

Final Report

VALUATION OF REDUCTIONS IN HUMAN HEALTH
SYMPTOMS AND RISKS

Volume 3

CONTINGENT VALUATION STUDY OF LIGHT SYMPTOMS AND ANGINA

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VALUATION OF REDUCTIONS IN HUMAN HEALTH SYMPTOMS AND RISKS

This is Volume 3 of a four volume report. The total project undertakes an assessment and reconciliation of attempts to value reductions in human health risks, and it develops new methods and estimates for these values. Volume 1 is the executive summary. Volume 2 contains a comparative assessment of work on valuing health risks. Based on the assessment, a set of interim morbidity and mortality values applicable to effects of criteria air pollutants is developed. Volume 3 reports on a study developing and applying contingent valuation techniques to the types of light symptoms often attributed to air pollution. Volume 4 reports on the design of approaches for valuing serious or life threatening illnesses.

Abstract of Volume 3

CONTINGENT VALUATION STUDY OF LIGHT SYMPTOMS AND ANGINA

Volume 3 reports on a contingent valuation study conducted as part of this project to estimate the benefits of light symptom reductions and angina relief. The approach is based on focus group experimentation followed by systematic household sampling.

Section 3.2 addresses the problem of quantifying reductions in symptoms. To cover the range of conditions encountered in environmental assessments, respondents needed to be asked about a variety of situations, but the variety had to be manageable. Four survey instruments were used. Two of the instruments were for relief from seven light symptoms, with one instrument pertaining to one day of relief and the other to thirty days of relief. Two of the instruments were for relief of angina, with one of these pertaining to ten days of relief and the other to twenty days.

Sections 3.3 and 3.4 explain the structure of the contingent valuation instrument. Section 3.5 explains the household sampling procedure, which was carried out in Chicago and Denver.

In Section 3.6 the empirical results are presented. A relationship was found between the number of days a symptom is experienced and the bid per day, indicating the existence of increasing marginal disutility of symptoms. Independent variables in regressions explaining bids included age, education and income, and these generally had positive coefficients.

Section 3.7 reports the results of an experimental mail survey where a response rate of 48 percent was achieved. Results were corroborative of the household surveys.

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3.1. INTRODUCTION

3.1.1. Purpose

The purpose of this section is to describe and explain the methods that were developed to estimate the value of reducing light symptoms attributable to air pollution. Intensive study of the effects of air pollution on human health has been underway for a number of years. Epidemiological and econometric studies are amassing evidence on the mortality effects of sulfur oxides and particulate. Much less attention has been paid to morbidity effects of air pollution and the economic value of avoiding these effects. Progress is being made, however, in establishing the health effects of pollutant exposures regularly experienced by large population groups, and economists have begun to turn their attention to estimating the achievable benefits of reduced illness. This is an important development, because knowledge of the value of symptom reduction is a major missing element of environmental policy analysis. Mortality benefits, while large for affected persons, are somewhat isolated instances. It is important to know the value of smaller benefits received by large numbers of people. This knowledge would greatly reduce the uncertainty of health benefits from cleaner air.

While the value of life literature has provided analytic constructs for valuing mortality benefits, economic analysis has offered no such ready construct for measuring the benefits of reduced illness. Most morbidity analyses have measured benefits in terms of reduced work loss days and reduced medical expenditures. Those measures, however, do not provide a conceptually satisfactory measure of morbidity benefits because they neglect the value of comfort and other benefits of health such as leisure and productivity of non-market work.

The purpose of this section is to describe a theoretically sound approach to empirically estimating the benefits of symptom reduction resulting from improvements in ambient air quality. Contingent valuation is the research method used to accomplish this objective.

Contingent valuation offers a technique capable of getting at values that are extraordinarily difficult to measure by other means, such as property value or revealed behavior methods. Health and aesthetic values of air and water quality, recreation and power plant siting are among the topics that have been addressed by contingent valuation. Our objective is to establish a contingent market in symptom reduction that encompasses all essential aspects of symptom disutility. Expressions of willingness to pay are designed to reflect the total value of symptom reduction, unlike payments in existing markets, which provide only partial measures of value.

Contingent valuation has become an established research

method during the last 10 or 15 years. Considerable advances have been made in overcoming methodological shortcomings and eliciting high quality information. The present study builds on this progress by applying contingent valuation to a neglected area of empirical economics.

3.1.2. Major Issues in Contingent Valuation

Several studies have summarized the analytic development of the contingent valuation method. Among these are Randall [1985] and Carson [1985]. Cummings et al. [1984] provides an extended critique of the present role and state of development of contingent valuation. In building upon this work, we have given greatest attention to three methodological areas. These are the information and preference context of contingent valuation, which frames the problem for the respondent and helps him research his preferences; the structure of the contingent market, which defines the good to be valued in a clear, concise and quantitative manner; and the bidding game process, which assists the respondent in arriving at carefully thought-out, unbiased values. This study builds on progress in dealing with those issues, and it considers the new problems they raise when dealing with morbidity.

3.1.2.1. Information and Preference Context

The quality of answers is affected by the fact that information is imperfect and thinking requires effort. If a person is asked out of the blue how he values a hypothetical situation, his answer may be nearly random unless considerable thought is given. Contingent valuation must give effort to helping the respondent invest in information and exploration of his preferences. Questions need to be asked related to background information on the subject matter--for example the respondent's health status and the various health costs and disutilities he has borne, such as loss of work, doctor bills and discomfort. In this way the respondent is helped to invest in thinking about considerations that go into a reasoned answer. Questions arise as to the optimum degree of investment and as to the content of the investment. Tedium is a major limit on the amount of time that can be taken. Attempts to help the respondent think about the problem will be counterproductive if he becomes bored. Manageable total length of the questionnaire becomes an extremely important consideration.

Questions of optimum content involve first, focusing on most important matters in view of the limited time available, and second, avoiding imparting bias by overstressing certain effects and understressing others. Helping the respondent invest in information raises unique problems in the case of morbidity because of the variety of ways that health affects a person. Guidance from economic theory is needed that sorts out the roles of work, medical costs, discomfort, and defensive measures.

These subjects must be introduced in common sense terms but still be consistent with the economic theory of utility maximization and consumer surplus. The theoretical framework for the information and preference context is given in section 4.3.

3.1.2.2. Structuring the Contingent Market

It is essential that the contingent market good be presented to respondents in a natural, believable way so that they can reach a valid judgement about it. It is equally important, however, that the good be defined in a precise way that is amenable to quantitative analysis. Reconciling these objectives required much experimentation.

Everyday language is an important part of the description of symptoms. Descriptions of the frequency, duration, and severity of symptoms must be included in a natural way that assures as much as possible that all respondents are thinking about the same thing when they express their willingness to pay.

In the case of light symptoms, the problem is simplified by the fact that most people have first-hand experience. This makes it possible to keep the description of the contingent market good fairly short and still fulfill both major objectives.

For severe symptoms, out of range of ordinary experience, more difficult problems are raised. The angina questionnaires posed these problems. A special effort must be made to help the respondent imagine what it would be like to live with extreme and recurrent pain--in the case of severe angina--or recurrent pain of less intensity in the case of mild angina.

Every respondent is asked to imagine having a specific angina health problem, in contrast to the light symptoms surveys, in which each respondent simply recalls his own endowment from his information and preference context.

After the contingent market good has been established, it is necessary to devise a vehicle for delivery of the good to the respondent, and a vehicle of payment. The payment vehicle problem has received much discussion in the literature. The vehicle for delivery has received less discussion, but will be important in future contingent valuation studies of health.

Much experimentation was devoted to devising an effective method of conveying the good--better health--to the respondent. An example is to attribute all light symptoms to allergy and postulating a new prescription drug, easy to take with no side effects, that would deliver a specified amount of relief. This delivery vehicle is expressed in tangible, concrete terms in the interest of achieving realism. But its realism proves to be a drawback because numerous respondents were found to object to the idea of taking medicine, they didn't accept the allergy, and the necessary specification of ease of use and no side effects

introduced abstractions that caused respondents to balk. Because efforts to achieve tangibility in the vehicle of delivery introduce distractions of this sort, use of pure willingness to pay questions is regarded as an advantageous approach.

The payment vehicle presents similar problems. Tangibility can be achieved by making payment come through higher prices or taxes. Public goods have been paid for through higher utility bills. Tangibility, however, is often found to be accompanied by suggestions of other matters of concern to respondents that distract them from making bids that reflect the true value of the contingent market good. As in the case of the vehicle for delivery of the good, there are strong reasons for using an abstract payment vehicle that simply asks "How much would you be willing to pay for this good?"

3.1.2.3. Bidding Game

Bidding formats have received extensive analysis in the literature. Drawing upon this literature, as well as extensive previous experimentation with alternative formats, the iterative bidding procedure was chosen. A major virtue of iterative bidding is the focusing of attention it demands of respondents. No bidding format is perfect, however, and several problem areas must always receive special attention. Strategic bidding and limited investment in information needed to bid serves as a convenient two-way classification of concerns.

Because normal precautions were taken, strategic bidding did not pose difficult problems, although one problem is worth mentioning. It is very important that the interviewer not suggest in any way what answer is being sought. There is a tendency among some respondents to try to please the interviewer with their answers, or to demonstrate their wisdom by giving the answer they believe the interviewer thinks correct.

The information-investment problem was much greater, however, and considerable research was devoted to it. Anchoring is a frequently encountered problem in bidding behavior with insufficient information.

Anchoring means that people seize upon a convenient, easy bid amount and stick to it across bids because they have little information based incentive to do otherwise. Starting point bias, often seen as a weakness of iterative bidding, is probably more fundamentally a problem of limited investment in information and inadequate researching of preferences on the part of the bidder. Focus group experience teaches that as questionnaires are enriched in their information and preference review aspects, anchoring at or near the starting point ceases to be a problem.

As more and more bid questions are asked about similar contingent market goods, it becomes increasingly difficult for respondents to recognize meaningful variations in value. Careful

preparation enhances the respondents' ability to handle more questions, but experience teaches that splitting the questionnaire or sacrificing information becomes a necessity.

At the opposite extreme from insufficient variation across questions for a respondent is excessive variation across respondents to a question. This too comes to be recognized as an information-investment problem. Variation is expected because respondents do not have perfect information about the good or their preferences. Problems arise when the respondents' understanding of the good and the market and of their own preferences is so limited that extraneous information predominates in determining bids. This problem is addressed in the theoretical framework of section 4.3 in Volume 4.

There are two important cases--extremely high bids and extremely low bids. Take the high bid case. A respondent may be thinking of the increase of his well being due to greater comfort without thinking of the food, clothing, housing, and other goods he must give up if he bids high, or he may simply forget about his budget constraint. With regard to respondents who bid too low, there may be a high threshold of perception due to the cost of thinking. For example, eliminating a cough will really be worth something to him but he bids zero because he has relegated coughs to an unimportant category where he does not bother to make comparisons.

3.1.3. Previous Contingent Valuation Work Morbidity

Some previous work has included morbidity as a part of other effects, as for example the study by Schulze et al. [1984], where air pollution effects, including both morbidity and visibility, were asked about. We are aware of only two previous contingent valuation studies concerned with morbidity as such. One is an asthma study by Rowe, Chestnut and Shaw (1984), reported in a paper by Rowe and Chestnut (1984).

Another research project, by Loehman and associates (1978, 1979, 1982), concerns the benefits of controlling sulfur oxides in Florida. In the 1979 study, a mail contingent valuation survey was sent to 1,977 residents in the Tampa Bay area, resulting in 432 returns. Willingness to pay questions were asked about the following three groups of symptoms: shortness of breath/chest pains; coughing/sneezing; head congestion/eye/ear/throat irritations. Values were elicited for minor and severe symptom days, which were defined briefly. No mention was made of any specific underlying disease, nor were causes such as air pollution mentioned. No specific delivery vehicle, such as a pill, was employed, and a simple, abstract payment vehicle--"tell us how much you would pay"--was chosen. The means of payment was a checklist, ranging from \$0 to \$1000 per year in ten increments.

The Loehman et al. study is similar to our seven symptom

survey in a number of respects. First of all there is a close correspondence between the symptom lists. In both cases a pure health attribute approach was used. The Loehman et al. study carefully avoided the introduction of redundant information in its introductory letter, its symptom narrative and in its delivery and payment vehicles. (Our mail survey, unlike the much more extensive door-to-door versions, used a medication to deliver the contingent market good). The Loehman et al. return rate-- 22 per cent--is much lower than our 48 per cent, which reflects the effectiveness of the Dillman procedures followed in our mail survey. A major difference between the two approaches is the large number (24) of similar willingness to pay questions in the Loehman et al. survey. Our surveys employed much fewer questions on any survey instrument in order to avoid taxing the respondents' concentration and the extent of their information and preference review.

3.1.4. Outline of the Remainder of This Section

Section 3.2 deals with quantifying symptom relief to be asked about in contingent valuation exercises. The basic problem is to cover a range of symptoms that is realistic in light of possible environmental control programs and their effects on people through dose-response relationships. Evidence is reviewed giving attention to normal and sensitive populations.

The design of other facets of the contingent valuation instrument is considered in section 3.3. Focus group experience leading to the instrument chosen is reviewed.

Section 3.4 presents the structure of the contingent valuation instrument used in this study. There are four instruments. Two of the instruments pertain to seven light symptoms, with the first asking about one-day relief and the second about 30-day relief. The other two instruments pertain to angina, one asking about 10-day and the other about 20-day relief.

After a discussion of the sampling approach in section 3.5, section 3.6 presents the empirical results from household personal surveys conducted in two cities in 1985. Summary statistics on bids and characteristics of respondents are given. Regression results explaining other bids are presented.

Finally, in section 3.7, the results from a corroborative mail questionnaire are discussed.

3.2. THE DOSE-RESPONSE PROBLEM AND THE DEFINITION OF SYMPTOM RELIEF

3.2.1. Implications of Dose-Response Relationships for Benefit Estimation

The values that respondents place on improvements in ambient air quality levels depend on the degree of pollution reduction and the time pattern of reduction, e.g. whether pollution is reduced on many days or only a few days. The value of an extra day of relief may depend on the level of symptoms prevailing before the relief. People might value an extra day of relief from symptoms differently if they were already experiencing several weeks of symptoms than if they were only experiencing one or two days.

The degree of relief cannot be specified before specific policy scenarios are known. Some policies could have only a small effect on pollution levels, while others could have a large effect. A complication is that any one policy will reduce pollution levels by different amounts in different places, depending for example on how far above a standard different areas are when the standard is imposed. Furthermore, a full analysis should not necessarily assume that standards are met absolutely. There may be days of exceedences, which will vary among areas.

The situation is further complicated by sensitive groups in the population. A large number of people in the population may experience only a small change in symptoms from a given reduction in pollution levels, whereas the same reduction may grant many days of relief to sensitive persons, including those whose allergic balance may be upset.

The general problem is to develop a way of valuing reductions in symptoms from pollution depending on the amount of relief from symptoms, where the relief may vary among areas and different types of people in amounts that are not known beforehand. In short, the problem is to estimate, not a single value, but a function that specifies value depending on amount of relief and symptom level prevailing in the absence of the policy being evaluated. This function provides a tool that can be used to value the variety of symptom reductions among areas and types of people.

The amount of relief and symptoms prevailing in the absence of relief must be applicable to the variety of conditions that will be encountered in reality. Respondents thus need to be asked about a variety of symptom situations. However, it would have done no good to query respondents about degrees of relief that are orders of magnitude greater than would be encountered. This consideration is important because of the limited time and attention available from any respondent.

Respondents had to be asked about a sufficient variety of

conditions, but the variety had to be in the realm of reality. These considerations guided the choice of symptom situations in the questionnaires. The choice of symptom situation had to take account of the imperfect state of knowledge about pollutant reduction. The basic strategy was to choose a range of symptom levels and symptom relief sufficient to capture the small effects which many policies would have on a large number of people and the substantial effects that could occur for sensitive persons especially in the presence of exceedences.

3.2.2. Effects of Criteria Pollutants on Health

To provide a basis for deciding on degree of symptom relief to be used in structuring contingent markets, this section brings together presently known information on health effects of criteria pollutants. Based on the results, light symptom relief and angina relief used in the questionnaires of the present study are described in sections 3.2.3 and 3.2.4.

3.2.2.1. Background

In considering the health benefits of policy to reduce air pollution, it is necessary to collect data on dose-response relationships. There are a number of symptoms and physiological responses that have been observed to occur with increasing doses of criteria pollutants. Some studies have shown increased mortality in areas where there have been relatively high concentrations of certain pollutants (see Lave & Seskin 1979). It is widely accepted that there is higher mortality among sensitive groups during acute pollution episodes (Carnow, 1979). There is considerable evidence to show that criteria pollutants, especially sulfur oxides, particulate and ozone are associated with respiratory irritation. Coughing, shortness of breath, throat and chest irritation and sinus problems appear to increase with higher levels of pollution. More serious damage to the lungs and respiratory tract have been known to occur in extreme cases.

The criteria pollutants that concern us include sulfur dioxide, particulate matter, carbon monoxide and nitrogen dioxide. Headaches, shortness of breath, chest discomfort and coughing are observed to occur when ozone concentrations are above 0.15-0.30 ppm, levels which occur frequently in the Los Angeles area and several other cities. Respiratory irritation with shortness of breath and a probable increase in coughing has been observed with concentrations of SO_2 and particulates that are experienced in cities like New York and Chicago.

Strong evidence for effects on mortality from epidemiological studies has been provided for sulfur dioxide and particulate matter. Other pollutants have not been shown to consistently affect mortality at concentrations observed in the ambient air.

One important consideration in looking at the effect of criteria pollutants on morbidity is the interaction among the various criteria pollutants. Sulfur dioxide has a greater effect the higher the concentration of particulate (Graves and Krumm, 1981). At least one study demonstrates synergism between SO_2 and ozone (Bates et al., 1974).

Weather conditions are also important in determining the effects of certain pollutants. Sulfur dioxide has a greater effect on health when the air temperature is below 40-50 degrees F. Higher humidity increases the rate at which SO_2 combines with water vapor to form sulfates, which are more harmful to health than SO_2 alone.

Another important consideration in analyzing the effects of pollution on health is to consider susceptible population groups. Those with chronic bronchitis or asthma are particularly susceptible to sulfur dioxide, particulates and ozone. Angina sufferers are sensitive to levels of carbon monoxide that are sometimes observed in the ambient air. Elderly persons with heart trouble may also be more susceptible to carbon monoxide and pollutants that affect the respiratory system. Children and pregnant women are more susceptible to respiratory infections, which may be aggravated by sulfur oxides, ozone and nitrogen oxides. Others with various genetic diseases or nutritional deficiencies may be more susceptible to certain pollutants.

Sulfur dioxide, particulates and ozone have a number of harmful health consequences which are possible at ambient levels. Carbon monoxide, which is especially high at certain locations, may affect the health of exposed occupational groups. Nitrogen oxides are of lesser concern to health, but will be mentioned briefly.

3.2.2.2. Effects of Carbon Monoxide on Health

Carbon monoxide has a number of effects on health which have been demonstrated both in the laboratory and in the ambient environment. There is plenty of information on the effects of acute exposures to carbon monoxide. Since CO comes primarily from automobile emissions, its ambient concentration varies with traffic volume, average speed and the subject's proximity to busy streets and highways. The effect of exposure to high levels of ambient CO depends on both the concentration and the length of exposure, which determines the level of carboxyhemoglobin (COHb) in the blood.

The U.S. ambient air quality standard for CO is 9 ppm ($10,000 \text{ mg/m}^3$) 8-hour -- average not to be exceeded more than once per year. The one hour standard is 35 ppm ($40,000 \text{ mg/m}^3$) -- not to be exceeded more than once per year. (Stern et al., 1984)

Observed maximum levels of CO in major cities in recent

years are usually in the range of 10-20 ppm for the 8-hour average and 30-40 ppm for the one-hour average. (EPA, 1979, based on data from Los Angeles, Baltimore and Denver). Ambient concentrations as high as 40 ppm (8-hour average) and 50 ppm (1-hour average) are possible in busy streets and intersections (McMullen, 1975). One-hour averages ranging from 100-200 ppm have been measured in unventilated parking garages and tunnels (Wright et al., 1975).

In the Chicago area in 1982, there were 3 excursions of the 8-hour standard of 9 ppm. The highest 8-hour average concentration was 15.5 ppm and the highest observed 1-hour concentration was 21.4 ppm. (Annual Air Quality Report., Illinois, 1982). Concentrations tend to be the highest in the winter with highest winter concentrations 2-3 times as large as maximum summer concentrations (EPA, 1979 based on data from LA, Baltimore and Denver).

Carbon monoxide exposure can be measured in terms of COHb formation, which is the basis for the EPA CO standards. The standards are "intended to protect against the occurrence of COHb levels above 2 percent" (Federal Register, 1971 cited in Calabrese, 1978). This level was based largely on a study by Beard and Wertheim (1967). For the COHb level to exceed 2%, most people must be exposed to CO concentrations of at least 12 ppm for 8 hours or 35 ppm for one hour. (Based on the Coburn equation discussed in Coburn et al., 1964). Beard and Wertheim observed impairment of time interval discrimination when the COHb concentration increases by 2%. Another study of smokers (Aronow, 1978) finds some aggravation of angina pectoris symptoms at this level. The findings of both of these studies have been sharply criticized.

In most studies, the first symptoms are not observed until the COHb level is 2.5-3% or above. At this level, several laboratory studies find an earlier onset of angina symptoms among susceptible persons (Aronow and Isbell, 1973; Anderson et al., 1973). There is also a possibility of aggravation of intermittent claudication (exercise-induced leg pain) in patients with cardiovascular problems (Aronow et al., 1974). This level of blood COHb can be reached when the 8-hr average concentration is 10-20 ppm or more, or when the one-hour average exceeds 40 ppm.

Effects on patients with coronary artery disease may be the most serious problem associated with exposure to low concentrations of CO. The stress this causes, which could ultimately lead to heart attacks, is difficult to measure (Stewart, 1976). Upwards of 25% of males over 45 years old may have preexisting coronary disease (Calabrese 1978, p. 61) There is not yet conclusive evidence that links CO exposure to higher mortality, but there is good reason to think that it has some effects on heart patients (based on a study by Goldsmith and Landaw, in Los Angeles and a study by Kuller et al., in Baltimore discussed by the National Research Council, 1977, p. 113). When

the COHb level in the blood reaches 4%, there is evidence for a decrease in exercise performance in healthy persons and those with chronic obstructive pulmonary disease (Aronow and Cassidy, 1975 and Aronow et al., 1977 cited in the EPA criteria document, 1979). This level can be reached when the ambient CO concentration is above 25 ppm (8-hour average). For the same effect from a one-hour exposure, the ambient concentration must be about 70-100 ppm or above. Eight-hour average CO concentrations often exceed 25 ppm in busy streets and intersections and toll booths. Concentrations above 25 ppm (8-hour average) or 50 ppm (one-hour average) are likely to affect primarily those who are occupationally exposed such as traffic officers, toll collectors, tunnel workers and parking garage attendants. When the blood COHb concentration reaches 5%, there is additional evidence for reduced time to the onset of exercise-induced angina and probably also increased duration of angina attacks (Aronow et al., 1972). At COHb levels of 4-6%, various studies have shown effects on vigilance tasks, visual perceptions and manual dexterity (Bender et al., 1972, Putz et al., 1976, Salvatore, 1974, Rummo and Salarnis, 1974). Winneke, however, found no effects on vigilance or manual dexterity when COHb concentrations were 5 and 10%. Effects such as headaches and drowsiness are not likely to occur until COHb levels reach 30%, well above anything expected even in tunnel and parking garage workers (Stern et al., 1984).

It is possible that susceptible individuals, such as those who suffer from angina pectoris, peripheral vascular disease and other types of heart problems, may be affected by ambient levels of CO on the worst days in major U.S. cities, if they are nonsmokers. Levels between 10 and 20 ppm occur on a few days in many cities. On these days, perhaps 10% of of the nonsmoking population in. a given city will be exposed for long enough to have COHb concentrations higher than 2.5%. No more than 5% of the adult population suffers from coronary heart disease and/or angina pectoris (Gordon, 1964). Of this susceptible population, it is doubtful that even 10% would experience noticeable symptoms as a result of elevated COHb and most of these would be quite minor. Hence, it is reasonable to conclude that no more than few additional days per year of mild angina symptoms because of ambient CO concentrations typical of U.S. cities. Possible effects on the frequency and severity of heart attacks are potentially a more serious problem, but there are no data to demonstrate the existence or magnitude of such effects.

Those who are occupationally exposed or smokers have a greater likelihood of experiencing symptoms such as aggravation of angina, reduced time to exhaustion during exercise, possible increased risk of heart attacks and effects on the performance of vigilance tasks. This may include traffic policemen, firefighters, parking garage attendants, tunnel workers and some industrial workers. Even among these groups, most symptoms are likely to be minor, affecting a relatively small number who are the most susceptible. There is no epidemiological evidence to show serious health problems from CO exposure among members of

these occupational groups, except in the most extreme circumstances.

TABLE 3-1

DOSE-RESPONSE RELATIONSHIPS FOR CO

Percent
COHb

- 2 Possible aggravation of angina in smokers (Aronow, 1978);
Possible impairment of time interval discrimination (Beard
and Wertheim, 1967);
- 2.5 Earlier onset of angina in laboratory studies (possible)
(Aronow & Isabell, 1973; Anderson et al., 1973);
Critical level for cardiovascular disease patients (EPA,
1979);
- 3 Aggravation of symptoms of intermittent claudication
possible (Aronow et al., 1974);
- 4 Reduced time to exhaustion in treadmill exercise in normal
subjects (Aronow & Cassidy, 1975);
Decrease in exercise performance in those with chronic
obstructive pulmonary (Aronow et al., 1977);
Reduced precision of hand-eye coordination (Bender et al.,
1972);
- 5 Likelihood of earlier onset of angina symptoms (Aronow et
al., 1972);
- 7 Increased reaction time (Rummo and Sularnis, 1974).

3.2.2.3. Health Effects of High Ozone Concentrations

Some of the most serious symptoms are associated with high ozone concentrations. Because a number of other photochemical oxidants normally occur along with ozone, it isn't always clear whether a symptom is caused by ozone or some other associated pollutant.

Most ozone problems occur in California. The highest concentrations of photochemical oxidants occur in the Los Angeles area. In a typical year, it is likely that the second highest one-hour average concentration will be close to 0.40 ppm at a station in the Los Angeles area. During the 1960s, one-hour average concentrations above 0.5 ppm were sometimes recorded (EPA, 1978).

Many other urbanized areas record levels of ozone above the national ambient standard which is 0.12 ppm one-hour average not to be exceeded more than once in any given year. San Diego, Denver and Philadelphia have each recorded 1-hour average concentrations of photochemical oxidants exceeding 0.3 ppm. Other eastern U.S. cities have almost never recorded concentrations above 0.3 ppm. Most, like Chicago, do not report maximum 1-hour average concentrations much above 0.2 ppm in a typical year. Since ozone is 65-100% of photochemical oxidants, ozone levels of 0.3-0.4 ppm may occur each year in Los Angeles, Denver and San Diego. Most other cities can expect maximum ozone levels of 0.15 to 0.25 ppm one-hour average.

Table 3-2 gives some idea of the concentrations of ambient ozone or photochemical oxidants at which various symptoms are observed. Typical symptoms include headaches, chest discomfort, coughing, throat irritation, increased susceptibility to acute respiratory diseases, impaired athletic performance and shortness of breath. Eye irritation is often observed, probably due to high levels of PAN, which is usually associated with ozone.

Some studies have found that ozone begins to have effects on airway resistance at concentrations of 0.10 ppm or below (Von Nieding and Wagner; Goldsmith and Nadel, 1969). The results of both studies are of uncertain reliability (EPA, 1978). Studies by Wayne et al., (1965) and Herman (1972), which the EPA considers more reliable, show a negative relationship between improvements in running time and oxidant concentration, when oxidant levels exceed 0.10-0.15 ppm. In several epidemiological studies, eye irritation has been shown to occur when oxidant concentrations approach 0.15 ppm (Mizoguchi, 1977; Hammer, 1974).

At least one laboratory study (Delucia and Adams, 1977) shows a reduction in lung function among exercising subjects when ozone concentrations reach 0.15 ppm. Mizoguchi finds increased sore throats and shortness of breath when the ambient oxidant level is above 0.15 ppm.

When the ambient ozone level is between 0.2 and 0.3 ppm, a

number of investigators observe symptoms particularly among susceptible groups such as asthmatics and others with chronic lung diseases. Young (1963), in a study of occupational exposure to ozone at this level, notes that 1 out of 7 smokers could detect irritating odors and noticed soreness of eyes and dryness of mouth, throat, and trachea, while 2-3 subjects experienced changes in lung function. Mizoguchi observed large increases in the number of high school students experiencing eye irritation, sore throat, shortness of breath, coughing, headaches, and watering eyes when oxidant levels exceed 0.23 ppm. Asthmatics and others with chronic lung disease experience aggravated symptoms when ozone exceeds 0.25 ppm (Schoettlin et al., 1961, Remmers and Balchum, 1965, Hackney, 1975). Several investigators have observed no effects when the ozone concentration is below 0.3 ppm. This is true for several studies of occupational exposure (Challen et al., 1958, Kleinfeld et al., 1957 and Bennet, 1962). Hackney, in one study of normal subjects at rest, found no symptoms even when concentrations reached 0.5 ppm.

Many studies have shown that when the ozone concentration exceeds 0.3 ppm, there will be effects in normal subjects at rest. These include headaches, chest discomfort and respiratory tract irritation (Hammer et al., 1974 Knelson et al., 1976 Kleinfeld et al., 1957 Hazucha and Bates, 1973).

Another way to look at ozone dose-response is to consider the results of regression studies of the relationship between increases in average daily maximum 1-hour ozone concentrations and days when people will restrict their activities (minor restricted activity days). Portney and Mullahy (1983) find that an increase of .01 ppm in the average daily maximum ozone concentration will result in 0.39-0.64 additional minor restricted activity days per capita in the course of a year. If this result is assumed to affect the population of all SMSAs, then a 0.01 ppm increase in the average daily maximum ozone concentration will result in between 40 and 75 million additional minor-restricted activity person-days per year in the United States.

The existence of symptoms resulting from exposure to high concentrations of ozone depends partly on the history of exposure. Typically, symptoms will be the worst on the second or third day of an ozone episode but will decline by the fourth or fifth day (Hackney, 1977 (2)). Those who have lived in areas where high ozone levels are common may experience fewer symptoms than others when exposed to a given high concentration (Hackney, 1977 (1)). Usually symptoms are present, only on days when the ozone concentration is high. Effects on asthmatics may persist for several days after the end of a period of high ozone concentrations (Golden, 1978).

The only groups which appear to be especially susceptible to ozone are asthmatics and others with chronic lung diseases. Age does not appear to matter. Persons over 70 have shown no effects even when concentrations are as high as 0.4 ppm (Gerking

et al., 1984).

In Illinois in recent years, the highest recorded ozone concentration has generally been below 0.20 ppm. In 1983, a year in which the weather was conducive to high ozone accumulation, the highest recorded concentration in Illinois (one-hour average) was .214 ppm in Alton, near St. Louis. The worst station recorded 13 days when the ozone concentrations exceeded the standard. The worst station in the Chicago area recorded six exceedances of the one-hour standard of 0.12 ppm. We can therefore predict that even in the worst years there will be fewer than 10 days when ozone concentrations will be high enough to affect athletic performance. Some individuals may experience some throat irritation and coughing on these days, though probably very minor. On the very worst days (no more than 3 days in 1983) as much as 5% of the population may experience eye irritation, 2% may experience some throat and/or shortness of breath, and less than 1% may experience coughing as a consequence of exposure to high concentrations of ozone. These estimates are based on one study of 515 school children in Tokyo. (Mizoguchi et al.) Other studies show no effects in resting subjects at levels that are likely on the worst days in Illinois. There may be some changes in lung function and minor symptoms in active individuals on the worst days in the Chicago area and in the St. Louis suburbs (Illinois EPA, Annual Air Quality Report, 1981, 1982, and 1983 - 3 volumes).

In some of the areas around Los Angeles, the ozone standard is violated more than 50 days per year (Gerking et al. 1984). There are probably several days each year in the Los Angeles area where the ozone concentration is high enough to result in aggravation of asthma symptoms in some subjects. On the worst days in a typical year, many exercising subjects will probably experience some coughing, eye irritation, shortness of breath, reduced endurance and headaches. At the very worst, there might be a few days in the Los Angeles area when 10% or more of the population experience some throat irritation, and more than 5% experience shortness of breath, cough or headache.

TABLE 3-2

DOSE-RESPONSE RELATIONSHIPS FOR OZONE

PPM

- 0.10 Possible increased airway resistance;
Effects on athletic performance; Possible eye irritation;
- 0.15 Beginning of possible symptoms in active individuals;
Possible sore throat, shortness of breath, cough, headache,
Possible changes in lung function;
- 0.20 Likely changes in lung function and other symptoms in
continuously exercising subjects;
Some evidence for no symptoms in subjects during and after
intermittent exercise;
- 0.25 No effects observed in resting subjects according to one
study;
First symptoms observed (probably) in subjects with
intermittent exercise regime;
Aggravation of asthma symptoms in some subjects;
Likely increased frequency of headaches, eye irritation,
sore throat, cough and shortness of breath in school
children (epidemiological study);
- 0.30 Increased frequency of headache, cough and chest
constriction (epidemiological study);
Reduced endurance in exercising subjects;
Changes in lung function in resting subjects;
No effects found in at least one study;
- 0.37 Level at which there is a broad consensus for the existence
of symptoms including cough, substernal pain, wheezing and
malaise.

3.2.2.4. Health Consequences of High SO₂ Concentrations

Until recently, sulfur dioxide was one of the most troublesome pollutants, especially in industrialized areas or near electric power plants. Sulfur dioxide, sulfates and related particulate matter have been implicated as the causes of excess mortality during acute pollution episodes in London, New York and Donora, Pa. At levels as low as 0.19 ppm (24-hour average), which were relatively common in London in the 1950s, and somewhat less common in Chicago and New York in the early 1960s, at least one study has shown increased mortality associated with high ambient concentrations of SO₂ (Wilkins, 1954). At concentrations above 0.4 ppm (24-hour average), which have been observed during some past episodes, there is a great deal of evidence for increased daily mortality, especially among the elderly, bronchitis patients and others with chronic lung diseases (Martin and Bradley, 1960). These effects are more likely when particulate concentrations are also high.

Sulfur dioxide emissions near major cities have been reduced by 50-80% since the 1960s so that it is unlikely that even the worst day of the year in Chicago will have concentrations high enough to involve increases in mortality. There is some possibility of respiratory effects from SO₂ or associated sulfates on the worst days in Madison county near St. Louis and a few other locations in other states. It is more difficult to demonstrate such effects at levels observed in the Chicago area in recent years.

Sulfur dioxide in high concentrations has been observed to cause decreased maximum expiratory flow, greater pulmonary flow resistance, airway resistance and reduced vital capacity (Snell and Luchsinger, 1969; Frank, 1961; Lawther, 1975). Any of these physiological effects may be associated with difficulty breathing. An increase in airway resistance may lead to coughing.

At ambient SO₂ concentrations as low as 0.10 ppm (24-hour average), some asthmatics showed increased airway resistance in a laboratory study (Sheppard, 1981). At concentrations ranging from .11 to .19 ppm Brasser et al. (1967) show increased hospital admissions and absenteeism from work for older persons. Likely worsening of health among chronic bronchitis patients occurs when daily average concentrations of SO₂ reach .20-.25 ppm accompanied by particulate matter (Lawther, 1970; Carnow, 1968). Accentuation of symptoms in patients with chronic lung disease has been observed in London when SO₂ concentrations are about 0.21 ppm accompanied by smoke concentrations of 300mg/m (Lawther, 1958). This compares with the 24-hour primary standard which is 0.14 ppm SO₂ not to be exceeded more than once a year (Stern et al., 1984).

A number of other studies show the relationship between annual mean SO₂ concentrations and health. At SO₂ levels greater

than 100 mg/m³ annual average (about 0.04 ppm) with smoke of at least 160 mg/m³, studies have shown greater frequency of respiratory symptoms and lung disease (Petrilli, 1966, Italian data), and greater frequency and severity of respiratory diseases in school children (Lunn et al., 1967). At about this same level, Wicken and Buck (1964) observed increased mortality. The annual primary standard for SO₂ is an average concentration of 0.03 ppm.

There is little information on the percentage of the population likely to experience symptoms from high ambient SO₂ concentrations. At levels commonly observed in the ambient air, most laboratory studies find that between 10 and 25 percent of the subjects experience symptoms. Because of the small sample size of most studies and the existence of other studies that show no effects at similar SO₂ concentrations, any statement about frequencies is open to question. Lave and Seskin (1977, p. 203) show an elasticity of daily mortality with respect to daily SO₂ concentrations of about 0.1 in a cross section of U.S. cities. Graves and Krumm (1982) show a similar elasticity of hospital admissions for respiratory disease with respect to SO₂ levels when particulates are high in Chicago.

In recent years, neither the annual standard nor the 24-hour standard have been exceeded in the Chicago area. The number of symptom days as a result of high SO₂ levels has fallen from perhaps as high as 100 in the early 1960s for those with chronic bronchitis, to none in recent years. There may be a few days in a year when the most susceptible older persons experience increased respiratory disease symptoms because of high SO₂ and when asthmatics experience greater airway resistance with possible coughing, wheezing or shortness of breath (see Graves and Krumm for some evidence from Chicago).

There has recently been some discussion of implementing a one-hour standard for SO₂. There are about 100 locations in the U.S. where hourly maximum SO₂ concentrations exceed 0.4 ppm during a typical year. In some of these locations there may be several days where there are one or two hours where asthmatics may experience wheezing and shortness of breath. There are also some locations near large smelters where short-term SO₂ concentrations exceed 1 ppm so that normal individuals may experience short periods of coughing and possible shortness of breath.

TABLE 3-3

DOSE-RESPONSE RELATIONSHIPS FOR SO₂

24-Hour Concentration

- 0.10 Increased airway resistance in asthmatics -- possible increase (Sheppard, 1981);
- 0.14 EPA 24-hour standard increased hospital admission and absenteeism from work for older persons possible (Brasser et al., 1967);
- 0.19 Possibility of increased mortality (Wilkins, 1954);
- 0.20 Likely worsening of health among chronic bronchitis patients (Lawther, 1970; Carnow, 1968);
- Accentuation of symptoms in patients with chronic lung disease (Lawther, 1958);
- 0.4 Likely increases in mortality, especially among elderly, bronchitis patients and others with chronic lung diseases (Martin and Bradley, 1960).

3.2.2.5. Dose-Response Relationships for Particulates

Particulates are probably the most difficult category of pollutants for dose-response estimation. A wide variety of solid and liquid particles of various sizes fall into this category. The human health effects will depend upon the type of particle as well as the size of the particle. Most of the adverse health effects of particulate are observed in association with high concentrations of SO (U.S. Office of Air Quality Planning and Standards (OAQPS) 1982, Graves & Krumm). Some of the health effects may be due to high concentrations of sulfates, which are more likely to form when SO_2 is combined with droplets of water and other particulate matter.

Particulates can have several types of effects on the human system. They can cause chemical or mechanical irritation to tissue or nerve receptors at the site of deposition (Widdicombe et al., 1962; Nadel, 1973). By altering host defense systems, such as the body's mechanism for the clearance of bacteria, particles may be associated with increased susceptibility to infection and the potential for the development of chronic lung diseases (Douglas and Wailer, 1966; Lunn et al., 1967; Kalpazanov et al., 1976). Particles can also cause reduced lung function or tissue damage (Alarie et al., 1975; Martin, 1964). In extreme cases, particles may have direct toxic effects on the human body (EPA, 1977; Winkelstein and Kantor, 1967).

Because most health effects are associated with small particles, it is difficult to speak of dose-response using total suspended particulates (TSP) as the standard. Another standard, currently being considered, would use the concentration of particles smaller than 10 micrometers (μm) in diameter (EPA, 1982). Various studies have shown that about half (45-55%) of suspended particulates fall within this size range.

In dose-response studies of short-term concentrations, there is little evidence for health risks of consequence below the 24-hour standard of $260 \text{ mg}/\text{m}^3$ TSP, equivalent to about $150 \text{ mg}/\text{m}^3$ smoke or particles smaller than 10 μm (U.S. OAQPS, 1982). There is a possibility of increased mortality when TSP rises above $260 \text{ mg}/\text{m}^3$, based on the results of several studies conducted in London and New York in the 1950s and 60s (Mazumdar et al., 1981; Schimell, 1978). Some studies show aggravation of bronchitis, but not generally until TSP concentrations reach at least $350 \text{ mg}/\text{m}^3$ (Lawther et al., 1970). A few studies show aggravation of bronchitis in London when smoke concentrations are below $250 \text{ mg}/\text{m}^3$. At smoke concentrations above $500 \text{ mg}/\text{m}^3$ (equivalent to TSP above $600 \text{ mg}/\text{m}^3$), most epidemiological studies show a significant positive relationship between particulate levels and mortality.

One study (Lambert and Reid, 1970) found increased cough and phlegm, and possible changes in lung function when 24-hour smoke concentrations exceed $100 \text{ mg}/\text{m}^3$, equivalent to TSP levels of 150-200 mg/m^3 .

We can also consider the likelihood of symptoms given different levels of long-term average particulate levels. The U.S. annual standard is 75 mg/m³ average TSP concentration. Few effects have been observed when long-term TSP concentrations are below 130 mg/m³ (Ferris et al., 1973, 1976). One study found some increased respiratory symptoms when the TSP concentration rises from 60-150 mg/m³ annual average (Bouhuys et al., 1973). According to at least one study, increased respiratory disease symptoms accompanied by a small reduction in lung function in adults are likely when measured TSP levels exceed 180 mg/m³ for a long period of time (Ferris et al., 1973). An increase in the frequency of respiratory diseases and reduced lung function has been shown from a study in England when long-term average smoke levels are between 230 and 300 mg/m³ (Lunn et al., 1967).

In recent years, annual average concentrations of particulates have exceeded the primary standard of 75 mg/m³ at only a few monitoring stations. Fewer than 10 percent of the stations in the Chicago area had average TSP levels which violated the standards in 1983. In Illinois, the highest annual average TSP level recorded in recent years has been about 134 mg/m³ at Granite City, near St. Louis. The highest average level recorded in the Chicago area in recent years has not been much greater than 80 mg/m³. Only a few sites in the Chicago area have recorded more than one exceedance of the 24-hour TSP standard in any given year. With the exception of 1983, there have been almost no sites in the Chicago area which have exceeded the standard more than once in a given year.

In 1981 and 1982, the highest 24-hour TSP concentration recorded in Illinois was about 460 mg/m³. In a typical year, about half of the stations report one or more days when the 24-hour TSP concentration exceeds 150 mg/m³, the EPA secondary standard. The worst monitoring station in Illinois, located in Granite City, recorded 22 days when the average TSP concentration exceeded 150 mg/m³ and 7 days when it exceeded 260 mg/m³ in 1983 (Illinois EPA, Annual Air Quality Report 1981, 1982, 1983).

Historically, annual particulate levels in the late 1950s averaged 200-300 mg/m³ or more in London and over 200mg/m³ in New York (Commins and Waller, 1967; Eisenbud, 1980). Chicago and other U.S. cities had similarly high levels during the early 1960s (U.S. HEW, 1969).

At present levels, persons living in or near heavily industrialized areas such as Granite City, Illinois experience possible increased respiratory symptoms on as many as 20 days per year because of high concentrations of particulates. In the worst years, there may be five or more days when high concentrations of particulates in Granite City result in possible increased mortality and aggravation of bronchitis symptoms. The evidence to support even these relatively minor effects is not very strong.

Residents of the Chicago area experience no more than 10 days when there is a possibility that they will experience increased respiratory disease symptoms, even in the worst locations. Only at a few locations on the one or two worst days a year is there a possibility of significant mortality effects or aggravation of bronchitis symptoms.

TABLE 3-4

DOSE-RESPONSE RELATIONSHIPS FOR PARTICULATES

Concentration
(mg/m³)

75	U.S. annual standard for total suspended particulate (TSP) Possible increased respiratory symptoms when annual average 60-150 (Bouhuys et al., 1973);
130	Possible respiratory symptoms above this level (annual average) (Ferris et al., 1973, 1976);
150	24-hour secondary standard for TSP Possible coughing and phlegm along with changes in lung function after 24-hour exposure (Lambert and Reid);
180	Likely increased respiratory symptoms with reduction in lung function after long-term exposure (Ferris et al.); Little evidence for short-term health risks (OAQPS, 1979);
260	U.S. 24-hour primary standard for TSP Possible increased mortality after 24 hours (Mazumdar et al., 1981; Schimmel, 1978); Possible aggravation of bronchitis;
350	Likely aggravation of bronchitis after short-term exposure (Lawter et al., 1970);
600	Significant positive effect on mortality likely at this level and above (QAQPS, 1979).

3.2.2.6. Effects of Exposure To High Concentrations of NO₂

The ambient standard for nitrogen dioxide is 0.05 ppm annual average concentration (Stern et al., 1984). Most effects on human health are the result of short-term exposure to concentrations of NO₂ greater than 0.5 ppm (EPA, 1982). Some studies have shown evidence of increased respiratory illness in children living in homes with gas stoves, where NO₂ concentration reaches almost 0.2 ppm in bedrooms and may have frequent peaks of 0.6 ppm (Florey et al., 1979; Speizer et al., 1980; Spengler et al., 1979; Melia et al. 1979, Goldstein et al., 1979). Single exposures for periods of a few hours or less often result in no effects even when the NO₂ concentration is 1.0 ppm or above (Hackney et al., 1978; Beiland, Ulmer, 1976). Asthmatics and those afflicted with chronic bronchitis are the most likely to experience symptoms including possible chest discomfort, dyspnea, headache and/or slight nasal discharge following 2 hours of exposure to 0.5 ppm NO₂ (Kerr et al., 1979).

Peak 1-hour ambient concentrations of NO₂ reach 0.4 ppm or above only in California and a few other locations (EPA, 1982). A larger number of cities including Phoenix, St. Louis and New York have reported peak hourly concentrations above 0.25 ppm for the period from 1975 to 1980.

Based on this information we conclude that it is possible that there could be a few days per year in California when asthmatics may be affected by high NO₂ concentrations. It could be that in some years there will be a few days when children experience increased risk of respiratory disease because of NO₂ concentrations repeatedly above 0.2 ppm. Otherwise the health effects of NO₂ are not very significant for those exposed to ambient concentrations.

3.2.3. Light Symptom Relief in the Present Study

From the above review, it is clear that a great range of uncertainty still attaches to the health effects of certain pollutants, particularly the light symptom effects. However, two conclusions stand out. First, realistic pollution control policies will give a fractional day or at most a few days of relief to the majority of people. Second, evidence is more tenuous regarding sensitive risk populations. The possibility needs to be allowed for that these persons would obtain greater relief.

Based on these conclusions the following strategy was chosen. For the light symptoms, one version of the questionnaire asked about one day of relief to establish values per day attaching to fractional-day relief or at most a few days of relief applicable to large numbers of people under many policies.

People were asked about their prevailing symptoms to see how symptom level affects the value per day of the small number of days of relief. A second version of the questionnaire asked about relief of thirty days to encompass sensitive groups whose allergic balance could be affected by ambient air quality changes.

3.2.4. Angina Relief in the Present Study

A basically similar strategy was followed in the questionnaires on the one heavy symptom considered--namely angina. However, the questionnaire strategy was modified to allow for the fact that angina is outside the realm of most people's experience. To find out how the value of varying degrees of relief are related to a prevailing level of symptoms, people were asked to suppose alternatively that they started from levels of one, ten and twenty symptom days of angina. Furthermore, angina being a more serious symptom found in different degrees of severity in the population, requires attention to the quality of the symptoms relieved. To retain manageability, the variety of starting endowments of angina were limited within each questionnaire. One version of the angina questionnaire asked about relief from one, five, and ten days of mild and severe angina. The other questionnaire asked about relief from one, ten, and twenty days of mild and severe angina.

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3.3. DESIGN OF QUESTIONNAIRES IN LIGHT OF FOCUS GROUP EXPERIENCE

3.3.1. Overview

Focus groups were the basic research tool employed in the development of the seven symptom and angina questionnaires. Many alternative versions of the questionnaires were administered to participants during the first half of focus group sessions, followed during the second half by discussions among participants and researchers. These sessions were followed by weekly meetings of the research team devoted to discussing strengths and shortcomings of the test questionnaires, discussing problems and new insights derived from the sessions, and formulating revised versions for testing with the next focus group.

Two seven light symptom questionnaires and two angina questionnaires resulted from this process. The following discussion outlines the major issues that received the greatest clarification and development as a result of the focus group process.

3.3.2. Contingent Valuation Product

Establishing a standard contingent market good to be purchased (in various quantities) by all respondents was a basic requirement. For analytic purposes, a well defined regressor is essential. Realism or concreteness was a complimentary objective, because respondents feel more comfortable bidding on tangible goods.

Early focus group experience confirmed a prior hypothesis that any mention of environmental pollution as a cause of symptoms would distract respondents from expressing their values. No mention of pollution is made in the final versions. Early versions of single light symptom questionnaires achieved concreteness by postulating the existence of an allergy that caused the symptom, and a new prescription medicine that relieved it. The medicine was declared safe by the doctor, and the allergy was declared to pose no underlying threats to health.

Use of variants of this approach with several focus groups, however, eventually convinced the research team that concreteness was purchased at the expense of distraction from the nature of the values being sought. Some respondents expressed disbelief in allergy as a source of some symptoms. They thought in terms of more serious disease as the source of difficulty, suggesting that people were not bidding purely for symptom relief. Some respondents related the cost of symptom discomfort to the price they spend on medicines to obtain relief. Maximum willingness to pay was thus confused with market price, causing misstatement of the correct values. In several focus groups, a frequent explanation for zero bids was that the experience is a common event in everyday life and that it is best simply to live with it until it passes. The zero bids of these respondents are thus

interpretable as "I usually don't spend money on medicines in these situations."

Introducing the judge merit of the doctor into the CV narrative appeared to have a similar unintended effect. Its purpose was to help the respondent accept the narrative as authentic and bid on the basis of best available information. One apparent result, however, was to increase the number of zero bids, because people took account of the fact that they usually don't visit the doctor because of these symptoms. The CV narrative implied a visit to the doctor, which would be costly in terms of both time and money.

Thus the attempt to construct a tangible, real-life situation in terms of allergy, medicine and implied doctor visit created an information overload that biased responses away from true willingness to pay for symptom relief. The solution to the problem was to use a more abstract narrative that abandoned these devices. In the final version of the questionnaire, the respondent was reminded of the various ways he might deal with the symptoms--buy medicine, go to the doctor or simply wait for them to go away. Then he was asked to notice that a cure might be worth even more than the price he had to pay for medicine or doctor's assistance, and might be valuable to him even if he just waited for relief to come on its own accord. The CV questions that follow this general introduction are of the form "If you were faced with 30 additional days of coughing in the next 12 months, would it be worth \$100 to completely get rid of these coughing days?"

This version of the light symptom questionnaire was field tested before being adopted, and was found to be effective. The relatively abstract nature of the contingent market good proved to be acceptable to respondents.

3.3.3. Bidding Framework

3.3.3.1. Symptom Selection: Light Symptoms

Because policy application was the research objective, a set of individual symptoms and symptom combinations had to be selected that would be affected by environmental policy. At the same time, contingent markets in symptom reduction had to be established in a manageable bidding framework. At the outset, the choice was between restricting each questionnaire to one or two symptoms on the one hand, or on the other hand, constructing more inclusive questionnaires that spanned the set of policy consequences.

The former route initially appeared to permit more intensive iterative bidding and the attainment of more points on the bid functions of each of the symptoms. Accordingly, one symptom questionnaires were developed and tested in focus groups. The result, however, was that respondents quickly tired of

concentrating at length on the symptom problems. Iterative bidding, while helpful in getting the bidding process focused on reasonable values, proved to be redundant after several applications.

The final seven symptom questionnaires contained the solutions to these problems. Tedium was reduced by introducing a variety of symptoms. Before money bids for symptom reduction were asked, respondents ranked the symptoms in order of bothersomeness to them. This led them to establish relative values among the symptoms before bidding and to think at length about their own preferences first. Iterative bids were obtained on the least -and most- bothersome symptoms. Bids for each of the intermediate symptoms were then directly obtained without iteration.

3.3.3.2. Symptom Selection: Angina

Angina symptoms were included in the light symptom surveys during early focus groups. It was decided to use them in a separate set of surveys to reduce the length and complexity of these exploratory survey forms. Angina symptoms were seen as being qualitatively different from the light symptoms. Consequently they required individually tailored sections to prepare the respondent for bidding. First, a longer, more detailed set of symptom descriptions was necessary because most people are unfamiliar with angina. Secondly, the health status part of the questionnaire had to be related to angina in order to establish the appropriate health endowment and serve as effective respondent warm-up.

The angina questionnaires represent a step in the direction of the study of life threatening health problems. Severe angina introduces anxiety and extreme pain. The narrative carefully excludes danger of death, however, and is thus purely symptom oriented. A risk of death question was included in early versions of the angina questionnaires, but was dropped when it was recognized that careful preparation of respondents in probability interpretation was necessary. It is expected that the angina responses will be useful in understanding health problems involving the anxiety and response of risk bearing associated with serious illness and death.

3.3.3.3. Frequency of Symptom Occurrence in Questionnaires

Much focus group experimentation was devoted to determining the proper number of bids to elicit from respondents. Progress in the solution of this problem complimented work in determining the number of symptoms it was feasible to investigate in one questionnaire. Several issues were involved. A purely practical problem was how many bids could a respondent make before losing concentration and giving mechanical answers. This question was discussed in numerous meetings following focus group sessions.

Various devices were developed to discourage mechanical bidding.

Another issue was the necessity of representing both normal and sensitive populations. Bids representing both small and large symptom responses to environmental change were necessary in order to estimate benefits among all affected groups. Getting people to take small symptom changes seriously required major experimentation. A third issue was the desirability of having an adequate manner of points to econometrically estimate bid or demand functions for symptom reduction.

As described in section 3.4, both the angina and the seven symptom surveys were split into two versions -- identical except for frequency of symptom occurrence and number of symptom days reduction to be valued.

3.3.4. Health Status

The health status module of the seven symptom survey underwent considerable evolution as a result of focus group experience. The basic challenge was to obtain a substantial amount of detailed information about the background and experience of the respondent with each of the seven symptoms, and information about expenditures for medicine and professional care on the symptoms. Early attempts proved to be cumbersome and time consuming, and much of the individual symptom detail was removed. When it became evident that too much analytically valuable information was being lost, further attempts were made to include it, and an efficient format, originally developed for an experimental mail survey, was successfully adopted.

3.3.5. Respondent-Interviewer Interaction

As expected, some respondents had difficulty concentrating on the survey for more than a few minutes. To combat this problem, a number of handout cards were developed for use throughout the interview. Some of these cards simply list the respondent's choices of answers. Others play a more active role in the survey. Ranking of symptoms was introduced into the seven-symptom survey primarily to avoid mechanical or inadequately thought-out bidding. People tended to bid the same amount for several symptoms without too much thought in early focus groups. The ranking approach required them to consider carefully which symptoms were more or less bothersome. (Ties were allowed.) Greater variation in bids resulted in later focus groups. The respondent arranged the symptom cards from least to most bothersome. He was asked to think carefully about the role of these symptoms in his own life. The resulting card order determined the order of bidding.

The tally sheet was filled out by the respondent to keep track of bids. The respondent was given an opportunity to revise

bids and symptom rankings, in case he had second thoughts about these judgments as the contingent valuation was carried out.

3.3.6. Length of Interview

Experience indicated that respondents could be kept involved in the interviews for up to about 40 minutes. All final questionnaires fall within that time limit.

3.4. STRUCTURE OF CV INSTRUMENT

The structure of the health survey is reflected partly in the organization of the questionnaires, and partly in the relationship of the questionnaires to each other. Internally, the four questionnaires have essentially the same organization. Their major features are questions on health endowment in the beginning, followed by contingent valuation questions and ending with questions on socioeconomic characteristics. A major structural feature of all questionnaires is that they contain a high degree of interaction throughout between interviewer and respondent. Pairs of angina and seven symptom questionnaires were used in the field in order to obtain responses on a range of symptom severities. This contributed greater precision to econometric estimation and assured that contingent market symptom avoidance spanned an adequately wide range of experience to be useful in policy analysis. Pairs of questionnaires were used rather than single versions in order to keep interview time within acceptable bounds. Responses were pooled during analysis into single data sets for the seven symptom and for angina.

Details of the questionnaire structure are given in the remainder of this section, using the one symptom day version of the seven symptom questionnaire for discussion. Differences in the other questionnaires are then described briefly.

3.4.1. Seven Symptom Health Questionnaire: 1 Day

3.4.1.1. Introduction

The first page of the questionnaire introduces the interviewer, briefly explains the purpose of the visit and seeks an eligible respondent. Some general respondent and interview identification is recorded.

3.4.1.2. Health Evaluation

The respondent is asked to subjectively rate his own health. This is followed by questions on perceived degree of control over own health, and frequency of illness or physical discomfort during the last month.

These three questions orient the respondent to thinking about the subject of health, about which detailed hypothetical and experience-based questions will be asked. They are also intended for use as explanatory variables in the analysis.

3.4.1.3. Health Status

This section focuses on the respondent's experience with the seven symptoms during the previous twelve months. It is difficult to get accurate recall over a year long period, but a

shorter period was ruled out because responses would likely be unrepresentative because of seasonal effects.

In the first question, people are simply asked if they have experienced any of the seven health problems during the last year. They are handed a card that lists the problems. A series of questions is then asked concerning the problems experienced by respondents. First, they are asked to recall about how many times they have experienced each problem. Next, respondents rank problems from most to least bothersome. These three initial questions are increasingly specific-- eliciting more and more recall and thought.

The next questions quantify symptom severity in physical terms. They obtain information on the numbers of days of activities of various kinds that were lost or interfered with by each of the symptoms. If work days were lost, they are asked how much earnings fell as a result.

The following questions pertain to purchase of medicine or use of professional health care related to the symptoms. First, respondents are asked if they have purchased medicine or visited a health professional. Then they are asked how many times and lastly, how much it cost (net of insurance payments). Lastly, respondents are asked if they have experienced any of the symptoms in combination. If so, they are asked to name the combination of symptoms they have experienced most frequently.

Health status was one of the most extensive and time-consuming sections of the questionnaire. The principal reason for obtaining such extensive health status information is to provide the data base for the comparison of the health expenditures and contingent valuation analyses. Less detailed data bases originally considered would have greatly restricted the comparative analysis.

The other purpose of the health status data is that it, together with the health evaluation responses, determined the health endowment of the respondent. It is important to know the initial health condition of the respondent because initial health is hypothesized to be an important influence on willingness to pay for additional symptom avoidance.

3.4.1.4. Defensive Measures

Respondents are asked if they have purchased any air quality control equipment for their home or car for health reasons. They are asked if they avoid smoking and if they have changed location of residence for health reasons.

Money spent on equipment to reduce the risk of health problems is an important part of what some people are willing to pay to avoid the seven questionnaire symptoms. Avoiding smoking is not money expenditure, but represents an expenditure of effort

for many people that is probably equivalent to a large monetary expenditure. Moving for health reasons reflects willingness to pay both in terms of dollar amount and effort.

The role of defensive measures, or averting behavior, was given considerable theoretical attention during the time that the survey was being prepared and administered in the field. That work is reported in sections 2.2 and 2.7. The abridged list of defensive measures included in the questionnaires had the purpose of giving a preliminary indication of the direction and extent of their influence on willingness to pay for symptom avoidance.

3.4.1.5. Ranking of Symptoms

This section is a preparation for the bidding of the contingent valuation section. It establishes the standardized hypothetical product to be valued. Each symptom is described in a brief statement read by the interviewer. Cards are handed to the respondent, summarizing the main points of each symptom description. The respondent is asked to suppose that his health endowment during the next twelve months will be exactly as it was in the past twelve months, except for one additional day of each of seven symptoms in turn. Thus, while the additional symptom day is the same for all, nevertheless the situation for each is unique because it is based on own individual experience. Several objectives are accomplished by this approach. First, a standard product is established, making it clear for purposes of quantitative analysis what is being valued by the bids. Second, realism is achieved by relating the contingent valuation problem to the respondent's personal experience. (The respondent has, of course, just spent quite a bit of time recalling that experience.) Third, it permits analytic exploration of the entire demand surface of the population by giving measures of willingness to substitute symptom free days for other goods over a wide range of health endowments.

The ranking procedure accomplishes the additional objective of establishing relative valuations among the symptoms in physical terms. It requires the respondent to think carefully about the symptoms in personal terms before bidding. Symptoms and symptom cards are presented to the respondent one by one, as described above. After each card is presented, the respondent is asked to arrange the cards in a stack with the more bothersome symptoms towards the bottom. Ties are permitted. The interviewer records the rankings on a tally sheet, in the order determined by the respondent.

3.4.1.6. Contingent Valuation

To further prepare the respondent for bidding, a household spending card is presented. This card lists six categories of household spending together with amounts and percentages spent by a typical family. The respondent is urged to think about the

actual amounts pertaining to his own family, and think specifically where symptom bids would affect the family budget.

After discussing the spending card, a paragraph is read to the respondent that gives some instructions about how to think of the contingent markets about to be examined. The problem addressed is that people often think about willingness to pay in terms of what they actually pay in the market for remedies. In cases where they are accustomed to suffering through a problem until it goes away without buying medicine or going to the doctor, people often declare their willingness to pay to be zero. Respondents are asked to set aside their actual behavior in these situations and enter a simpler kind of hypothetical market in which a monetary payment could be exchanged for a cure. The contingent market is structured this way in order to avoid the larger number of zero bids that were found to result from alternative structures. An important feature of the contingent market structure is that it abstracts from visits to the doctor, purchases of medicine or similar activities usually associated with curing health problems. A straightforward, abstract market involving a simple expression of willingness to pay was adopted and found, with suitable preparation, to be acceptable to respondents. The advantage of this approach over more tangibly constructed markets is that it avoids the equation of "I usually do nothing to treat this symptom" with "I am willing to pay zero."

Bidding then proceeds for each of the seven symptoms. For each symptom, the respondent is asked to suppose that his health will be the same during the next year as last, except for one additional day of the symptom in question. Bidding begins with the least bothersome problem identified by the symptom card at the top of the stack. The second contingent valuation is given for the most bothersome problem, corresponding to the bottom card.

These two bids are obtained by means of iterative bidding. An arbitrary starting period of 100 dollars is used. Bidding proceeds up -- doubled -- or down -- halved -- depending on whether the respondent says yes or no to the opening offer. Once a no answer is received after an opening yes bid, half the difference between the last no answer and the most recent yes answer is asked. Bidding concludes with the last yes answer or zero. Answers are recorded on the tally sheet.

Having bracketed the dollar values on the least and most bothersome symptoms, the respondent is asked to decide the values for avoiding symptoms of intermediate bothersomeness. No bidding game is utilized; the respondent simply enters the values on the tally sheet. The respondent is encouraged to change bids, or even alter the original rankings if desired.

The next part of the contingent valuation section is devoted to combinations of symptoms. One combination consists of an extra day of cough, sinus and throat problems. Another

consists of an extra day of headache, nausea, and drowsiness symptoms. As an approach to valuing the avoidance of a day of these symptoms, the respondent is asked to add respective individual bids and compare the sum with the value of avoiding all three together.

The next contingent valuation question asks willingness to pay for a day of symptom relief for the respondent's entire household, using the first three symptom combination: cough, sinus and throat problems. The last question extends the day of relief from the three symptoms to everyone in the entire United States. The bid is for relief over and above that already bid for the respondent's own family.

3.4.1.7. Reasons

In this section, the respondent distinguishes loss of activity in the market (work away from home; medical expenses) and activities outside the market (comfort, work at home, recreation). Respondents rank as many of the six categories (including "other," which they are asked to specify) as pertain to them. One intended use of the rankings is a descriptive tabulation that provides a qualitative summary of the importance of the symptoms to the general population. Another use is to provide additional information for the comparative analysis of willingness to pay vs. health expenditures in valuing symptom reduction.

The second reasons question asks respondents to compare the severity of the hypothetical symptoms described to them in the contingent market with the severity of corresponding symptoms they actually experienced. Then respondents are asked how much they would pay to completely get rid of the symptoms they have actually experienced. The question helps to quantify the product being offered by linking it to the hypothetical symptom descriptions in terms of severity. Information on frequency has already been gathered in the health status section.

While the contingent value question on actual symptom experience logically belongs in the previous section, including it here gives the respondent a little relief and variety, and permits proper preparatory questioning.

Finally, an opportunity is given to change many of the bids and rankings about which the respondent may have had second thoughts.

3.4.1.8. Socioeconomic Questions

Socioeconomic information, together with the health endowment data collected at the beginning of the survey, quantifies the explanatory variables in the willingness to pay regressions. Socioeconomic questions comprise general

demographic household information, various measures of household market activity and general measures of human capital. The health endowment information is complementary in that it quantifies important specific human capital variables.

The first three questions deal with past and expected change of residence. The next question identifies the respondent's occupation. A question on respondent aptitudes is included partly as a general human capital measure, and partly for the purpose of gauging ability to respond to the questionnaire. The remainder of the socioeconomic section gathers household data on age, race, education, family size and structure, current and permanent income, wealth and saving.

3.4.1.9. Interviewer Evaluation

At the end of the questionnaire, the interviewer records comments that may be helpful in identifying problems that call into question the quality of the responses.

3.4.2. Seven Symptom Health Questionnaire: 30 Days.

This version of the seven light symptom survey is identical to the one day version except that avoidance of thirty additional days of symptoms, instead of one additional day, are ranked and valued in the ranking and CV sections.

3.4.3. Angina Health Questionnaire: 10 Days.

The angina questionnaires are identical to the seven symptom questionnaires in the following sections: introduction, health evaluation, defensive measures, reasons, socioeconomic questions and interviewer evaluation. The content of the remaining sections is modified as described below.

3.4.3.1. Health Status

The first group of questions pertains to respondents who have been diagnosed as having a heart condition of any kind. First, they are asked if they know the name of their condition. Next, they are asked to list the symptoms they have experienced and to rank them according to how bad they were. Frequency of occurrence is then recorded. For those respondents who experienced some curtailment of normal activity, information similar to that in the seven symptom survey is obtained. Respondents are then asked about types and extent of health care they have received for their condition during the past year, and associated expenses. The health status section concludes by asking all respondents, including those without heart condition, if they are familiar with the subject of the survey--angina pectoris; whether they know anyone with the condition; and how

they are related to these people.

As in the seven symptom surveys, the health status section establishes the respondent's health endowment most closely related to the concern of the questionnaire, as well relevant health expenditure data. The questions about familiarity with the health problem are an important addition to the angina questionnaire, because they address the question of the importance of familiarity and semantic efforts.

3.4.3.2. Contingent Valuation

The contingent valuation sections of the ten day and twenty day angina questionnaires are structured identically. The ten day questionnaire is described in detail here, followed by a brief comparison with the twenty day version.

The section begins with a general two paragraph introduction that asks the respondent to imagine having the angina problems about to be described -- first a relatively mild problem; then a severe one. The introduction concludes with a brief statement about the extent of angina pectoris in the United States.

Contingent valuation begins with an endowment of one day of mild angina symptoms a month on the average. The problem is described by the interviewer and summarized on a card handed to the respondent. Willingness to pay to avoid the problem is elicited by means of an iterative bid with a starting point of \$53.00. The odd number was chosen to avoid tempting the respondent to settle for a round number at the beginning.

The next question supposes an endowment of ten mild symptom days a month. Willingness to pay pertains to eliminating one of these days. Iterative bidding is again employed, starting at twice the value determined by the respondent on the previous answer. The third question pertains to eliminating all ten symptom days. The fourth question eliminates five of the ten symptom days. No iteration is employed in the third and fourth questions.

The second half of the contingent valuation section pertains to severe angina, which is described by the interviewer and by the summary card handed to the respondent. Endowments, levels of avoidance and bidding strategy are the same as for mild angina. The starting bid for avoidance of the one day per month of severe angina is twice the corresponding bid for mild angina. Twice this bid is the starting point for eliminating one day out of ten severe angina days.

3.4.4. Angina Health Questionnaire: 20 Days

This version of the angina survey is identical to the ten day survey, except that the endowment of angina the respondents

were asked to imagine they experienced, and the number of days of relief bid for, ranged from one day to ten days to twenty days of mild and severe angina.

3.5. HOUSEHOLD SAMPLING

3.5.1. Sampling Procedures

The basic objective of the sample design was to obtain a representative cross section of households on which to base inferences about health behavior. Two metropolitan areas were sampled--Chicago and Denver. Two different cities were chosen to test for possible regional differences in responses.

Random sampling was employed. Census tracts within each metropolitan area, and starting points within each tract, were chosen randomly. The sample in each metropolitan area was drawn using 1980 census tract maps and census statistical tables. First, all of the n census tracts in the urban portion of the metropolitan area were assigned numbers one through n . Then about thirty numbers between one and n were drawn from a table of random numbers and matched with the corresponding census tracts. Eight interviews were to be taken within each tract, in the order drawn, until an adequate city sample was obtained. Extra tracts were drawn in case eight interviews could not be obtained in some of the tracts. The sampling order of the random draw had to be followed, however; no interviewer discretion was allowed in tract choice.

Random selection of households within each tract was achieved in a similar way. Every block within each selected tract was assigned a number between one and m , which was determined by counting the blocks shown on the census tract maps. A random number between one and m was chosen to determine the block where interviewing started. Additional blocks were determined by going to the next-higher numbered block as indicated in the tract maps (returning to the lowest-numbered block if necessary).

The interviewer's starting point on each block and the direction to proceed around the block were uniformly specified in advance for all interviewers. The procedure continued until eight interviews were obtained within a tract.

Copies of census tract maps were provided to all interviewers, with starting blocks clearly indicated. Field supervisors in each city worked closely with interviewers, and monitored their work. Contact between the field supervisors and the University of Chicago survey coordinator was maintained throughout.

3.5.2. Sample Size and Editing

One-hundred-ninety-nine interviews were completed, approximately equally divided between two cities. Twenty three of these interviews had to be removed from the sample. The reasons for removal were infinite bids (respondents who said they

would pay any amount), random bidders, whose bids bore no logical relationship to each other, and protectors.

Similar to other personal interviewer surveys employed in the past, a few incomplete and inconsistent responses were a problem in the analysis. It was occasionally necessary to extrapolate existing information to fill the gaps left by respondents who were unwilling or unable to provide consistent or thorough information. In the present surveys, two areas required particular attention: willingness to pay bids and values of household income.

The bids are crucial to the CV framework and it was necessary to assure their validity. "Protectors," respondents who refused to give any bids, were removed from the sample. The protectors were determined by the lack of any CV bids and/or an interviewer comment, and were distinguished from those who wished to bid zero. Zero bidders were left in the sample on the grounds that the bids were felt to be legitimate by the interviewer and by the consistency of other information provided.

Equally important to being willing to participate in the experiment (i.e. not be a protestor) is that the respondent fully understood the nature of the exercise. A lack of understanding of the willingness to pay concept led to the exclusion or editing of two other groups of respondents. First are random bidders, the several respondents who bid dollar amounts that were grossly out of sequence for the manner in which they had ranked the symptoms. They were entirely excluded. As should be clear by the description of the survey instruments, this was a problem only in the seven light symptom versions. A second and somewhat more important group was the few respondents who bid infinite amounts (a willingness to pay "any amount") or exorbitantly high amounts (two or three times their yearly income) for the relief of the symptoms. As was stressed in the survey, it is important for a CV experiment to have bids that are consistent with the household budget constraint. In most cases, respondents offered unrealistic bids for only one or two endowments. The various combinations of symptoms, the additional amount to relieve the entire United States and twenty days of severe angina were the questions that occasionally induced unrealistic bids. Allowing those respondents' other, more reasonable, bids to be included, the questionable bids were set equal to missing values. Exclusion of the very high bidders may have produced some downward bias on the summary statistics and the regression results because the actual, although unknown, values of these bidders may have been higher than others in the sample.

The final determination of household income also needed additional work. To gather this figure, the survey used a direct question on yearly income and a variety of questions concerning hours, weeks and months worked, and hourly, weekly, and monthly wages of all members of the household. If income was still undetermined, a default mechanism allowed the respondent's median census tract income to be used.

3.6. EMPIRICAL RESULTS FROM HOUSEHOLD PERSONAL INTERVIEWS

3.6.1. Introduction

The four versions of the personal interviews were administered throughout the Chicago and Denver metropolitan areas in the winter of 1984/85. The data were collected from the field interviewers by an area supervisor and returned to the University of Chicago for coding, inputting and analysis. This section presents the summary statistics and gives the results of the regression analyses.

Multiple regression analysis was used to investigate the relationship between the contingent valuation bids for improved health and various socioeconomic and health status measures. The goal was to determine how much of the variation in individuals' bids could be explained by differences in observed characteristics. Since the four versions of the surveys ask respondents to value quite different changes in health, each version is analyzed separately.

The socioeconomic measures used as explanatory variables in the regressions are income, education, race (white/non-white), age and sex. Assuming health is a normal good, it is expected that higher income respondents would bid larger amounts. Since wealth or permanent income may be more relevant to the individual's willingness to pay than his current income, a variable indicating whether the respondent owns or rents was included in an earlier set of regressions as a proxy for wealth. However, this variable had an unexpected sign, and is not included in the regressions reported below. There is no obvious explanation for the anomalous results, except that the own/rent variable may be a poor proxy for wealth, perhaps because door to door sampling may result in an atypical mixture of owners and renters .

The remaining socioeconomic measures used as explanatory variables are motivated by the literature on the demand for health and medical care. For a review of this literature, see Feldstein (1982); a standard reference is Grossman (1972a,b). Studies have found systematic differences in demand for medical care and health according to education, race, age, and sex. These same patterns may appear in the contingent markets for health defined in the four surveys. If so, the better educated individuals are expected to bid more for improvements in health. Whites are expected to bid more than nonwhites, older individuals are expected to bid more than the young, and females are expected to bid more than males.

Differences in the expected cost of illness (out of pocket medical expenses and foregone earnings) might also help explain differences in bids to avoid illness. Measurement of these expected costs is difficult, however. For those individuals who had experience with the light symptoms, past costs may be used as an estimate of expected costs, but this limits the sample. For

these smaller samples, willingness to pay bids were regressed on experienced cost of illness, as described in section 2.6 of Volume 2. The cost of illness were measured as the sum of medical expenses and foregone earnings, adjusted for health insurance coverage and paid sick leave. The coefficients on the cost of illness terms were not significantly different from zero, indicating that in these small samples the willingness to pay bids and cost of illness show no strong tendency to move together in a systematic fashion. Cost of illness measures were not used in the regressions using the full samples reported below.

A set of health status measures were included in the regressions as explanatory variables for the willingness to pay bids. For all four surveys, a measure of general health status was included, indicating whether the respondent judged his own health to be excellent, or other, that is, to be only good, fair or poor. For the seven symptom surveys, the individual's previous experience with the symptom was included. For the angina surveys, a dummy variable indicating whether the individual had a heart condition or not was included. Individuals in bad health, as indicated by these measures, are expected to bid higher amounts for improvements in their health, reflecting increasing marginal disutility of bad health.

The concept of increasing marginal disutility can be seen to be the converse of the more familiar idea of decreasing marginal utility. Equation (3.1) represents an ordinary utility function,

$$(3.1) \quad U = u(H),$$

where H = symptom free days. The utility of the individual is simplified to be a function of only symptom free days. It is assumed that the utility function exhibits traditional properties of a positive marginal utility, $(du)/(dH) > 0$, and diminishing marginal utility, $(d^2u)/(d^2H) < 0$. The second assumption implies that the more healthy days an individual experiences, the less he is willing to pay to obtain an additional good day.

The case at hand does not deal directly with healthy days, but rather with the change in symptom days experienced and the indirect effect on individual utility. The amount of symptom free days can be expressed as

$$(3.2) \quad H = T - S,$$

where T = Total number of days available;
 S = Days were a symptom is experienced.

Thus the amount that people are willing to pay to rid themselves of a particular symptom is a measure of marginal disutility, not marginal utility.

The marginal utility of a symptom day is expressed as follows and is negative:

$$(3.3) \quad (dU)/(dS) = ((dU)/(dH)) ((dH)/(dS)) .$$

However, from equation (3.2), $(dH)/(dS) = -1$; therefore

$$(3.4) \quad (dU)/(dS) = - (dU)/(dH) < 0,$$

since $(dU)/(dH)$ is assumed to be positive.

Marginal disutility, M , is the negative of the marginal utility expression in equation (3.4):

$$(3.5) \quad M = (dU(H))/(dH) .$$

The CV experiment considers the change in the marginal disutility as the number of symptom days increases. From equation (3.5), we get

$$(3.6) \quad (dM)/(dS) = (d^2U(H))/dH^2 (dH)/(dS) .$$

Recalling that $(dH)/(dS) = -1$, we find

$$(3.7) \quad (dM)/(dS) = - (d^2U(H))/(dH^2) > 0 .$$

This follows from the original assumption that the utility function exhibits increasing marginal utility.

The analysis has shown that the hypothesis of diminishing marginal utility of good, a commodity that is enjoyed by an individual, implies increasing marginal disutility of a bad, a commodity that is not enjoyed by an individual. Thus, the result that people are willing to pay more for an extra day of relief the more symptom days that they have already experienced, is consistent with received utility theory.

Summary statistics and the results of the regression analyses are reported in sections 3.6.2 through 3.6.5. These sections also discuss in greater detail the regression techniques used. Section 3.6.6 summarizes the results of the analyses and

discusses the implications for valuing health.

3.6.2. Seven Symptoms: One Day Relief

3.6.2.1. Summary Statistics

Reported in Table 3-5 are the means and standard deviations for all variables that were included in the regression analysis of the seven symptoms, one day relief questionnaire.

Presented first are the bids to relieve one day of each of the seven light symptoms. The mean values range from \$50.28 to relieve one day of nausea to \$25.20 to relieve one day of coughing. The ranking of the symptoms from most bothersome to least bothersome, according to mean bid values, is: nausea, headaches, sinus problems, drowsiness, throat congestion, itchy eyes, and coughing. The next set of variables presented are the bids to relieve a combination of the symptoms for the individual and the United States, and to relieve the symptoms that are actually experienced by the respondents.

Following the bids are the independent variables used in the analysis. The central tendencies for income and education are high for a random sample, but not very different from those obtained in other door-to-door surveys. There is a substantial spread in these variables.

The "white," "own-rent," "sex," and the various health status variable are zero-one dummy variables as indicated. Seventy-three percent of those interviewed answered "white" to the race question. The health status variables disclose the respondents' general perception of their personal health.

The last set of variables used in the analysis indicates the respondents' experience with each of the seven symptoms over a twelve month period. The mean symptom days range from 19.75 days of itchy eyes to 1.3 days with nausea. The mean values may appear slightly large. This is primarily due to the respondents who claim to have experienced a symptom extremely frequently. The two largest values, for example, headaches and itchy eyes, each had one respondent who claimed to have experienced the symptom virtually every day of the year in question.

Table 3-5
Means and Standard Deviations for Seven Light Symptom
One Day Survey

Variable	Label	Mean	Standard Deviation
BIDCGH1	Bid to relieve 1 additional day in coughing	25.20	38.66
BIDSNS1	Bid to relieve 1 additional day of sinus problems	35.05	42.32
BIDTHT1	Bid to relieve 1 additional day of throat congestion	28.97	42.29
BIDEYE1	Bid to relieve 1 additional day of itchy eyes	27.73	33.01
BIDDRW1	Bid to relieve 1 additional day of drowsiness	31.41	45.69
BIDHED1	Bid to relieve 1 additional day of headaches	40.10	61.23
BINAS1	Bid to relieve 1 additional day of nausea	50.28	102.41
BID1231	Bid to relieve 1 additional day of coughing, throat congestion, and sinus problems	65.60	77.13
BID5671	Bid to relieve 1 additional day of drowsiness, headaches, and nausea	95.08	158.84
BIDCOMB1	Bid to relieve 1 additional day of coughing, congestion and sinus symptoms for entire household	113.65	148.48
BIDUS1	Bid to relieve 1 additional day of coughing, sinus and congestion for entire United States	137.97	297.96
PERSBID1	Bid to relieve own actual	614.09	1356.96

Table 3-5 (continued)

Variable	Label	Mean	Standard Deviation
INCOME	1983 income of household (dollars)	28583.30	24371.50
EDUC1	Education of person 1 (years)	14.25	4.57
AGE1	Age of person 1 (years)	44.49	15.77
WHITE	1 if white, 0 otherwise	0.73	0.45
SEX	1 if female, 0 if male	0.55	0.50
NOEXHLTH	1 if not excellent overall health, 0 otherwise	0.65	0.48
DAYSSYM1	number of days of coughing	7.65	20.94
DAYSSYM2	number of days of sinus problems	14.08	32.75
DAYSSYM3	number of days of throat congestion	6.83	20.94
DAYSSYM4	number of days of itchy eyes	19.75	69.93
DAYSSYM5	number of days of drowsiness	2.50	10.50
DAYSSYM6	number of days of headaches	15.88	62.88
DAYSSYM7	number of days of nausea	1.30	4.98

3.6.2.2. Regression Analysis

Using the one day relief data, ordinary least squares regressions were performed. Household income, age, sex, education and race of the respondent, as well as home ownership, various measures of health status and experience with the seven symptoms were used as the explanatory variables. Equation (3.8) is the equation that was estimated.

$$(3.8) \quad Y_{in} = a_i + b_{i1}X_{1n} + b_{i2}X_{2n} + \dots + b_{ik}X_{kn}$$

where Y_{in} = Bid i of person n (i refers to a symptom or combination of symptoms and n refers to the respondent)

a_i = Intercept

b_{ij} = Effect of independent variables j on the i th bid

X_{jn} = Independent variable j for person n

U_{in} = Stochastic error on bid for person n on the i th bid.

The results of the ordinary least squares regressions are presented in Table 3-6. In general, the results offer little support for the expected relationships between the different socioeconomic variables and the amounts bid. The effects of income on bids tended to be small or even negative, and the estimated coefficient is never statistically significantly different from zero. As expected, the more educated did tend to bid more. The coefficient on education is positive in nearly all of the regressions, but is only significantly different from zero at the 95 percent confidence level in one case. It approaches statistical significance in several other cases. In most cases whites bid more than non-whites, as expected, but the effect is never statistically significant. In general, older individuals bid more than the young, but of the estimated coefficients that are positive only one is significantly so. In addition, in the regression explaining the bids to relieve a day of headaches, age had a negative and significant coefficient. Finally, no systematic relationship between the sex of the respondent and the amount bid is found. In about half of the regressions females tended to bid more and in about half females bid less; most of the time these coefficients are not significant in the statistical sense.

More support is found for the expected positive relationship between poor health and amount bid, reflecting increasing marginal disutility of illness. Being in other than excellent

Table 3-6
 Seven Light Symptom One Day Survey Regression Results
 Parameter Estimates

	Coughing	Sinus Problems	Throat Congestion	Itchy Eyes
Intercept	-103.79 (-2.84)	-56.73 (-1.48)	-46.75 (-1.00)	-95.05 (-2.69)
Income	-0.000026 (-0.10)	0.000036 (0.14)	-0.00051 (-1.57)	-0.000023 (-0.11)
Education1	2.85 (1.91)	2.72 (1.71)	2.51 (1.33)	4.22 (2.79)
White	22.41 (1.47)	-3.47 (-0.21)	21.21 (1.13)	19.02 (1.42)
Age1	1.56 (3.23)	0.74 (1.46)	0.46 (0.83)	0.64 (1.65)
Sex	-20.77 (-1.62)	10.57 (0.77)	-10.98 (-0.69)	4.91 (0.42)
Noexhlth	4.58 (0.30)	8.95 (0.59)	31.53 (1.86)	20.36 (1.65)
Days of Dependent Variable	1.43 (3.43)	0.71 (3.23)	1.12 (2.14)	0.15 (1.79)
F Value	3.23	2.83	2.00	2.07
R-Square	0.48	0.45	0.37	0.38

Note: t values in parentheses

Table 3-6 (continued)

	Drowsiness	Headaches	Nausea
Intercept	45.40 (0.93)	47.84 (0.74)	-101.20 (-1.62)
Income	-0.00018 (-0.54)	-0.00081 (-1.82)	-0.00019 (-0.45)
Education1	-2.24 (-1.10)	1.21 (0.45)	3.53 (1.38)
White	3.62 (0.18)	39.18 (1.46)	43.93 (1.77)
Age1	0.74 (1.16)	-1.88 (-2.15)	0.77 (1.06)
Sex	-28.63 (-1.61)	29.87 (1.27)	-4.24 (-0.20)
NoExhlth	-2.22 (-0.11)	73.32 (2.83)	47.05 (2.08)
Days of Depen- dent Variable	3.25 (2.93)	-0.006 (-0.03)	16.91 (8.23)
F Value	2.11	2.84	18.22
R-Square	0.38	0.45	0.84

Note: t values in parentheses

Table 3-6 (continued)

	BID- 1231	BID- 5671	BID- COMB1	BID- US1	PERS- BID1
Intercept	-15.64 (-0.21)	-80.74 (-0.52)	-73.16 (-0.45)	- 369.45 (-1.01)	172.38 (0.11)
Income	0.000062 (0.12)	-0.00066 (-0.67)	0.00046 (0.42)	0.0039 (1.57)	0.0081 (0.75)
Education1	3.77 (1.33)	3.46 (0.61)	9.74 (1.41)	14.36 (0.92)	-19.91 (-0.30)
White	-21.98 (-0.77)	75.34 (1.37)	17.42 (0.25)	56.94 (0.36)	1178.75 (1.73)
Age1	-0.21 (-0.2288)	0.06 (0.03)	-2.13 (-1.07)	1.56 (0.35)	-17.08 (-0.88)
Sex	45.21 (1.87)	-2.22 (-0.04)	135.96 (2.29)	66.80 (0.50)	-447.45 (-0.77)
NoExhlth	3.99 (0.14)	85.52 (1.60)	94.24 (1.49)	83.11 (0.58)	1135.23 (1.84)
Dayssym1	0.91 (0.57)	- -	- -	- -	- -
Dayssym2	1.14 (1.49)	- -	- -	- -	- -
Dayssym3	1.04 (1.31)	- -	- -	- -	- -
Dayssym5	-	-18.01 (-1.27)			
Dayssym6	-	2.59 (1.38)	- -	- -	- -
Dayssym7	-	23.24 (4.98)	-	-	-
F Value	4.28	5.82	2.28	1.09	1.10
R-Square	0.64	0.70	0.35	0.21	0.21

Note: t values in parentheses

health had a positive effect on the amount bid in all but one regression. The estimated coefficients are significant at the 95 percent confidence level in two cases, and significant at the 90 percent level in two more instances. In addition, a strong relationship exists between the respondents' actual experiences, with a symptom and their bids to relieve that symptom. The parameter estimate is usually positive and significantly different from zero. This result holds better for the individual symptom bids than for the bids to relieve combinations of symptoms.

Bids to relieve one symptom day of each of the seven symptoms were also estimated using Zellner's seemingly unrelated regression technique. This procedure will account for any correlation across the bids by individuals. Beginning with the ordinary least squares equation (3.8), this method allows for a correlation in the error terms, giving more efficient estimates. The results (not presented) were parameter estimates that are consistent with the ordinary least squares method. In addition, this technique shows the relationship that exists between the regressions for each of the seven symptoms. It should be noted that all values are positive and occasionally quite close to one. There appears to be a strong correlation between the bids for headaches and nausea, and a lesser but still strong relationship between itching eyes, and both nausea and headaches.

3.6.3. Seven Symptoms Thirty Days Relief

3.6.3.1. Summary Statistics

Table 3-7 shows the means and standard deviations for the variables in the thirty days relief surveys.

As before, the means and standard deviations of the bids for each of the seven symptoms and combinations of symptoms are presented first. The mean bids for each of the seven symptoms range from \$488.20 to relieve thirty days of headaches to \$166.50 to relieve thirty days of coughing. Drowsiness, sinus problems, itching eyes, throat congestion and nausea is the order of the remaining middle symptoms. This ranking is different from that in the one day version, with only sinus problems, coughing and throat congestion occupying the same position.

The thirty day results are also not thirty times larger than the one day even though the added endowment is thirty times larger. The differences between the one day and thirty day bid values appear to be on the order of ten. Comparison of the bids from the two difference survey instruments thus does not support the hypothesis of increasing marginal disutility of symptom days. This is in contrast to the results of the regressions explaining the one day bids.

Table 3-7
Means and Standard Deviations For Seven Light Symptoms
Thirty Day Survey

Variable	Label	Mean	Standard Deviaton
BIDCGH3	Bid to relieve 30 additional days of coughing	166.50	230.27
BIDSNS3	Bid to relieve 30 additional days of sinus problems	265.62	359.82
BIDTHT3	Bid to relieve 30 days additional of throat congestion	206.26	284.88
BIDEYE3	Bid to relieve 30 additional days of itching eyes	235.53	458.94
BIDDRW3	Bid to relieve 30 additional days of drowsiness	317.98	593.00
BIDHED3	Bid to relieve 30 additional days of headaches	488.20	833.21
BIDNAS3	Bid to relieve 30 additional days of nausea	186.02	256.02
BID I233	Bid to relieve 30 additional days of coughing, throat congestion and sinus problems	624.98	879.87
BID 5673	Bid to relieve 30 additional days of drowsiness, headaches and nausea	868.89	1343.36
BIDCOMB3	Bid to relieve 30 additional days of coughing, congestion and sinus symptoms for entire household	1250.00	2165.51
BIDUS3	Bid to relieve 30 additional days of coughing, sinus and congestion for entire United States	483.46	1013.62
PERSBID3	Bid to relieve own actual	1169.07	2369.27

Table 3-7 (continued)

Variable	Label	Mean	Standard Deviation
Income	1983 income of household (dollars)	30109.70	18359.90
EDUC1	Education of person 1 (years)	13.83	4.10
AGE1	Age of person 1 (years)	42.15	15.72
WHITE	1 if respondent is white, 0 otherwise	0.81	0.40
SEX	1 if female, 0 if male	0.49	0.51
NOEXHLTH	1 if excellent overall health, 0 otherwise	0.70	0.46
DAYSSYM	1 number of days of coughing	4.96	14.05
DAYSSYM	2 number of days of sinus problems	9.64	28.39
DAYSSYM	3 number of days of throat congestion	1.89	4.82
DAYSSYM	4 number of days of itchy eyes	33.15	112.74
DAYSSYM	5 number of days of drowsiness	6.74	43.75
DAYSSYM	6 number of days of headaches	24.23	62.54
DAYSSYM	7 number of days of nausea	1.96	4.52

Most of the independent variables that follow in Table 3-7 are consistent with those found in the one day experiment.

3.6.3.2. Regression Analysis

The analysis of bids for thirty days of symptom relief is similar to the analysis of the one day bids already discussed. The results of the ordinary least squares regressions are presented in Table 3-8. The results are not supportive of the expected relationships between the socioeconomic variables and the amount bid. Income had a generally positive effect on bids, but the estimated coefficients were never significantly different from zero. In fact, virtually none of the estimated coefficients on the socioeconomic variables differed significantly from zero in the statistical sense. In addition, for many of the variables the signs of the coefficients were not consistent across regressions explaining bids for different symptoms.

The results of the regressions explaining the thirty day bids are also not supportive of a positive relationship between poor health as indicated by a general health status variable or the number of days of a symptom the individual actually experienced. There was some tendency for the individuals who had experienced more days of a symptom to bid more for thirty days of relief. However, the estimated coefficients were not significant, and the signs of the coefficients were not always consistent across regressions.

The seemingly unrelated regressions (not reported) again yielded comparable, but more efficient parameter estimates than the ordinary least squares regressions. The correlation across models is considerably stronger than was found in the one day results. A correlation greater than .9 is found across the same models as in the one day sample as well as across many other models.

Table 3-8

Seven Light Symptom Thirty Day Survey Regression Results
Parameter Estimates

	Coughing	Sinus Problems	Throat Congestion	Itchy Eyes
Intercept	365.02 (1.45)	258.35 (0.59)	322.28 (0.96)	135.52 (0.23)
Income	0.0007 (0.31)	0.0002 (0.05)	0.00095 (0.30)	0.062 (1.16)
Education1	-3.98 (-0.37)	2.93 (0.15)	6.91 (0.48)	29.50 (1.20)
White	-197.72 (-1.74)	-133.96 (-0.66)	-324.37 (-2.22)	-723.34 (-2.39)
Age1	-0.10 (-0.03)	1.56 (0.32)	1.07 (0.29)	5.61 (0.88)
Sex	-15.11 (-0.19)	-20.76 (-0.15)	49.26 (0.47)	-85.52 (-0.47)
NoExhlth	-19.17 (-0.22)	-26.44 (0.18)	-52.72 (-0.22)	-71.30 (-0.78)
Days of Depen- dent Variable	6.93 (1.79)	0.08 (0.01)	-2.22 (-0.22)	-0.74 (-0.78)
F Value	1.51	0.14	0.84	1.37
R - Square	0.28	0.04	0.18	0.26

Note: t values in parentheses

Table 3-8 (continued)

	Drowsiness	Headaches	Nausea
Intercept	449.52 (0.60)	615.88 (0.57)	159.09 (0.59)
Income	0.0072 (0.99)	0.007 (0.73)	-0.00013 (-0.05)
Education1	-18.35 (-0.56)	55.30 (1.23)	7.91 (0.61)
White	5.85 (0.02)	-1027.00 (-2.13)	-100.50 (-0.88)
Age1	5.48 (0.65)	-2.65 (-0.23)	0.24 (0.08)
Sex	-194.53 (-0.82)	-375.92 (-1.11)	-187.54 (-1.98)
NoExhlth	-377.89 (-1.46)	56.40 (0.16)	56.48 (0.58)
Days of Depen- dent Variable	3.07 (1.11)	1.17 (0.38)	10.42 (1.03)
F Value	0.92	1.27	0.90
R-Square	0.19	0.25	0.19

Note: t values in parentheses

Table 3-8 (continued)

	BID- 1233	BID- 5673	BID- COMB3	BID- US3	PERS - BID3
Intercept	147.26 (0.14)	1057.77 (0.32)	-52.83 (-0.02)	1051.17 (0.81)	-1267.41 (-0.55)
Income	0.0014 (0.14)	0.0051 (0.32)	0.017 (0.72)	-0.009 (-0.75)	0.03 (1.34)
Education1	52.42 (1.15)	33.55 (0.42)	180.75 (1.62)	0.10 (0.002)	30.27 (0.30)
White	-500.35 (-0.99)	-789.38 (-0.92)	-2670.97 (-2.37)	-118.13 (-0.21)	-210.71 (-0.21)
Age1	6.90 (0.58)	0.20 (0.01)	27.80 (0.97)	-9.37 (-0.66)	30.57 (1.19)
Sex	-211.81 (-0.62)	-810.01 (-1.32)	-574.83 (-0.71)	-235.54 (-0.58)	207.12 (0.29)
NoExhlth	21.16 (-0.62)	53.06 (0.09)	-465.29 (-0.52)	495.77 (1.11)	-324.67 (-0.41)
Dayssym1	40.23 (1.46)	-	-	-	-
Dayssym2	-18.57 (-0.84)	-	-	-	-
Dayssym3	-57.01 (-1.29)	-	-	-	-
Dayssym5	-	11.53 (1.95)			
Dayssym6	-	0.80 (0.17)	-	-	-
Dayssym7	-	62.32 (1.02)	-	-	-
F Value	0.67	1.40	1.53	0.46	0.67
R-Square	0.19	0.33	0.25	0.09	0.12

Note: t values in parentheses

3.6.4. Angina: Ten Day Endowment

3.6.4.1. Summary Statistics

Table 3-9 presents the means and standard deviations for the data collected in the angina ten day surveys. The first eight values are the dependent variables used in the regression analysis. The bids vary from \$261.84 to relieve ten days of severe angina when the respondent is endowed with ten severe days to \$66.08 to relieve one mild day when only afflicted with one mild day. The bids can be seen to vary according to the severity and duration of the endowment, and according to level of relief provided.

The relationships found between different bids are supportive of the hypothesis of increasing marginal disutility of illness. In general, the more severe or the greater duration of the angina the respondent was asked to suppose he was endowed with, the greater the amount bid. The mean bid for one day of relief from mild angina when the respondent was endowed with ten mild days is greater than the mean bid for the same amount of relief when the respondent was endowed with only one day (\$83.95 and \$66.08 respectively). The same holds true for the bids for relief from one severe day when endowed with either ten or one days.

The independent variables that follow are similar to those found in the light symptom surveys. A major difference is the replacement of symptom days experienced with the variable, HEARTCON, that indicates whether or not an individual respondent has experienced a heart condition. This new variable should permit similar explanatory effects on the magnitude of the bids as well as allow for testing the existence of increasing marginal disutility of this symptom. About one quarter of this sample had ever experienced a heart condition.

The other independent variables are equivalent in nature to those found in the earlier tables. It should be noted that a slightly lower income figure and a higher average age are found in this version.

Table 3-9
Means and Standard Deviations for
Angina Ten Day Survey

Variable	Label	Mean	Standard Deviation
BIDTEN1	Bid relieve 1 mild day when have 1 mild day	66.08	55.68
BIDTEN2	Bid relieve 1 mild day when have 10 mild days	83.95	102.30
BIDTEN3	Bid relieve 10 mild days when have 10 mild days	154.36	165.21
BIDTEN4	Bid relieve 5 mild days when have 10 mild days	96.18	103.87
BIDTEN5	Bid relieve 1 severe day when have 1 severe day	123.59	101.63
BIDTEN6	Bid relieve 1 severe day when have 10 severe days	144.74	145.72
BIDTEN7	Bid relieve 10 severe days when have 10 severe days	261.84	244.80
BIDTEN8	Bid relieve 5 severe days when have 10 severe days	192.90	195.03

Table 3-9 (Continued)

Variable	Label	Mean	Standard Deviation
INCOME	1983 income of household (dollars)	25531.00	18842.70
EDUC1	Education of person 1 (years)	13.20	3.43
AGE1	Age of person 1 (years)	50.33	17.79
WHITE	1 if respondent is white, 0 otherwise	0.85	0.36
SEX	1 if female, 0 if male	0.50	0.51
NOEXHLTH	1 if not excellent overall health, 0 otherwise	0.70	0.46
HEARTCON	1 if has heart condition, 0 otherwise	0.25	0.44

3.6.4.2. Regression Results

For both angina surveys, ordinary least squares and seemingly unrelated regressions were performed to estimate equation (3.8). Results for the ten day survey are presented in Table 3-10. As in the seven light symptom results, there is little support for the expected relationships between the socioeconomic variables and the amounts bid for relief from angina. Income always has a positive coefficient, but it is never significantly different from zero. The signs of the coefficients on other variables tend to vary. None of the estimated coefficients is significantly different from zero.

The angina regression results do not provide support for the existence of increasing marginal disutility of symptom days. Neither the measure of general poor health status or the heart condition experience variable had a significant positive effect on the willingness to pay bids.

The insignificant effect of having a heart condition on willingness to pay for angina relief may be partially due to the definition of the variable. Unlike the symptom variables in the seven symptom analysis, HEARTCON stems from a general question concerning the respondent's experience with any heart condition. The endowments that are suggested here may be out of the range of experience of most respondents. Therefore, even those who do indicate having a heart condition may have never experienced symptoms similar to those described. On the whole, experience with the seven light symptoms is expected to explain bids better than experience with a heart condition. The reason is that the light symptom experience pertains exactly to the light symptom bids, whereas heart condition experience at best bears only a partial relationship to the angina bids.

The results of the seemingly unrelated regressions (not reported) are extremely similar to the ordinary least square results, but may be considered a more efficient estimate. A strong correlation between models was found, with correlation values consistently in the range of .8 or .9.

Table 3-10

Angina Ten Day Survey Regression Results
Parameter Estimates

	BIDTEN1	BIDTEN2	BIDTEN3	BIDTEN4
Intercept	114.32 (1.43)	8.71 (0.08)	153.69 (0.85)	37.34 (0.26)
Income	0.00023 (0.30)	0.00026 (0.25)	0.00078 (0.45)	0.00017 (0.12)
Education1	-2.37 (-0.55)	0.85 (0.15)	-5.01 (-0.51)	-1.14 (-0.14)
White	-5.07 (-0.15)	3.90 (0.09)	57.70 (0.77)	45.16 (0.75)
Age1	-0.69 (-0.85)	0.10 (0.09)	-1.21 (-0.66)	-0.51 (-0.35)
Sex	12.41 (0.55)	39.19 (1.28)	23.88 (0.46)	38.67 (0.94)
NoExhlth	14.03 (0.53)	23.17 (0.64)	55.75 (0.92)	62.38 (1.28)
Heartcon	6.99 (0.23)	23.17 (0.57)	-21.65 (-0.32)	-10.17 (-0.19)
F Value	0.25	0.48	0.36	0.45
R-Square	0.06	0.11	0.08	0.10

Note: t values in parentheses

Table 3-10 (continued)

	BIDTEN5	BIDTEN6	BIDTEN7	BIDTEN8
Intercept	171.14 (1.16)	260.26 (1.29)	455.45 (1.56)	321.29 (1.24)
Income	0.00046 (0.33)	0.0015 (0.79)	0.0038 (1.31)	0.0044 (1.79)
Education1	-1.42 (-0.18)	-8.11 (-0.74)	-21.11 (-1.33)	-18.19 (-1.29)
White	-18.85 (-0.31)	-17.09 (-0.20)	60.69 (0.50)	1.04 (0.01)
Age1	-0.50 (-0.33)	-0.007 (-0.004)	-2.00 (-0.68)	-0.0086 (-0.003)
Sex	-5.34 (-0.13)	17.11 (0.30)	28.99 (0.35)	54.97 (0.75)
NoExhlth	13.37 (0.27)	-63.43 (-0.94)	16.88 (0.17)	-30.08 (-0.35)
Heartcon	-17.04 (-0.31)	-1.26 (-0.02)	-22.32 (-0.20)	-57.80 (-0.59)
F Value	0.12	0.22	0.66	0.68
R-Square	0.03	0.05	0.14	0.15

Note: t values in parentheses

3.6.5. Angina: Twenty Day Endowment

3.6.5.1. Summary Statistics

Table 3-11 presents the means and standard deviations for all variables used in the analysis of the survey that incorporated an endowment of twenty days of angina. In this version, the bids ranged from \$844.38 to relieve twenty days of severe angina to \$90.24 for eliminating one day of mild angina a month.

For a given number of days of relief from angina, the mean bids tend to vary directly with the severity and duration of the endowment. As explained above, this is seen as evidence of an increasing marginal disutility of illness.

Two points should be raised concerning the size of the bids. First, and most notably, is the difference between BIDTEN1 and BIDTWT1 as well as between BIDTEN5 and BIDTWT5. As described above, the first and fifth bid requests are the same for each survey. While BIDTEN1 and BIDTWT1 are relatively close, \$66.08 and \$90.24 respectively, BIDTEN5 and BIDTWT5 are quite far apart, \$123.59 and \$278.88 respectively. A small part of the difference may be explained by the differences in income in the two samples. The ten day sample mean income was \$25,531.00 while the twenty day was higher at \$29,950.10. This explanation assumes that income has a strong positive effect on bid values. The regression analysis presented below adds some support to this proposition. The difference in value can also be explained by the outliers in the bids. Some respondents bid considerably higher than others, but offered no grounds for removing them from the sample. The importance of these bids can be seen by observing the large standard deviation for BIDTWT5.

It should be noted that the twenty day results represent more than a two-fold increase in bid values over the ten day results. This point is consistent with increasing marginal disutility since respondents on average are willing to pay proportionately larger amounts for relief when confronted with larger endowments.

Table 3-11
Means and Standard Deviations For
Angina Twenty Day Survey

Variable	Label	Mean	Standard Deviation
BIDTWT1	Bid relieve one mild day when have one mild day	90.24	103.56
BIDTWT2	Bid relieve one mild day when have twenty mild days	99.05	179.78
BIDTWT3	Bid relieve twenty mild days when have twenty mild days	486.25	923.90
BIDTWT4	Bid relieve ten mild days when have twenty mild days	287.63	506.59
BIDTWT5	Bid relieve one severe day when have one severe day	278.88	776.35
BIDTWT6	Bid relieve one severe day when have twenty severe days	208.78	339.09
BIDTWT7	Bid relieve twenty severe days when have twenty severe days	844.38	1609.94
BIDTWT8	Bid relieve ten severe days when have twenty severe days	506.25	1000.27

Table 3-11 (continued)

Variable	Label	Mean	Standard Deviation
INCOME	1983 income of household (dollars)	29950.10	23723.70
EDUC1	Education of person 1 (years)	14.15	3.02
AGE1	Age of person 1 (years)	48.13	18.46
WHITE	1 if respondent is white, 0 otherwise	0.74	0.44
SEX	1 if female, 0 if male	0.69	0.47
NOEXHLTH	1 if not excellent overall health, 0 otherwise	0.67	0.48
HEARTCON	1 if has heart condition, 0 otherwise	0.14	0.35

3.6.5.2. Regression Analysis

The ordinary least squares results are presented in Table 3-12. Income tends to be a significant factor in the determination of the bids. The estimated coefficient is positive in all regressions, and significant at at least the 95 percent confidence level in all but two of the regressions. No strong relationships are found between the bids and the other socioeconomic variables or health status measures.

The seemingly unrelated regressions (not reported) behaved in a manner similar to that found in the ten day version and gave results equivalent to the ordinary least squares method. The correlation across models tended not to be as strong as the angina ten day results. While many values were in the range of 0.8 and 0.9, there were also many values considerably lower or even negative.

Table 3-12

Angina Twenty Day Survey Regression Results
Parameter Estimates

	BIDTWT1	BIDTWT2	BIDTWT3	BIDTWT4
Intercept	-3.11 (-0.03)	487.85 (2.30)	-873.41 (-1.06)	-130.71 (-0.28)
Income	0.0027 (3.48)	0.00029 (0.19)	0.012 (2.06)	0.0082 (2.44)
Educ1	-2.45 (-0.40)	-11.77 (-0.98)	54.70 (1.17)	10.36 (0.39)
White	40.40 (1.02)	-114.07 (-1.47)	77.97 (0.26)	2.40 (0.01)
Age1	0.02 (0.02)	-1.53 (-0.79)	6.81 (0.90)	2.55 (0.59)
Sex	-26.75 (-0.71)	-150.99 (-2.03)	-212.20 (-0.73)	-218.65 (-1.31)
NoExhlth	24.80 (0.72)	37.89 (0.56)	-185.22 (-0.70)	8.36 (0.05)
Heartcon	92.80 (1.82)	29.20 (0.29)	98.89 (0.25)	22.75 (0.10)
F Value	2.56	1.44	1.66	1.81
R-Square	0.39	0.27	0.29	0.32

Note: t values in parentheses

Table 3-12 (continued)

	BIDTWT5	BIDTWT6	BIDTWT7	BIDTWT8
Intercept	-430.43 (-0.50)	710.20 (1.77)	-1031.89 (-1.13)	-581.14 (-0.76)
Income	0.023 (3.76)	0.0049 (1.73)	0.03 (3.80)	0.03 (5.28)
Educ1	-34.23 (-0.70)	-24.92 (-1.09)	25.14 (0.39)	-30.14 (-0.70)
White	212.08 (0.67)	95.36 (0.65)	447.37 (1.06)	293.35 (1.05)
Age1	-1.86 (-0.24)	-6.64 (-1.81)	5.88 (0.56)	2.83 (0.41)
Sex	407.64 (1.35)	-58.57 (-0.42)	125.71 (0.31)	78.58 (0.29)
NoExhlth	176.86 (0.64)	-94.12 (-0.73)	-133.95 (-0.36)	189.73 (0.78)
Heartcon	-785.21 (0.96)	-688.51 (1.73)	2534.89 (0.77)	906.58 (0.81)
F Value	2.22	1.37	2.73	4.62
R-Square	0.36	0.25	0.41	0.54

Note: t values in parentheses

3.6.6. Summary and Implications

Two conclusions can be drawn from the empirical investigation of the willingness to pay bids for relief from light symptoms and angina. The first finding is that various pieces of evidence support the hypothesis of increasing marginal disutility of illness. As shown in section 3.6.1 this hypothesis follows from the more standard assumption of decreasing marginal utility from health. In the one day and thirty days light symptom surveys, respondents were asked to bid for one day or thirty days of relief given their previous experience with the symptom. It was notable in the one day survey that those respondents who had experienced more days of a symptom tended to bid more for the marginal day of relief. This offers support for the hypothesis of increasing marginal disutility, though support was not found in the regression analyses of the thirty day surveys. However, considerable additional support was found for the hypothesis in the angina surveys. In these surveys the respondents were asked to suppose they experienced different endowments of angina, and were then asked to bid for relief. Again, the results are seen as consistent with the hypothesis of increasing marginal disutility of illness: respondents tended to bid more when they were given endowments of increased severity or duration.

Second, the regression analyses yielded little support for any strong relationships between various socioeconomic variables and the willingness to pay bids. In a number of regressions certain socioeconomic variables were significantly related to willingness to pay; a case in point is the consistent and significant positive impact of income on the bids for angina relief in the twenty day survey. However, income was not always an important explanatory variable in other sets of regressions.

As described in section 2.6 of Volume 2, one further finding of the surveys was that the most important reason given as explanation of the willingness to pay bids was to avoid the discomfort of illness. This suggests that a respondent's taste for health, or his distaste for illness, will dominate the amount he is willing to bid. In this situation it is not surprising that no strong relationship was found between the socioeconomic variables and the willingness to pay bids. There is no reason to expect that a person's taste for health will systematically vary with these observable quantities. This pertains to a final point on the methodology of contingent valuation. Some researchers have argued that evidence that contingent values are systematically related to socioeconomic variables such as income tends to support the validity of the method. The converse is not necessarily true: failure to find systematic relationships is not necessarily indicative that contingent valuation methods are faulty. The empirical analyses of the results of the four surveys is entirely consistent with individuals making rational choices over the value of health and reporting those values accurately in a contingent valuation experiment. Unobservable differences between individuals accounted for much of the variation in bids.

3.7. MAIL QUESTIONNAIRE

3.7.1. Background

It is clear that the personal interviews on which contingent valuation was based produced the most complete and highest quality data. It is also the case that personal interviews are much more expensive than telephone and mail interviews. Realizing that greater accuracy in estimation of willingness to pay could be obtained through a larger number of interviews, these less costly modes of survey research were considered.

Telephone interviews, which are intermediate in cost between personal and mail interviews, were not chosen because the relatively brief interviews required for telephone surveys would not allow adequate time for thoughtful bidding. Also, a strong possibility was seen that advance mailing of the tally sheet, use of which by the respondent was essential to generation of a reasoned set of bids, would significantly lower the response rate. Instead, it was decided that an experimental mail survey would be considered.

3.7.2. Design of the Mail Survey.

The experimental mail survey was based on six common air pollution induced symptoms. The pollutants that could cause such symptoms included sulfur dioxide, nitrogen dioxide, ozone and carbon monoxide. The mail survey was based on two questionnaires. One included a set of comparative questions concerning earnings lost and expenditures for physician visits, medicines, and other medical expenses for each symptom. The second questionnaire was identical to the first except for omission of these comparative questions. This was done because it was anticipated that the additional time and effort required to answer these memory based comparative questions might significantly lower the response rate to the mail survey.

The symptoms included in the mail questionnaires include painful headache, coughing spells, stuffed up sinuses, itching eyes, and heavy drowsiness when driving. Respondents were asked about their willingness to make monthly payments for an excellent medicine that would eliminate a certain endowment of three symptom days each month of each symptom. The medicine would only have to be taken once a month, and it would be safe and have no side effects. Respondents were also told that their bids for the different symptoms would not be added to any multiple symptom monthly total, that each symptom and the bid associated with it would occur separately, without the other symptoms.

The common questions in the two mail surveys asked whether the respondents had ever experienced each symptom (to establish interest and focus, Q.1); the degree to which each symptom bothers them (to encourage thoughtful variation in bids, Q.2); reasons for choosing the amounts of the bids, Q.4). Demographic

information was also collected. The demographic variables included sex and age of respondents, highest level of education, number of persons in the household, and household income in 1983.

It was decided that the mail survey methodology would be that known as the "Dillman Method." This method indicates that an approximately 70 percent response rate of the general public could be achieved in a mail survey (Dillman, 1978).

3.7.3. Sample and Response Rate

Reverse telephone directories for the Chicago metropolitan area were used to draw a sample of 103 names and addresses, using interval sampling with a random start. Business addresses were excluded. Addresses without the name of the resident and those with unlisted telephone numbers were included and addressed to "Resident." Questionnaire types A and B were alternated, producing an almost equal number of mailings. Of the 103 mailed questionnaires, 15 were returned to sender, indicating that the subject had moved since publication of the reverse directories. This yielded 88 possible mail interviews. Of this number, 42 completed questionnaires were returned, a response rate of 48 percent. This is a reasonably high response rate but below that suggested by Dillman. Forty-two questionnaires is not a large sample, but it is adequate for an exploratory survey and analysis. The response rates for the two questionnaires were exactly equal. The addition of the comparative expense questions did not lower the response rate of the longer questionnaire.

3.7.4. Results of the Survey

The first question asked whether the respondent had ever experienced each symptom. The results are shown in Table 3-13.

A majority of the respondents reported having experienced every symptom except drowsiness when driving, which was reported by 43 percent. The most commonly experienced symptom was stuffed up sinuses.

Question 2 asked the degree to which each symptom bothered the respondent. Only those who had experienced a symptom were asked how much it bothered them. The results are shown in Table 3-14.

Table 3-13

WHETHEREVER EXPERIENCED SYMPTOM

Symptom	Percent Ever Experienced in the Symptom
Painful headache	71%
Coughing spells	55%
Stuffed up sinuses	81%
Irritated throat	69%
Itching and smarting of your eyes	50%
Heavy drowsiness when driving	43%
Number of cases	42

Table 3-14

HOW MUCH SYMPTOM BOTHERS THE RESPONDENT

Symptom	Does Not Bother Me	Bothers Me Some	Bothers Me A Lot
Painful headaches	30%	47	17
Coughing spells	35%	48	13
Stuffed up sinuses	22%	40	19
Irritated throat	20%	57	20
Itching eyes	22%	56	22
Heavy drowsiness when driving	35%	40	10

Table 3-14 (continued)

Symptom	Bothers Me A Great Deal	Total	Mean Score%	Number of Cases
Painful headache	6	100%	3.8	30
Coughing spells	4	100%	2.9	23
Stuffed up sinuses	19	100%	3.4	37
Irritated throat	3	100%	3.1	30
Itching eyes	*%	100%	3.0	23
Heavy drowsiness when driving	15	100%	3.1	20

- a. The mean score is based on Does not bother me = 2, Bothers me some = 3, Bothers me a lot = 4, and Bothers me a great deal = 5.
- b. * = less than one percent.

All of the symptoms centered on "Bothers me some," but both the percentage distributions and the mean scores based on the percentage distributions showed stuffed up sinuses to be the symptom which bothered the respondents the most, averaging about midway between "Bothers me some" and "Bothers me a lot."

Question 3 asked about willingness to pay each month to eliminate three symptom days of each symptom per month through purchase of a safe, effective, side-effect-free medicine. The results are shown in Table 3-15.

Personal discomfort symptoms mean bids were in the \$8 to \$9 per month range, representing yearly bids of about \$100 to \$115. The average willingness to pay to eliminate heavy drowsiness when driving was about \$5.40 per month, or \$65 per year. The highest willingness to pay was expressed for two symptoms: stuffed up sinuses (\$116 per year), which is consistent with the answers to Question 2, in which stuffed up sinuses were reported to be the most bothersome symptom, and to eliminate headache days (\$113 per year).

About 20 percent of the respondents did not bid on each symptom because they had never experienced the symptom. The question was not structured to exclude those who had never experienced each symptom. Instead, most of those respondents who had reported never having experienced a symptom spontaneously decided not to bid on elimination of the symptom. A few of those who had never experienced each symptom did make a bid, typically zero.

Question 4 asked about the reasons for willingness to pay in Question 3. The data on reasons are shown in Table 3-16.

The most common basis for willingness to pay bids was personal comfort. About 84 percent of all respondents who bid listed personal comfort as a reason for their bids. To avoid loss of work or other usual activity was the next most frequently mentioned reason, it was reported by 32 percent of the respondents. The other reasons ranged between 10 and 20 percent of the total.

The fact that only 14 percent of the respondents mentioned the amount of their monthly income as being a basis for their bids might suggest lack of realism in bidding. However, the modest level of the bids, typically less than 10 dollars per month, suggests that the budget constraint was taken into consideration when bidding.

Table 3-15

WILLINGNESS TO PAY PER MONTH
TO ELIMINATE 3 SYMPTOM DAYS PER MONTH

Symptom	Mean Amount Willing To Pay Per Mo.	Mean Amount Willing To Pay Per Year ^a	Number of Cases
Painful headache	\$9.39	\$113	33
Coughing spells	8.87	106	30
Stuffed up sinuses	9.68	116	34
Irritated throat	8.42	101	31
Itching eyes	8.63	104	27
Heavy drowsiness when driving	5.41	65	27

^a Calculated by multiplying the mean monthly bid by 12.

Table 3-16

REASONS FOR WILLINGNESS TO PAY AMOUNTS

Reasons	Percent Mentioning
Comfort	84%
To avoid loss of work or other usual activity	32%
Amount of monthly income	14%
Spend less for other medicines	16%
Spend less for doctor bills and other medical care	11%
To not have to take other medicines	19%
Other	11%
Number of cases	37

Question 5 in questionnaire B, which appeared only in the Type B questionnaire, asked about symptom days experienced in the last 12 months for each symptoms; days of work or other usual activity lost; earnings lost, and medical-care expenses induced by the symptom. Although 12 months may be too long a period for accurate recall, it is also true that the symptoms included in this question and elsewhere in the questionnaire are quite seasonal in their incidence. This would imply that the use of a time period of less than one year would have produced considerable variation according to the month of the year in which the survey was conducted. On balance, the data produced by this question should be viewed as being approximate in accuracy.

The question about medical care expenses did not ask for expenses net of any health insurance reimbursement. The phrasing of the question suggests out-of-pocket expenditure. It should be noted, however, that important, the relatively low costs of over-the-counter medications, doctor office visits and prescription drugs measured here are not covered by most health insurance policies.

The findings from question 5 are shown in Table 3-17. Mean data are presented both for those who experienced each symptom and across all respondents, to show aggregate personal and financial impact.

Of the 21 Type B questionnaires, one was not completely ascertained with respect to question 5, leaving 20 useable cases. This is not a large number of cases, but a sample worthy of explanatory analysis. The number of cases of the last three symptoms--irritated throat, itching eyes, and drowsiness--was quite small. The data for these symptoms should be viewed as being merely suggestive.

The most frequently reported symptom was stuffed up sinuses, reported by 80 percent of the respondents. The least frequently reported symptoms were itching eyes (35 percent) and heavy drowsiness when driving (20 percent). Stuffed up sinuses also had the highest average number of symptom days--34 days per year for those experiencing the symptom and 27 days averaged across all respondents. Headaches were next most frequently reported, averaging 28 days for those experiencing headaches and 17 days averaged across all respondents. Itching eyes and heavy drowsiness when driving were the least frequently reported symptom days.

In terms of days of work or other work usual activity lost, headaches produced the greatest mean number of days lost--1.9 days per year for those experiencing headaches and 1.1 days averaged across all respondents. Stuffed up sinuses produced the next greatest number of average days lost--0.9 days for those experiencing stuffed up sinuses and 0.8 days averaged over all respondents. No days of work or other usual activity lost were reported for itching eyes and heavy drowsiness when driving.

Table 3-17

MEAN INCIDENCE OF SYMPTOM DAYS,
MEAN DAYS LOST, MEAN EARNINGS LOST,
AND MEAN MEDICAL CARE EXPENSE, LAST 12 MONTHS

Symptom	Had Symptom Last 12 Mos.	Mean Symptom Days		Mean Days Work or Other Lost	
		Symptom ^a	All ^b	Symptom	All
Painful headache	60%	28	17	1.9	1.1
Coughing spells	50	9	4	0.6	0.3
Stuffed up sinuses	80	34	27	0.9	0.8
Irritated throat	60	8	5	0.3	0.2
Itching eyes	35	9	3	0.3	0.8
Heavy drowsiness when driving	20	7	1	*	*

Table 3-17 (continued)

Symptom	Mean Earnings Lost		Mean Medical Expense		Number of Cases
	Symptom ^a	All ^b	Symptom	All	
Painful headache	\$179	\$108	\$100	\$60	12
Coughing spells	67	31	4	2	10
Stuffed up sinuses	22	18	15	12	16
Irritated throat	8	5	5	3	12
Itching eyes	*	*	*	*	7
Heavy drowsiness when driving	*	*	*	*	4

b: Symptom = all those reporting the symptom in the last 12 months.
a: All = mean across all 20 Type B questionnaire respondents.

Headaches also produced the greatest mean loss of earnings--averaging \$179 per year for those experiencing headaches and an average of \$108 for all respondents. Coughing caused the next highest average loss of earnings - - \$67 per year for those experiencing coughing and an average of \$31 for all respondents. Stuffed up sinuses produced an average of \$22 in earnings lost for those experiencing this symptom and \$18 for all respondent. Headaches similarly produced the highest average medical expenses averaged across all respondents. The next highest mean medical expense was for stuffed up sinuses--averaging \$22 per year for those experiencing stuffed up sinuses and an average of \$17 per year for all respondents.

In terms of comparison of willingness to pay with earnings lost and medical care expenses, for those respondents reporting each symptom it is clear that mean willingness to pay, shown in Table 3-15, greatly exceeded both mean earnings lost and mean medical expense, both separately and in combination, for all symptoms except headache, where both mean earnings lost and mean medical expense were of the same general magnitude as mean willingness to pay. For headaches the mean earnings loss was \$179, the mean medical expense \$100, and the mean willingness to pay \$113.

3.7.5. Demographics

Respondents were almost evenly divided between male (56 percent) and female (44 percent) respondents. The cover letter asked that the adult who usually pays the bills complete the questionnaire.

The age distribution of the respondents is shown in Table 3-18.

The distribution of respondents according to age appears to be reasonably representative of the age distribution among adults.

The distribution of respondents by highest level of education is shown in Table 3-19.

The distribution of respondents according to highest level of formal education achieved shows the distribution to be broadly representative, but showing a somewhat higher rate of representation among those with higher education.

Table 3-18

AGE DISTRIBUTION OF RESPONDENTS

Age of Respondent	Percentage Distribution
18-24	*%
25-34	29
35-44	19
45-54	15
55-64	17
65-74	15
75 and over	5
Total	100%
Number of cases	41

Table 3-19
EDUCATION OF RESPONDENTS

Highest Level of Education	Percent Distribution
Some grade school	5%
Completed grade school	5
Some high school	*
Completed high school	20
Some college	25

Table 3-19 (continued)

Highest Level of Education	Percent Distribution
Completed college	17
Some graduate work	13
A graduate degree	15
Total	100%
Number of cases	40

The distribution of respondents by number of persons living in the household is shown in Table 3-20.

The distribution of respondents according to size of household shows that about half (51 percent) of the respondents lived in a two member household, 15 percent in single member households, and about one-third (34 percent) in households of three or more persons.

The distribution of respondents by level of household income in 1983 is shown in Table 3-21.

Although the household incomes of the respondents ranged broadly across income levels, overrepresentation of those with higher levels of income is evident.

Table 3-20

NUMBER OF PERSONS LIVING IN HOUSEHOLD

Number of Persons in Household	Percent Distribution
One	15%
Two	51
Three	5
Four	22
Five	7
Six or more	*

Total	100%
Number of cases	41

Table 3-21
HOUSEHOLD INCOME IN 1983

Household Income	Percent Distribution
Less than \$3,000	*%
\$3,000-4,999	3
\$5,000-9,999	3
\$10,000-14,999	14
\$15,000-19,999	5
\$20,000-24,999	8
\$25,000-29,999	16
\$30,000-39,999	16
\$30,000-49,999	11
\$50,000 and over	24
Total	100%
Number of cases	37

3.7.6. Summary of Results

An experimental mail survey was conducted to, determine whether it would be feasible to greatly expand the number of cases on which the contingent valuation estimates could be based. As in the personal interview questionnaires, the indirect, symptom based approach to willingness to pay was adopted, using six common air pollution caused symptoms, including those caused by general air pollution, ozone, and carbon monoxide. Two questionnaires were developed, identical except that one questionnaire, Type B, added a set of comparative questions which measure, earnings lost and medical care expense occasioned by the symptoms. The Dillman mail survey method was employed for this survey.

An equal probability sample of 103 names and addresses representing the Chicago metropolitan area adult resident population was drawn from reverse telephone directories. Discounting 15 addresses which had changed, a response rate of 48 percent of the 88 possible interviews was achieved, forming a data based of 42 cases.

The symptom which was reported to be both most commonly ever experienced and most bothersome was stuffed up sinuses.

The willingness to pay question was based on a certain endowment of 3 symptom days per month for each symptom. The bids were for an effective, safe, side-effect-free medication which would have to be taken only once a month. The mean bids to eliminate the personal discomfort symptoms of headache, coughing, stuffed up sinuses, irritated throat, and itching eyes ranged between \$8.42 and \$9.68 per month, or \$101 and \$116 per year. The mean willingness to pay to eliminate heavy drowsiness when driving was \$5.41 per month, or \$65 per year.

By far the most common reason underlying the amount of the bids was personal comfort. Next most frequently mentioned was to avoid loss of work or other usual activity.

The comparative set of questions again showed stuffed up sinuses to be the most commonly experienced symptom, followed by headaches, irritated throat, and coughing, which also were common. Stuffed up sinuses showed the highest mean number of symptom days per year--27 averaged across all respondents, with headaches showing a mean 17 symptom days per year. However, in terms of days of work or other usual activity lost, headaches produced the largest mean number of days lost, 1.1 per year averaged over all respondents. Earnings lost because of headache was by far the largest--averaging \$108 per year across all respondents. Medical care expenses were also by far the largest for headaches--averaging \$60 per year over all respondents. Coughing caused the next highest mean level of earnings loss and stuffed up sinuses the next highest mean medical expenses. In terms of comparative analysis, mean willingness to pay greatly

exceeded both mean earnings loss and medical expense and the total of these two means for all symptoms except headaches, for which mean willingness to pay, mean earnings lost and mean medical expense all were of the same approximate magnitude.

Analysis of the demographic characteristics of the respondents showed male respondents to be slightly more common than female respondents, the age distribution to be approximately representative, and the educational distribution to be somewhat skewed toward those among those with higher levels of education. Size of household proved to be mostly two-person households, with a third of the households having three or more persons. The distribution of household incomes showed overrepresentation of those with higher levels of income.

As a final note, the results from the mail survey can be compared to the data gathered through the personal interviews. The most direct comparison involves the seven light symptom one day and thirty days surveys. The mean bids for the mail survey, which considers the relief of three symptoms days per month, are mostly intermediate in value between the one day and thirty day means for comparable symptom. They are not however, three times the one day mean bids nor one tenth of the thirty day means.

When examining the mail data, one also finds a positive relationship between the mean bid for a symptom and the number of days the symptom was actually experienced. The same relationship was also clearly observed within the seven symptom one day data. This observation adds further evidence to the proposition of an increasing marginal disutility for experiencing a particular symptom.

3.7.7. References

1. Don A. Dillman, Mail and Telephone Survey: The Total Design(New York: Wiley and Sons, 1978). In the Dillman method the first mailing is followed three weeks later by a second mailing and by a registered mail or special delivery third mailing in the seventh week after the first meeting. In this study the final meeting was via special delivery mail.

APPENDIX
FIELD QUESTIONNAIRES FOR LIGHT SYMPTOM AND ANGINA

This appendix synthesizes the form field questionnaires used in the contingent valuation studies of light symptoms and angina. The form questionnaires pertain to:

1. Relief from one day of light symptoms;
2. Relief from 30 days of light symptoms;
3. Relief from up to 10 days of angina symptoms; and
4. Relief from up to 20 days of angina symptoms.

A.1 7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

November 15, 1984 Version

Format_____		City_____
Interviewer#_____		Respondent#_____
Date_____	[Check One]--	Center City_____
Time Started_____		Suburban_____
Time Ended_____		Rural_____

Hello. I'm _____ from the University of Illinois School of Public Health. We are visiting with people in your area as part of a research project about risks to your health. We have scientifically selected a sample of households to represent your area and your household has been chosen as part of the sample.

Are you the [male/female] head of the household?

[If not, ask to speak to the head and start over.]

Your opinions are very important and we hope you will help us. Please be assured that this is purely a research project and we do not represent any business or product. No sales call will result by your participation in this study. The information you provide us will remain confidential.

The questionnaire will take about 30 minutes.

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

A. HEALTH EVALUATION

[Interviewer circle numbers.]

A-1. Would you describe your overall health as being

1 Excellent 2 Good 3 Fair 4 Poor

A-2. Please look at this card and tell me which statement best describes the control you have over your health.

[Interviewer hand out card on ABILITY TO CONTROL HEALTH.]

- 1 There is little I can do because it is beyond my control.
- 2 I can do some things, but they have little effect.
- 3 My actions have a moderate effect.
- 4 My actions have a great effect.

[Interviewer take card from respondent.]

A-3. How often were you bothered by any illness, bodily disorders, aches or pains, during the last month?

Every day	1
Almost every day	2
About half of the time	3
Now and then, but less than half of the time	4
Rarely	5
None of the time	6

H. HEALTH STATUS

Now we are going to talk about whether you have certain health problems and how they have occurred. Most people have difficulty remembering how many times they have experienced these problems, but it is important that you try to remember about how often you have had them. The health problems are listed on this card.

[Hand respondent Health Problem card.]

H-1. Which of the health problems on the card have you experienced in the last 12 months?

[For any health problem named, circle the number at the top of the column corresponding to the symptom. Remember to turn the page to complete each question.]

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

COUGHING SPELLS	STUFFED UP SINUSES	THROAT CONGESTION	ITCHING EYES
-----------------	--------------------	-------------------	--------------

(Questions)

H-2. About how many days have you had this in the last 12 months? 1 2 3 4
 ↓ ↓ ↓ ↓
 \ / \ / \ / \ /
 ____ days ____ days ____ days ____ days

H-3. Which of these bothered you the most?
 1-most, 7-least ____ ____ ____ ____

H-4. During the last year did this health problem cause you to miss one or more days of usual activity such as work, school, or work at home?
 Write H for housework, N for no activity missed, S for school, W for work away from home.
 ____ ____ ____ ____

H-5. About how many days of work or other usual activity did you lose because of this?
 ____ days ____ days ____ days ____ days

H-6. Were there one or more days during the last year when this health problem caused you to greatly reduce your normal activities?
 Enter number of days.
 ____ days ____ days ____ days ____ days

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

HEAVY DROWSINESS	HEADACHE	NAUSEA
---------------------	----------	--------

(Questions)

H-2. About how many days have you had this in the last 12 months?

5 6 7
 ↓ ↓ ↓
 \ / \ / \ /
 _____ days _____ days _____ days

H-3. Which of these bothered you the most?
 1-most, 7-least

H-4. During the last year did this health problem cause you to miss one or more days of usual activity such as work, school, or work at home? Write H for housework, N for no activity missed, S for school, W for work away from home.

H-5. About how many days of work or other usual activity did you lose because of this?

_____ days _____ days _____ days

H-6. Were there one or more days during the last year when this health problem caused you to greatly reduce your normal activities? Enter number of days.

_____ days _____ days _____ days

7-SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

COUGHING SPELLS	STUFFED UP SINUSES	THROAT CONGESTION	ITCHING EYES
-----------------	--------------------	-------------------	--------------

1	2	3	4
✓	✓	✓	✓

H-7. During the last year did you purchase any medicine for this health problem, either over the counter or with a prescription?
Check for yes.

H-8. About how much did you spend for this medicine?

\$ _____ \$ _____ \$ _____ \$ _____

H-9. How much of this cost (if any) was paid by insurance or any other health plan?

\$ _____ \$ _____ \$ _____ \$ _____

H-10. During the last year did you visit a doctor, clinic, hospital, or other source of professional medical care for this problem?
Enter number of visits.

H-11. About how much did these visits cost during the last year?

\$ _____ \$ _____ \$ _____ \$ _____

H-12. About how much of this cost was paid by insurance or any other plan?

\$ _____ \$ _____ \$ _____ \$ _____

H-13. [If Work Days Lost in H-5]
About how much earnings were lost because of work days missed?

\$ _____ \$ _____ \$ _____ \$ _____

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

HEAVY DROWSINESS	HEADACHE	NAUSEA
---------------------	----------	--------

5	6	7

H-7. During the last year did you purchase any medicine for this health problem, either over the counter or with a prescription?
Check for yes.

H-8. About how much did you spend for this medicine?

\$ ----- \$ ----- \$ -----

H-9. How much of this cost (if any) was paid by insurance or any other health plan?

\$ ----- \$ ----- \$ -----

H-10. During the last year did you visit a doctor, clinic, hospital, or other source of professional medical care for this problem?
Enter number of visits.

H-11. About how much did these visits cost during the last year?

\$ ----- \$ ----- \$ -----

H-12. About how much of this cost was paid by insurance or any other plan?

\$ ----- \$ ----- \$ -----

H-13. [If Work Days Lost in H-5]
About how much earnings were lost because of work days missed?

\$ ----- \$ ----- \$ -----

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

H-14 Did you have any of the symptoms in combination? [Check one]

Yes _____

No _____ [Skip to Section M.]

H-15 What combination did you have most often? [1 = Coughing spells. 2 = Stuffed up sinuses. 3 = Throat congestion. 4 = Itching eyes. 5 = Headache. 6 = Heavy drowsiness. 7 = Nausea. For example, a combination of stuffed up sinuses, itching eyes and headache should be recorded as 2,4,5.]

Combination _____

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

M. DEFENSIVE MEASURES

Now I would like to ask you some questions about your day-to-day living that are related to the symptoms we have been discussing.

M-1 Do you have any of the following in your home or car, purchased for health reasons?

Air Conditioner	YES _____	NO _____
Air Purifier	YES _____	NO _____
Humidifier	YES _____	NO _____
Other (_____)	YES _____	NO _____

M-2 Do you smoke? Yes _____ [Skip to M-3]
No _____

(a) Did you ever smoke? Yes _____ No _____ [Skip to M-2(c)]
(b) Did you quit for health reasons? Yes _____ No _____
(c) Would you smoke if smoking were not damaging to your health? Yes _____ No _____

M-3 Have you ever changed to location of your residence for health reasons?

Yes _____
No _____ [Skip to Section R]

M-4 Where did you move from? _____

M-5 To? _____

M-6 What health problem prompted the move? _____

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

R. RANKING OF SYMPTOMS

In this next set of questions, I'm going to describe several symptoms of discomfort that are common to many people. The symptoms will not necessarily describe what you experience. I would like you to put yourself in the position of having these symptoms, however.

I want you to suppose that your health in the next 12 months is going to be like it was in the past 12 months, except that you will experience an additional day of a given symptom.

First we're going to talk about which of the symptoms you consider to be worst, and which you would be bothered by the least.

Everyone has experienced coughing. Please look at this card, which describes a particular coughing experience.

[Hand respondent Coughing Days card]

The card describes the one additional day on which coughing occurs. You will cough about twice an hour in spells that last 10 to 20 seconds. You will feel the cough in your chest, but it is not severe enough to make you red in the face.

I am going to pause briefly to let you think about how much you would mind the one additional day of coughing.

[Interviewer pause for 15 seconds]

Now suppose that, instead of having the one additional day of coughing, you will have one additional day of sinus problems in the next 12 months. In other respects, your health will be exactly as it has been in the last 12 months.

A day of sinus problems is described on this card.

[Interviewer hand respondent Days of Sinus Problems card]

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

You will have congestion and pain in your sinuses and forehead all day. You will be bothered by a feeling of stuffiness in your head, accompanied by sinus drainage in your throat. You will need to blow your nose every few minutes. You will have to breathe through your mouth most of the time.

Please think over how much you would be bothered by the one additional day of sinus problems, and compare it to the day of coughing. Think about which symptom you mind the least and which the most.

When you have decided, please tell me which bothers you more.

[Check one]

----- One Coughing day

----- One Day of sinus problems

Place that card under the other card.

[Wait for respondent to arrange cards]

Another problem that bothers people is throat congestion. Here is a card describing a day of throat congestion.

[Hand respondent card on Day of Throat Congestion]

On this day, you will have congestion in your throat and upper respiratory tract. You will make repeated efforts to clear your throat. The throat clearing is annoying to you and those around you. Your throat will be scratchy. Your voice will be hoarse, and you will have some difficulty speaking.

Suppose that instead of either the coughing or the sinus problems, you will have one additional day of throat congestion, as described on the card.

Please rank the 3 symptoms. The question is which day bothers you the least, which the next least, and which bothers you the most.

Take your time.

Place the three cards in the order you have decided on.

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

[Interviewer check to see cards are in proper order. If respondent has difficulty in ranking the days, read the following three indented paragraphs. If respondent has difficulty in ranking later on in the questionnaire, return and read these paragraphs, Otherwise, do not read the indented paragraphs to the respondent]

If there are symptoms that bother you the same, cards for those days should be next to each other in the deck. It does not matter which comes before the other.

For example, if you don't care whether you have coughing or sinus problems, either of the two cards may be on top.

[Interviewer be sure that the cards for any group within which there is indifference are in their proper place in the deck, showing how this group ranks relative to the other days.]

Symptoms that you mind less than coughing and sinus problems should be on the top, symptoms that mind more should be on the bottom.

[Resume text if indented paragraphs were not read]

Let's go on to eye irritation. Here is a card describing a day with this type of problem.

[Hand respondent card on Days of Itching and Smarting of Eyes]

Watering and smarting of your eyes on this day forces you to interrupt what you are doing every 15 minutes or so. You rub your eyes and close them. Stinging of your eyes brings tears three times during the day--bad enough to cause you to use a handkerchief or kleenex around your eyes.

We want to proceed as before. Please think about how much you mind one additional day of this symptom and how you rank it with the others.

[Wait until respondent has finished arranging cards]

Next we consider a day on which you have headaches. Here is the card that describes the headache experience.

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

[Hand respondent Headache Day card]

Two rather painful, splitting headaches will strike some time during the day. Each period of headache will last 2 hours.

Please proceed as before. Think about how much you mind the additional day of headaches. After you have decided, put the card in its proper place in the deck.

[Wait until respondent is through]

We have a couple of more symptoms to consider. The next one is drowsiness. Here is a card describing a day when you are bothered by heavy drowsiness.

[Hand respondent Heavy Drowsiness card]

You will have extreme difficulty staying awake during 6 of the hours when you are normally awake. Sometimes your eyelids will flutter. You will doze off for an instant now and then. The drowsiness will interfere with your social activities and other leisure. You will find the drowsiness dangerous if it comes over you while you are driving or working with tools, appliances or other machinery.

After thinking about one additional day when you have drowsiness, add the card to the deck to reflect where it comes in your ranking.

[Wait for respondent to finish, and then proceed]

The last symptom is nausea. Here is a card about it.

[Hand respondent Nausea card]

Throughout the day, you will have a lingering urge to vomit, but you will not be able to do so. Stomach distress will be strong. There will be no actual pain.

As before, think about how you rank one additional day of nausea, and place it in the deck.

Thank you. I'm going to record your answers for use later. Let's keep the deck sitting there. We'll use it in a minute.

[Interviewer record rankings on Tally Sheet.]

CV. CONTINGENT VALUATION

In this next set of questions, I'm going to ask you how much it would be worth to you to avoid the symptoms we've been talking about.

The answers in this part are for yourself alone and not for any other members of your household.

Before we start, please look at this card showing how a typical family spends its take-home income.

[Hand respondent Household Spending card]

When you pay to avoid symptoms, the money will have to come out of one of the categories shown. We'll leave the card here so that you can think about where the money comes from that you would spend to avoid the symptoms. Keep in mind, however, that your situation is probably different from this one.

Let's think about ways we normally deal with health problems. One way is to go to the doctor, another way is to buy medicine at the drugstore. Oftentimes we don't do anything at all--we just suffer through the problem until it goes away. It might be that the price of a bottle of medicine or a visit to the doctor measures the value of a cure. But if we stop to think about it, the cure might be worth much more to us than that--if we really had to pay it. A cure might be valuable to us even when we just suffer with the problem until it goes away. In such cases we might ask ourselves "How much would I be willing to pay to get rid of this problem right now, even if I don't want to take medicine or visit the doctor?"

With these thoughts in mind, please try to give the largest dollar value a cure would be worth to you when answering the next few questions.

Now look at the card at the top of the deck--[symptom]-- which is the symptom you mind least.

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

CV-1. If your health symptoms in the next 12 months were the same as in the last 12 months, except that you would also be faced with one additional day of [symptom], would it be worth \$100 to you to completely get rid of these days of symptoms? [Circle one]

Yes

No

CV-2. [If answer to CV-1 is Yes, ask if getting rid of the day would be worth \$200, \$400--doubling each time until a No response is obtained. Then subtract half the difference between the two previous answers. Continue adding or subtracting half the difference between the last two answers until respondent no longer wants to change.]

[If answer to CV-1 is No, ask \$50, \$25--decreasing by half until a Yes response is obtained. Then add half the difference between the two previous answers, continuing with the half difference procedure until respondent no longer wants to change.] [Record final bid at top of tally sheet.]

Next look at the card at the bottom of the deck which is the symptom you mind the most.

[Interviewer: For the following two questions, you will need a calculated bid for CV-3. The calculated bid for CV-3 is the bid to get rid of the least bothersome day given in the answer to CV-2, multiplied by two.]

CV-3. If your health symptoms were the same in the next 12 months as in the last 12 months, except that you would also be faced with one day of the symptom you mind the most, would you be willing to pay [calculated bid for CV-5] to completely get rid of the symptoms on that day? [Circle one]

Yes

No

CV-4. [If the answer to CV- is Yes, ask if respondent would be willing to pay double the calculated bid for CV-3. Proceed by further doubling until a No answer is obtained. Then subtract half the difference between the first No amount and the last Yes amount. Continue increasing or decreasing by half the difference until a final bid is obtained.]

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

[If the answer to CV-3 is No, ask if respondent would be willing to pay half the calculated bid for CV-3. Proceed by halving until a Yes answer is obtained. Then add half the difference between the first Yes amount and the last No amount. Continue increasing or decreasing by half the difference until a final bid is obtained]

[Record Final bid at bottom at tally sheet.]

I have here a tally sheet for you to keep track of your answers. [Interviewer hand respondent Tally Sheet]

Here is a pencil. [Interviewer hand respondent pencil]

The first column of the Tally Sheet is called "Symptom Days Ranked from Least to Most Bothersome". In this column, I have written the symptoms in the correct order from the deck of cards you have arranged.

The second column of the Tally Sheet is your Bid to avoid additional symptom day. The dollar amounts you have given are for the first and last lines in this column.

At this point, think about how much you would be willing to pay to avoid one additional day of the other five symptoms that you placed between the least and most bothersome,

Take as much time as you need to decide on the amounts you would be willing to pay to avoid each symptom day. As you decide on the amounts, record them.

People often find that they want to change the bids originally given for the least and most bothersome days. They often take several tries at each entry in the column.

Feel free to change any of the amounts as much as you want. In this part, people find themselves using the eraser a lot.

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

Tally Sheet

RANKING OF SYMPTOMS
FROM LEAST TO MOST
BOTHERSOME

BID FOR ONE DAY OF
RELIEF IN THE NEXT
12 MONTHS

1) _____

\$ _____ per year

2) _____

\$ _____ per year

3) _____

\$ _____ per year

4) _____

\$ _____ per year

5) _____

\$ _____ per year

6) _____

\$ _____ per year

7) _____

\$ _____ per year

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

[Interviewer wait for respondent to complete the column. Avoid any appearance of impatience]

CV-5. So far we have been considering the symptoms individually. Sometimes, however, they occur together.

Suppose you faced one day in the coming year in which you had the three following symptoms on a single day. [Interviewer hand respondent cough, sinus, throat card.] You would have coughing, stuffed up sinuses and throat congestion on that day.

Look at your bids for these three individual symptoms on the Tally Sheet. Let's add them up.

[Interviewer compare sum with respondent. Record sum]

Sum of individual bids:

_____dollars

Think about whether you would be willing to pay more or less than this sum to get rid of one day on which all 5 of the symptoms occur together. When you are ready, please tell me how much are you willing to pay to get rid of the one day of combined symptoms.

Bid to get rid of one day of combined cough, sinus and throat symptoms:

_____dollars

CV-6 Now suppose that you faced 1 day in the coming year of these three symptoms. [Interviewer hand respondent Headache, Nausea, Drowsiness card.] You would have headache, nausea, and drowsiness.

Once again, let's add up your bids for the individual symptoms.

[Interviewer compare sum with respondent. Record sum.]

Sum of Individual bids:

_____dollars

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

How much would you be willing to pay to get rid of 1 day on which all 3 of the symptoms occur together?

Bid to get rid of 1 day of headache,
nausea and drowsiness:

-----dollars

CV-7. Your answers so far have been about how much you would pay for relief of yourself alone.

Look again at the card for combined coughing, sinus and ingestion symptoms. How much would your household be willing to pay to relieve the one day of combined symptoms for yourself and every other member of your household.

Bid for relieving household of
one day of combined symptoms

----- dollars

CV-8. I have one final question on amounts you are willing to pay. Suppose that everybody in the United States faced one additional day of combined coughing, sinus and congestion symptoms. How much extra would your household be willing to pay for everybody's symptoms to be eliminated on this day? This is in addition to the amount you just stated for your household alone.

Addition to household payment to get rid of day of
combined symptoms for everybody in the United States:

-----dollars

RE. REASONS

The value questions are now complete, but before we move on, would you tell me what the major reasons were for your answers. Here is a card that list some reasons.

[Interviewer hand respondent Reasons card]

[Interviewer: The following list will be needed to record the ranking of reasons in question RE-1]

-----	Comfort
-----	Loss of work at home
-----	Loss of work away from home
-----	Loss of recreation
-----	Reduce medical expenses
-----	Other (Specify)

RE-1. Please look at the card and tell me the most important reason for the amounts you were willing to pay.

[Interviewer enter "1" beside the reason given as answer]

Please continue with the next most important reason, the one after that, and so forth for all the reasons that influenced your bid.

[Interviewer enter "2" beside the next most important reason, "3" beside the one after that, and so forth for all reasons mentioned by respondent]

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

RE-2. [This question is for respondents who have experienced one or more of the health problems as reported in H-1. For respondents who didn't experience any of the health problems, skip to RE-4.]

Could you tell me how the symptoms you actually experienced during the last 12 months compared with the symptom days described in this questionnaire. Please indicate whether your symptoms were worse than, about the same, or less severe than those described.

[W=worse. S=same. L=less severe. Make no entry if respondent did not have the symptom]

- Coughing
- Sinuses
- Throat Congestion
- Itching Eyes
- Headaches
- Heavy Drowsiness
- Nausea

RE-3. Concerning the seven symptoms we have been discussing, how much would you be willing to pay to completely get rid of the symptoms you have actually experienced?

----- dollars

RE-4: Because we want your best answers, I am asking you once again whether you would like to go back and change any of your bids or rankings given in your responses to previous questions.

Do you want to change any of your answers? [Circle one]

Yes

No

[Allow respondent to change any answers. Record all changes made by respondent in appropriate places on questionnaire.]

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

Please give me back all the cards you have. These include the symptom cards, the family spending card and the reasons card.

Also please give me the Tally Sheet you have filled out.

[Interviewer take back cards and Tally Sheet. INSERT TALLY SHEET INSIDE THIS QUESTIONNAIRE IMMEDIATELY AFTER THE FIRST PAGE]

S. SOCIOECONOMIC QUESTIONS

So that we can analyze the responses we get from different people, we need to ask you a few questions about your household. Your answers will be completely confidential.

- S-1. Have you moved during the last 5 years? _____
- S-2. What is the farthest you moved? _____
- S-3. Do you expect to move in the next 3 years? _____
- S-4. What is your occupation? _____

[Hand respondent Skills card.]

S-5. Among the items on this list, tell me which you like to do or are good at, and which you dislike or feel you're not very good at. If you have no particular feeling about the item, tell me "no opinion."

[Mark 1 for like/good at; 0 for dislike/not good at; No for no opinion.]

- A. Arithmetic/Mathematics _____
- B. Foreign languages _____
- C. Reading newspapers/magazines/books _____
- D. Interpreting blueprints/diagrams for assembling kits or models _____
- E. Interpreting financial/tax statements _____

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

S-6 Use the instructions on this page to complete the table on the next page.

Number: Each person is assigned a number, 1, 2, 3, etc. Circle the number which represents the respondent.

Relationship: Indicate the customary family relationships (spouse, son, grandmother, etc.). For non-family relationships, just write "friend."

Education: What is the highest grade or year in school completed?

None.....	0								
Elementary.....	1	2	3	4	5	6	7	8	
High School.....	9	10	11	12					
College.....	13	14	15	16					
Some Graduate School.....	17	18							
Graduate or Professional Degree.....	20								

School: Is_____currently attending a school, college or university full-time?

Work: Does_____usually work [or seek employment] outside the household?

If No, go to next person.
If Yes, continue .

Months : How many months did_____work in 1983?

Hours : How many hours/week did_____usually work in 1983?

Wage : [Record either hourly, weekly or monthly wage.]

7 - SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

ANSWERS TO S-7

	1.	2.	3.	4.	5.	6.	7.
PERSON							
AGE							
RELATIONSHIP IN FAMILY							
SEX (M/F)							
EDUCATION							
IN SCHOOL (YES/NO)							
WORK (YES/NO)							
MONTHS WORKED 1983							
HOURS WORKED PER WEEK 1983							
HOURLY WAGE [OR]							
WEEKLY WAGE [OR]							
MONTHLY WAGE							

S-7. [Race/ethnic group, of respondent. Interviewer Check One].

Asian _____
Black _____
Hispanic _____
White _____
Other _____

S-8. In your household, do you: [Check One]

- a. ---- share or pool your incomes, as a family or couple might do.
- b. ----- live alone, or keep your personal incomes separate, as friends sharing a house/apartment might do.

S-9. [Present Income Card] Please look at this card. Tell me which letter best describes your [household if S-8a; or personal if S-8b] income before taxes in 1983. Include income from all sources, including work, investments, business profits, interest on savings, pensions, social security, support from relatives, and any other benefits.

----- [Letter]
----- [Refused, or didn't know and refused to guess].

S-10. Was your personal income in 1983 [Check One]

- a. about the same as other recent years? -----
- b. much higher than in other recent years? ----
- c. much lower than in other recent years? ----

S-11. In 5 years time, do you expect your income to be:

- a. about the same as in 1983? ----
- b. much higher than in 1983? ----
- c. much lower than in 1983? ----

S-12. Do you lose pay when you miss a day of work because of sickness?

Yes -----
No -----

7-SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

S-13. [Does your household if S-8a; Do you if S-8b]
[Check One]

- a. manage to save or invest a little? -----
- b. just get by on current income? -----
- c. have to dip into savings or
investments just to make ends meet? -----

S-14. If you wanted to work a few more [or "a few" for non-income
earners] hours a week, do you think you could find work?
Yes ----- No -----

S-15. [If Yes] How much do you think you'd be paid?
\$-----/ H O U R

S-16. Do you own your residence or do you rent it?

Own -----

Rent ----- [Skip to S-16c.]

[If own]

- a) About what fraction of the value of your
house is the outstanding balance on the
mortgage?

For example if the house value is
\$10,000, then the mortgage balance
is a fraction of the house value is 1/5.

- b) If you had to pay off all of your debts,
except your mortgage, would you be able to do
so without borrowing any money or selling your
home?

Yes ----- [Go to S-27]

No ----- [End Interview]

[If rent]

If you had to pay off all of your debts, would you
be able to do so without borrowing any money?

Yes ----- [Go to S-27]

No ----- [End Interview]

7-SYMPTOM HEALTH QUESTIONNAIRE: ONE DAY

S-17. Would the amount left be as much as your yearly income?

Yes -----

No -----

S-18. Do you have any other comments about the subject we discussed? [Interviewer enter answers on last page, along with your own comments.]

I.E. INTERVIEWER EVALUATION

Record any comments which might help us understand the answers given by the respondent, especially those who protest during the bidding questions.

A.2 7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

(Same in all respects as one day version of 7-Symptom Health Questionnaire, except for R. and CV sections reproduced here.)

R. RANKING OF SYMPTOMS

In this next set of questions, I'm going to describe several symptoms of discomfort that are common to many people. The symptoms will not necessarily describe what you experience. I would like you to put yourself in the position of having these symptoms, however.

I want you to suppose that your health in the next 12 months is going to be like it was in the past 12 months, except that you will experience an additional 30 days of a given symptom.

First we're going to talk about which of the symptoms you consider to be worst, and which you would be bothered by the least.

Everyone has experienced coughing. Please look at this card, which describes a particular coughing experience.

[Hand respondent Coughing Days card]

The card describes the 30 additional days on which coughing occurs. You will cough about twice an hour in spells that last 10 to 20 seconds. You will feel the cough in your chest, but it is not severe enough to make you red in the face.

I am going to pause briefly to let you think about how much you would mind the 30 additional days of coughing.

[Interviewer pause for 15 seconds]

Now suppose that, instead of having the 30 additional days of coughing, you will have 30 additional days of sinus problems in the next 12 months. In other respects, your health will be exactly as it has been in the last 12 months.

A day of sinus problems is described on this card.

[Interviewer hand respondent Days of Sinus Problems card]

7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

You will have congestion and pain in your sinuses and forehead all day. You will be bothered by a feeling of stuffiness in your head, accompanied by sinus drainage in your throat. You will need to blow your nose every few minutes, You will have to breathe through your mouth most of the time.

Please think over how much you would be bothered by the 30 additional days of sinus problems, and compare it to the 30 days of coughing. Think about which symptom you mind the least and which the most.

When you have decided, please tell me which bothers you more.

[Check one]

----- 30 Coughing days

----- 30 Days of sinus problems

Place that card, under the other card.

[Wait for respondent to arrange cards]

Another problem that bothers people is throat congestion. Here is a card describing a day of throat congestion.

[Hand respondent card on Day of Throat Congestion]

On these days, you will have congestion in your throat and upper respiratory tract. You will make repeated efforts to clear your throat. The throat clearing is annoying to you and those around you. Your throat will be scratchy. Your voice will be hoarse, and you will have some difficulty speaking.

Suppose that instead of either the coughing or the sinus problems, you will have 30 additional days of throat congestion, as described on the card.

Please rank the 3 symptoms. The question is which day bothers you the least, which the next least, and which bothers you the most.

Take your time.

Place the three cards in the order you have decided on.

7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

[Interviewer check to see cards are in proper order. If respondent has difficulty in ranking the days, read the following three indented paragraphs. If respondent has difficulty in ranking later on in the questionnaire, return and read these paragraphs. Otherwise, do not read the indented paragraphs to the respondent]

If there are symptoms that bother you the same, cards for those days should be next to each other in the deck. It does not matter which comes before the other.

For example, if you don't care whether you have coughing or sinus problems, either of the two cards may be on top.

[Interviewer be sure that the cards for any group within which there is indifference are in their proper place in the deck, showing how this group ranks relative to the other days.]

Symptoms that you mind less than coughing and sinus problems should be on the top, symptoms that mind more should be on the bottom.

[Resume text if indented paragraphs were not read]

Let's go on to eye irritation. Here is a card describing a day with this type of problem.

[Hand respondent card on Days of Itching and Smarting of Eyes]

Watering and smarting of your eyes on these days forces you to interrupt what you are doing every 15 minutes or so. You rub your eyes and close them. Stinging of your eyes brings tears three times during the day--bad enough to cause you to use a handkerchief or kleenex around your eyes.

We want to proceed as before. Please think about how much you mind 30 additional days of this symptom and how you rank it with the others.

[Wait until respondent has finished arranging cards]

Next we consider days on which you have headaches. Here is the card that describes the headache experience.

[Hand respondent Headache Day card]

7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

Two rather painful, splitting headaches will strike some time during the day. Each period of headache will last 2 hours.

Please proceed as before, Think about how much you mind the 30 additional days of headaches. After you have decided, put the card in its proper place in the deck.

[Wait until respondent is through]

We have a couple of more symptoms to consider. The next one is drowsiness. Here is a card describing a day when you are bothered by heavy drowsiness.

[Hand respondent Heavy Drowsiness card]

You will have extreme difficulty staying awake during 6 of the hours when you are normally awake. Sometimes your eyelids will flutter. You will doze off for an instant now and then. The drowsiness will interfere with your social activities and other leisure. You will find the drowsiness dangerous if it comes over you while you are driving or working with tools, appliances or other machinery.

After thinking about the 30 additional days when you have drowsiness, add the card to the deck to reflect where it comes in your ranking.

[Wait for respondent to finish, and then proceed]

The last symptom is nausea. Here is a card about it.

[Hand respondent Nausea card]

Throughout the day, you will have a lingering urge to vomit, but you will not be able to do so. Stomach distress will be strong. There will be no actual pain.

As before, think about how you rank the 30 additional days of nausea, and place it in the deck.

Thank you. I'm going to record your answers for use later. Let's keep the deck sitting there. We'll use it in a minute.

[Interviewer record rankings on Tally Sheet.]

CV. CONTINGENT VALUATION

In this next set of questions, I'm going to ask you how much it would be worth to you to avoid the symptoms we've been talking about.

The answers in this part are for yourself alone and not for any other members of your household.

Before we start, please look at this card showing how a typical family spends its take-home income.

[Hand respondent Household Spending card]

When you pay to avoid symptoms, the money will have to come out of one of the categories shown. We'll leave the card here so that you can think about where the money comes from that you would spend to avoid the symptoms. Keep in mind, however, that your situation is probably different from this one.

Let's think about ways we normally deal with health problems. One way is to go to the doctor, another way is to buy medicine at the drugstore. Oftentimes we don't do any thing at all--we just suffer through the problem until it goes away. It might be that the price of a bottle of medicine or a visit to the doctor measures the value of a cure. But if we stop to think about it, the cure might be worth much more to us than that--if we really had to pay it. A cure might be valuable to us even when we just suffer with the problem until it goes away. In such cases we might ask ourselves "How much would I be willing to pay to get rid of this problem right now, even if I don't want to take medicine or visist the doctor?"

With these thoughts in mind, please try to give the largest dollar value a cure would be worth to you when answering the next few questions.

Now look at the card at the top of the deck--[symptom]-- which is the symptom you mind least.

7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

CV-1. If your health symptoms in the next 12 months were the same as in the last 12 months, except that you would also be faced with 30 additional days of [symptom], would it be worth \$100 to you to completely get rid of these days of symptoms? [Circle one]

Yes No

CV-2. [If answer to CV-1 is Yes, ask if getting rid of the day would be worth \$200, \$400--doubling each time until a No response is obtained. Then subtract half the difference between the two previous answers. Continue adding or subtracting half the difference between the last two answers until respondent no longer wants to change.]

[If answer to CV-1 is No, ask \$50, \$25--decreasing by half until a Yes response is obtained. Then add half the difference between the two previous answers, continuing with the half difference procedure until respondent no longer wants to change.] [Record final bid at top of tally sheet.]

Next look at the card at the bottom of the deck, which is the symptom you mind the most.

[Interviewer: For the following two questions, you will need a calculated bid for CV-3. The calculated bid for CV-3 is the bid to get rid of the least bothersome day given in the answer to CV-2, multiplied by two.]

CV-3. If your health symptoms were the same in the next 12 months as in the last 12 months, except that you would also be faced with 30 days of the symptom you mind the most, would you be willing to pay [calculated bid for CV-5] to completely get rid of the symptoms on that day? [Circle one]

Yes No

CV-4. [If the answer to CV-3 is Yes, ask if respondent would be willing to pay double the calculated bid for CV-3. Proceed by further doubling until a No answer is obtained. Then subtract half the difference between the first No amount and the last Yes amount. Continue increasing or decreasing by half the difference until a final bid is obtained.]

7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

[If the answer to CV-3 is No, ask if respondent would be willing to pay half the calculated bid for CV-3. Proceed by halving until a Yes answer is obtained. Then add half the difference between the first Yes amount and the last No amount. Continue increasing or decreasing by half the difference until a final bid is obtained]

[Record Final bid at bottom at tally sheet.]

I have here a tally sheet for you to keep track of your answers. [Interviewer hand respondent Tally Sheet]

Here is a pencil. [Interviewer hand respondent pencil]

The first column of the Tally Sheet is called "Symptom Days Ranked from Least to Most Bothersome". In this column, I have written the symptoms in the correct order from the deck of cards you have arranged.

The second column of the Tally Sheet is your Bid to avoid additional symptom days. The dollar amounts you have given are for the first and last lines in this column.

At this point, think about how much you would be willing to pay to avoid 30 additional days of the other five symptoms that you placed between the least and most bothersome.

Take as much time as you need to decide on the amounts you would be willing to pay to avoid each symptom day. As you decide on the amounts, record them.

People often find that they want to change the bids originally given for the least and most bothersome days. They often take several tries at each entry in the column.

Feel free to change any of the amounts as much as you want. In this part, people find themselves using the eraser a lot.

Tally Sheet

RANKING OF SYMPTOMS
FROM LEAST TO MOST
BOTHERSOME

BID FOR 30 DAYS OF
RELIEF IN THE NEXT
12 MONTHS

- 1) ----- \$----- per year
- 2) ----- \$----- per year
- 3) ----- \$----- per year
- 4) ----- \$----- per year
- 5) ----- \$----- per year
- 6) ----- \$----- per year
- 7) ----- \$----- per year

7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

[Interviewer wait for respondent to complete the column. Avoid any appearance of impatience]

CV-5. So far we have been considering the symptoms individually. Sometimes, however, they occur together.

Suppose you faced 30 days in the coming year in which you had the three following symptoms on each day. [Interviewer hand respondent Cough, Sinus, Throat card.] You would have coughing, stuffed up sinuses and throat congestion on each of the 30 days.

Look at your bids for these three individual symptoms on the Tally Sheet. Let's add them up.

[Interviewer compare sum with respondent. Record sum]

Sum of individual bids:

----- dollars

Think about whether you would be willing to pay more or less than this sum to get rid of 30 days on which all 3 of the symptoms occur together. When you are ready, please tell me how much are you willing to pay to get rid of the 30 days of combined symptoms.

Bid to get rid of 30 days of combined cough, sinus and throat symptoms:

-----dollars

CV-6 Now suppose that you faced 30 days in the coming year of these three symptoms. [Interviewer hand respondent Headache, Nausea, Drowsiness card.] You would have headache, nausea, and drowsiness.

Once again, let's add up your bids for the individual symptoms.

[Interviewer compare sum with respondent. Record sum.]

Sum of Individual bids:

-----dollars

7-SYMPTOM HEALTH QUESTIONNAIRE: 30 DAYS

How much would you be willing to pay to get rid of 30 days on which all 3 of the symptoms occur together?

Bid to get rid of 30 days of headache, nausea and drowsiness:

-----dollars

CV-7. Your answers so far have been about how much you would pay for relief of yourself alone.

Look again at the card for combined coughing, sinus and congestion symptoms. How much would your household be willing to pay to relieve the 30 days of combined symptoms for yourself and every other member of your household.

Bid for relieving household of 30 days of combined symptoms

----- dollars

CV-8. I have one final question on amounts you are willing to pay. Suppose that everybody in the United States faced 30 additional days of combined coughing, sinus and congestion symptoms. How much extra would your household be willing to pay for everybody's symptoms to be eliminated on these days? This is in addition to the amount you just stated for your household alone.

Addition to household payment to get rid of day of combined symptoms for everybody in the United States:

-----dollars

A.3 ANGINA HEALTH QUESTIONNAIRE: 10 DAY

Nov. 18,1984 Version

Form# _____	City _____
Interviewer# _____	
Date _____	[Check One]-- Center City _____
Time Started _____	Suburban _____
Time Ended _____	Rural _____
Respondent # _____	

Hello. I'm _____ from the University of Illinois School of Public Health. We are visiting with people in your area as part of a research project about health and risks to health. We have scientifically selected a sample of households to represent your area and your household has been chosen as part of the sample.

Are you the [male/female] head of the household?

[If not, ask to speak to the head and start over.]

Your opinions are very important and we hope you will help us. Please be assured that this is purely a research project and we do not represent any business or product. No sales call will result by your participation in this study. The information you provide us will remain confidential.

The questionnaire will take about 30 minutes.

A. HEALTH EVALUATION

[Interviewer circle numbers.]

Self-assessment of own health status.

A-1. Would you describe your overall health as being

1 Excellent 2 Good 3 Fair 4 Poor

[Interviewer hand out Control card.]

A-2. Please look at this card and tell me which statement best describes the control you have over your health.

1. There is little I can do because it is beyond my control
2. I can do some things, but they have little effect.
3. My actions have a moderate effect.
4. My actions have a great effect.

A-3. How often were you bothered by any illness, bodily disorders, aches or pains, during the last month?

	(Circle one)
Every day	1
Almost every day	2
About half of the time	3
Now and then, but less than half of the time	4
Rarely	5
None of the time	6

HEALTH STATUS

H-1. Have you been diagnosed by your doctor as having a heart condition of any kind?

No ----- [Skip to H17]

Yes -----

H-2. Do you know the name of your heart condition?

NAME(S) -----

DON'T KNOW -----

H-3. List the symptoms that you experience because of your heart condition. [Enter the symptoms in the first column]

SYMPTOM	RANK	NUMBER OF DAYS PER YEAR
---------	------	----------------------------

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

H-4. Which of these symptoms bother you the most. [Number the symptoms in the Rank column. 1=worst]

H-5. On about how many days did you experience these symptoms in the last 12 months? [Put number in Number Per Year column.]

H-6. During the last year did this health problem cause you to miss one or more days of usual activity, such as work, school, or work at home?

No ----- [Skip to H-9] Yes -----

ANGINA HEALTH QUESTIONNAIRE: 10 DAY

H-7. How many days did you lose of:

Work _____ School _____ Housework _____

Other (Specify) _____ None _____ [Skip to H-9.]

H-8. About how much earnings were lost because of work days missed?

\$-----

H-9. During the last year did you purchase any medicine for your heart condition?

No _____ [skip to H-13.] Yes _____

H-10. About how much did you spend for medicine for this during the last year?

\$-----

H-11. Was any of this cost paid by insurance or any other health plan?

No _____ [Skip to H-13.] Yes _____

H-12 How much was paid? \$-----

H-13. During the last year did you visit a doctor, clinic, hospital, or other source of professional medical care for this health problem?

No _____ [Skip to H-17]

Visit mainly for this _____

Part of visit for other purpose _____

H-14. About how many visits were there? _____ visits

H-15. About how much did these visits cost during the last year?

\$-----

ANGINA HEALTH QUESTIONNAIRE: 10 DAY

H-16. About how much of this cost was paid by insurance or any other plan?

\$ _____

[If Angina not mentioned in H-3]

H-17. Are you familiar with the condition called "angina pectoris"?

No _____ [Skip to Defensive Measures] Yes _____

H-18. Have you ever known anyone with this condition?

No _____ [Skip to Defensive Measures]

Yes _____

H-19. State their relationship to you, such as father, aunt or friend.

M. DEFENSIVE MEASURES

Now I would like to ask you some questions about your day-to-day living that are related to the symptoms we have been discussing,

M-1 Do you have any of the following in your home or car, purchased for health reasons?

Air Conditioner YES _____ NO _____

Air Purifier YES _____ NO _____

Humidifier YES _____ NO _____

Other (_____) YES _____ NO _____

M-2 Do you smoke? Yes _____ [Skip to M-3]

No _____

(a) Did you ever smoke? Yes _____ No _____ [Skip to M-2(c)]

(b) Did you quit for health reasons? Yes _____ No _____

(c) Would you smoke if smoking were not damaging to your health? Yes _____ No _____

M-3 Have you ever changed to location of your residence for health reasons?

Yes _____

No _____ [Skip to Section CV]

M-4 Where did you move from? _____

M-5 To? _____

M-6 What health problem prompted the move? _____

CV. CONTINGENT VALUATION--ANGINA

In this next set of questions, I'm going to ask you how much it would be worth to you to reduce or avoid angina pectoris--a painful condition that can occur with different frequencies and different levels of severity. The description I will read to you almost certainly won't describe your own circumstances. I would like you to put yourself in the position of having these symptoms, however, and tell me what it would be worth to you to remove them.

Angina is a painful condition of the chest that afflicts about 500,000 people in the United States. It can occur in people of any age, although most sufferers are 50 years of age or older. Symptoms can be of varying degrees of severity. Even the severest instances however, hardly ever result in death.

Mild Angina: One Day

First let's consider mild angina. Here is a card describing it. [Hand respondent card on Mild Angina.]

An attack lasts anywhere from 10 minutes to 3 hours. You experience stiffness in the shoulders, backache and numbness in the hands and feet. Often, these symptoms are accompanied by difficulty breathing with any exertion and dull persistent chest pain like a band is tightening around your chest.

Suppose that in an average month, you can expect 1 of these symptom days.

Angina Tally Sheet

Frequency

Value

MILD ANGINA:

You have one day of mild angina each month

Value of eliminating one day a month 1. \$ _____ /month

You have 10 days of mild angina each month

Value of eliminating one day a month 2. \$ _____ /month

Value of eliminating 10 days a month 3. \$ _____ /month

Value of eliminating 5 days a month 4. \$ _____ /month

SEVERE ANGINA:

You have one day of severe angina each month

Value of eliminating one day a month 5. \$ _____ /month

You have 10 days of severe angina each month

Value of eliminating one day a month 6. \$ _____ /month

Value of eliminating 10 days a month 7. \$ _____ /month

Value of eliminating 5 days a month 8. \$ _____ /month

ANGINA HEALTH QUESTIONNAIRE: 10 DAY

CV-1 Would it be worth \$53 a month to completely avoid the day of symptoms?

Yes -----

No -----

[If Yes, ask \$100, \$200, etc. until Reject. Then work back to highest previous Accept (but no further).

If No, ask \$20, \$10, etc. until Accept. Then work back if necessary. Record final answer on Tally Sheet, Value 1.]

Mild Angina:10 days

Next suppose you have the angina condition 10 days a month on the average. Would it be worth [Double Value 1] per month to completely avoid one of those days each month?

Yes ----- No -----

[Iterate as in Value 1 instructions. Record on Tally Sheet, Value 2.]

Again let's suppose you have the angina condition 10 days a month, just as described on the card you have. This time I'd like you to tell me how much you'd be willing to pay to completely eliminate all ten symptom days each month.

[Record on Tally Sheet, Value 3.]

Suppose you had the opportunity to eliminate half of these 10 symptom days. How much would it be worth to you to be free of the five symptom days each month?

[Record on Tally Sheet, Value 4.]

Severe Angina:One Day

Now let's look at a more severe angina problem. Here is a card about it. [Hand respondent card on Severe Angina.] Severe angina has all the symptoms we have just discussed, but some of them are considerably worse. There is a feeling of suffocation. Chest pain is now almost unbearable. The experience can be terrifying because one feels as though one were dying. After having some experience with these attacks, however, and with assurances from the doctor, one learns that they do not pose a risk of death. The symptoms last 10 minutes to 3 hours and occur one day a month.

ANGINA HEALTH QUESTIONNAIRE: 10 DAY

Suppose you had the severe angina condition one day a month. Would it be worth [Double Value 1] a month to completely avoid the day of symptoms?

Yes _____ No _____

[Iterate as in Value 1 instructions. Record on Tally Sheet, Value 5.]

Next suppose you have the severe angina condition 10 days a month. Would it be worth [Double Value 5] a month to completely avoid one of those days each month?

Yes _____ No _____

[Iterate as in Value 1 instructions. Record on Tally Sheet, Value 6.]

Again let's suppose you have the severe angina condition 10 days a month, as described on the card. This time, tell me how much it would be worth to you to completely eliminate all ten days of severe angina each month.

[Record on Tally Sheet, Value 7.]

One last question. Once again you experience the severe angina symptoms ten days a month. Suppose you could eliminate half the symptom days each month. How much would you be willing to pay to be free of 5 of the 10 symptom days each month?

[Record on Tally Sheet, Value 8.]

Now I'd like to show you a summary of your answers, [Hand Tally Sheet to respondent.]

[If any of the Severe Angina values are smaller than the corresponding Mild Angina values, point it out on the Tally Sheet and say]

Value _____ for Severe Angina is smaller than Value _____ for Mild Angina, even though the situations are the same in other respects. Would you like to make a change that takes this into account?

[If there are no inconsistencies, say]

Tell me if they look o.k. to you, or if any answers need to be changed.

[Record any changes. Take back Tally Sheet and Symptom cards.]

RE. REASONS

The value questions are now complete, but before we move on, would you tell me what the major reasons were for your answers, Here is a card that list some reasons.

[Interviewer hand respondent Reasons card]

[Interviewer: The following list will be needed to record the ranking of reasons in question RE-1]

----- Comfort
----- Loss of work at home
----- Loss of work away from home
----- Loss of recreation
----- Reduce medical expenses
----- Other (Specify)

RE-1. Please look at the card and tell me the most important reason for the amounts you were willing to pay.

[Interviewer enter "1" beside the reason given as answer]

Please continue with the next most important reason, the one after that, and so forth for all the reasons that influenced your bid.

[Interviewer enter "2" beside the next most important reason, "3" beside the one after that, and so forth for all reasons mentioned by respondent].

ANGINA HEALTH QUESTIONNAIRE: 10 DAY

SOCIOECONOMIC QUESTIONS

(Same as in 7-Symptom Health Questionnaire: One Day)

A.4 ANGINA HEALTH QUESTIONNAIRE: 20 DAY

(Same in all respects as Angina Health Questionnaire: 10 Day, except for CV section reproduced here).

CV. CONTINGENT VALUATION--ANGINA

In this next set of questions, I'm going to ask you how much it would be worth to you in order to reduce or avoid angina pectoris--a painful condition that can occur with different frequencies and different levels of severity. The description I will read to you almost certainly won't describe your own circumstances. I would like you to put yourself in the position of having these symptoms, however, and tell me what it would be worth to you to remove them.

Angina is a painful condition of the chest that afflicts about 500,000 people in the United States. It can occur in people of any age, although most sufferers are 50 years of age or older. Symptoms can be of varying degrees of severity. Even the severest instances however, hardly ever result in death.

Mild Angina:One Day

First let's consider mild angina. Here is a card describing it. [Hand respondent card on Mild Angina.]

An attack lasts anywhere from 10 minutes to 3 hours. You experience stiffness in the shoulders, backache and numbness in the hands and feet. Often, these symptoms are accompanied by difficulty breathing with any exertion and dull persistent chest pain like a band is tightening around your chest.

Suppose that in an average month, you can expect 1 of these symptom days.

Angina Tally Sheet

Frequency

Value

MILD ANGINA:

You have one day of mild angina each month

Value of eliminating one day a month 1. \$-----/month

You have 20 days of mild angina each month

Value of eliminating one day a month 2. \$-----/month

Value of eliminating 20 days a month 3. \$-----/month

Value of eliminating 10 days a month 4. \$-----/month

SEVERE ANGINA:

You have one day of severe angina each month

Value of eliminating one day a month 5. \$-----/month

You have 20 days of severe angina each month

Value of eliminating one day a month 6. \$-----/month

Value of eliminating 20 days a month 7. \$-----/month

Value of eliminating 10 days a month 8. \$-----/month

ANGINA HEALTH QUESTIONNAIRE: 20 DAY

CV-1 Would it be worth \$53 a month to completely avoid the day of symptoms?

Yes -----

No -----

[If Yes, ask \$100, \$200, etc. until Reject. Then work back to highest previous Accept (but no further).]

If No, ask \$20, \$10, etc. until Accept. Then work back if necessary. Record final answer on tally sheet, Value 1.]

Mild Angina:20 days

Next suppose you have the angina condition 20 days a month on the average. Would it be worth [Double Value 1] per month to completely avoid one of those days each month?

Yes -----

No -----

[Iterate as in Value 1 instructions. Record on Tally Sheet, Value 2.]

Again let's suppose you have the angina condition 20 days a month, just as described on the card you have. This time I'd like you to tell me how much you'd be willing to pay to completely eliminate all 20 symptom days each month.

[Record on Tally Sheet, Value 3.]

Suppose you had the opportunity to eliminate half of these 20 symptom days. How much would it be worth to you to be free of the ten symptom days each month?

[Record on Tally Sheet, Value 4.]

Severe Angina-One Day

Now let's look at a more severe angina problem. Here is a card about it. [Hand respondent card on Severe Angina.] Severe angina has all the symptoms we have just discussed, but some of them are considerably worse. There is a feeling of suffocation. Chest pain is now almost unbearable. The experience can be terrifying because one feels as though one were dying. After having some experience with these attacks, however, and with assurances from the doctor, one learns that they do not pose a risk of death. The symptoms last 10 minutes to 3 hours and occur one day a month.

ANGINA HEALTH QUESTIONNAIRE: 20 DAY

Suppose you had the severe angina condition one day a month. Would it be worth [Double Value 1] a month to completely avoid the day of symptoms?

Yes _____ No _____

[Iterate as in Value 1 instructions. Record on Tally Sheet, Value 5.]

Next suppose you have the severe angina condition 20 days a month. Would it be worth [Double Value 5] a month to completely avoid one of those days each month?

Yes _____ No _____

[Iterate as in Value 1 instructions. Record on Tally Sheet, Value 6.]

Again let's suppose you have the severe angina condition 20 days a month, as described on the card. This time, tell me how much it would be worth to you to completely eliminate all 20 days of severe angina each month.

[Record on Tally Sheet, Value 7.]

One last question. Once again you experience the severe angina symptoms 20 days a month. Suppose you could eliminate half the symptom days each month. How much would you be willing to pay to be free of 10 of the 20 symptom days each month?

[Record on Tally Sheet, Value 8.]

Now I'd like to show you a summary of your answers. [Hand Tally Sheet to respondent.]

[If any of the Severe Angina values are smaller than the corresponding Mild Angina values, point it out on the Tally Sheet and say]

Value _____ for Severe Angina is smaller than Value _____ for Mild Angina, even though the situations are the same in other respects. Would you like to make a change that takes this into account?

[If there are no inconsistencies, say]

Tell me if they look o.k. to you, or if any answers need to be changed.

[Record any changes. Take back Tally Sheet and Symptom cards.]