionnaire to us, please accept our sincere thanks for your help in this study. If not, please do so today (even if you don't have an allergy). Because the questionnaire has been sent to a relatively small number of employees, it is very important that yours also be included in this study if the results are to accurately reflect the attitudes and values of full-time University employees.

If by chance you did not receive the questionnaire booklet, or if it was misplaced, please call (292-1716) or write to me, and I will get another one into campus mail today.

Sincerely,

[Signature]

Gregory Reardon
Asst. Professor

College of Pharmacy
500 W. 12th Av.
Columbus, OH 43210
CAMPUS
Appendix E

RESULTS OF EARLY/LATE RESPONDENT ANALYSIS
### Allergic Rhinitis Sufferers

#### Table of Cyclicality by Group

<table>
<thead>
<tr>
<th>Cycle Group</th>
<th>Frequency</th>
<th>Row Pct</th>
<th>COL Pct Early</th>
<th>COL Pct Late</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>.</td>
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<td>.</td>
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<td></td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>.</td>
<td>.</td>
<td>.</td>
<td></td>
<td>.</td>
</tr>
<tr>
<td>1</td>
<td>77</td>
<td>61</td>
<td>138</td>
<td>31.95</td>
<td>57.26</td>
</tr>
<tr>
<td></td>
<td>57.46</td>
<td>57.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>57</td>
<td>46</td>
<td>103</td>
<td>23.65</td>
<td>42.74</td>
</tr>
<tr>
<td></td>
<td>55.34</td>
<td>44.66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>42.54</td>
<td>42.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>134</td>
<td>107</td>
<td>241</td>
<td>55.60</td>
<td>44.40</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Statistics for 2-Way Tables

- **Chi-Square**: 0.005  \( DF = 1 \)  \( PROB = 0.9436 \)
- **Phi**: 0.005
- **Contingency Coefficient**: 0.005
- **Cramer's V**: 0.005
- **Likelihood Ratio Chi-Square**: 0.005  \( DF = 1 \)  \( PROB = 0.9437 \)
- **Continuity Adj. Chi-Square**: 0.004  \( DF = 1 \)  \( PROB = 0.9519 \)
- **Fisher's Exact Test (1-Tail)**: 0.5238  \( PROB = 0.0000 \)
- **Fisher's Exact Test (2-Tail)**: 1.0000
**TABLE OF SEX BY GROUP**

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**STATISTICS FOR 2-WAY TABLES**

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STATISTICS FOR 2-WAY TABLES

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allergic rhinitis sufferers

TABLE OF EDUCATION BY GROUP

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STATISTICS FOR 2-WAY TABLES

- **CHI-SQUARE** = 7.360  DF = 4  PR0B=0.1181
- **PHI** = 0.176
- **CONTINGENCY COEFFICIENT** = 0.173
- **CRAMER'S V** = 0.176
- **LIKELIHOOD RATIO CHISQUARE** = 8.533  DF = 4  PR0B=0.0739
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**STATISTICS FOR 2-WAY TABLES**

**WARNING:** OVER 20% OF THE CELLS HAVE EXPECTED COUNTS LESS THAN 5.

TABLE IS SO SPARSE THAT CHI-SQUARE MAY NOT BE A VALID TEST.

- **Chi-square:** 14.784, DF = 8, Prob = 0.0635
- **PHI:** 0.255
- **CONTINGENCY COEFFICIENT:** 0.247
- **CRAMER'S V:** 0.247
- **LIKELIHOOD RATIO CHISQUARE:** 14.909, DF = 8, Prob = 0.0609
### Allergic Rhinitis Sufferers

#### T-Test Procedure

**Variable: Age**

<table>
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<tr>
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<th>N</th>
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<th>Std Dev</th>
<th>Std Error</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Variances</th>
<th>T</th>
<th>DF</th>
<th>Prob &gt;</th>
<th>Ti</th>
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For H0: Variances are equal, $F' = 1.38$ with 132 and 104 DF, $Prob > F' = 0.0838$

**Variable: Time of Year "Allergy is Worst" Severity**

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<th>Std Dev</th>
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<th>Minimum</th>
<th>Maximum</th>
<th>Variances</th>
<th>T</th>
<th>DF</th>
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For H0: Variances are equal, $F' = 1.15$ with 105 and 131 DF, $Prob > F' = 0.4530$

**Variable: "Entire Year" Allergy Severity**

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<th>DF</th>
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For H0: Variances are equal, $F' = 1.10$ with 128 and 102 DF, $Prob > F' = 0.6054$

**Variable: Total Cost-of-Illness**

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<th>Std Error</th>
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For H0: Variances are equal, $F' = 5.25$ with 98 and 116 DF, $Prob > F' = 0.0001$

**Variable: Contingent Valuation for Avoidance of Six Months of Allergic Rhinitis Like That Experienced**

<table>
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<th>Mean</th>
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For H0: Variances are equal, $F' = 11.19$ with 100 and 126 DF, $Prob > F' = 0.0001$
Glossary of Terms

**Aggregated Utility Function** A model which measures utility for a good or service as a function determined from group, rather than individual, parameters.

**All Product Profiles** The group of product profiles consisting entirely of the subgroups: orthogonal and hold-out product profiles.

**Allergic Rhinitis** A disorder of the upper respiratory tract characterized by an immune system response to airborne allergens, especially pollen. Symptoms include rhinorrhea, conjunctivitis, nasal pruritus, lacrimation, and others.

**Attribute Category** One of the types of features which are characteristic of a product. For a pharmaceutical product, attribute categories may include: dosage form, dosing interval, color, taste, indications, etc.

**Attribute Level** The specific feature, of an attribute category, which is characteristic of a product. For a pharmaceutical product with the attribute category, dosing interval, the attribute levels may be once a day, twice a day, four times daily, etc.

**Compensating Surplus** For a given change in the health status (from the status quo) of an individual, regardless of whether the change is negatively or positively valued, compensating surplus is the change in income (positive or negative) that would be required to return an individual to the original level of satisfaction as at status quo.

**Contingent Valuation** A method of determining the value of a good or service by estimating an individual's demand, i.e. the maximum price an individual would be willing to pay for a given quantity of a good or service.

**Ecological Representativeness** In evaluating external validity, ecological representativeness refers to the extent to which the results of an empirical study can be generalized from the sample to other or larger populations (Kerlinger, 1973).

**Expected Benefit** The net benefit, which results from the sum of all possible benefits, times the subjective probability of benefit occurrence. For instance, a product that is perceived to have a 0.5 chance of completely eradicating a disease, and a 0.5 chance of not altering the disease at all, has a net benefit of 50% disease eradication.

**Health Productivity (Human Capital) Function** A method of determining the value of a health good or service by specifying a relationship
between an individual's health and his/her expenditures for treatment and prevention of illness, as well as gains or losses, to society, in the value of other goods or services produced and consumed by the individual.

**Hold-out Product Profile** A product profile which is distinct from the orthogonal product profiles, and is independent of direct utility measurement. Hold-out profiles are designed to reflect actual products in the marketplace, and are rated by subjects on a contingent valuation scale only.

**Huber-hybrid Model** A method of stochastically measuring the utility of a good or service by combining desirability ratings of individual attributes with desirability ratings of complete product profiles.

**Intra-individual Utility Function** A model which measures utility for a good or service from individual parameters only. Intra-individual utility functions are more reliable than aggregate functions since the underlying utility scale may vary from one individual to the next. However, intra-individual utility functions are only reliable for the individuals measured.

**Iterative Bidding Process** A method commonly used in measurement of an individual's contingent valuation of a good or service, in personal interviews. The individual is presented with several dollar values, usually one pair at a time, and is asked to indicate which dollar value is closest to the "true" perceived value for the individual. Response choices are iteratively narrowed until the interviewer is satisfied that a sufficient approximation of contingent valuation has been reached.

**Marginal Utility** The additional satisfaction which results from an additional unit increase of a good or service, when the levels of consumption of all other commodities are held constant (Mansfield, 1979).

**Orthogonal Array of Product Profiles** A selection of product profiles, often imaginary, such that attribute levels are balanced among products. For example, a product which has the lowest attribute level for a given attribute category will be assigned the highest attribute level for another attribute category. Orthogonal product profiles will be rated by each subject on a desirability scale (for Huber-hybrid utility) as well as on a contingent valuation scale.

**Product Profile** A collection of attribute levels which represent a product, real or imaginary.

**Psychosocial Costs** The value of health care consequences which do not directly affect the value of goods and services produced or consumed by an individual. Psychosocial costs may include such things as pain, anxiety, and embarrassment.
Self-Explicated Utility Model A method of deterministically measuring the utility of a good or service as a sum of measurements of attributes of a good or service on a desirability scale. In the weighted self-explicated model, desirability measurements are weighted according to the importance of the category of attribute being measured.

Utility A measure that represents a particular level of satisfaction, to an individual, which results from benefits of a particular good or service.

Variable Representativeness A measure of external validity. Variable representativeness is the generalizability of the meaning of variables used for a study sample. For example, in addressing variable representativeness one may ask, does the variable "desirability" mean the same for benefits of pharmaceutical products as it does for non-health related products (Kerlinger, 1973)?

Willingness to Accept The converse of willingness to pay. For acceptance of a condition with negative value, willingness to accept reflects the value of equivalent goods and services which an individual would be willing to receive to compensate for the negatively valued condition.

Willingness to Pay The economic demand for a good or service. Willingness to pay reflects the value of a good or service in terms of economic efficiency, that is, the net increase in value which the good or service creates, without regard to distributional aspects of this value.


