A CONTINGENT VALUATION OF CUSTOMER DELAY IN MEDICAL SERVICES

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INTRODUCTION

Waiting at medical practices is a typical feature of the U.S. health care market. Non-monetary factors such as opportunity cost of a patient's travel time and waiting time have been included in the analysis of the demand and pricing of medical services [e.g.; Holtmann, 1972; Phelps and Newhouse, 1974; Acton, 1975; DeVany et al., 1983; Coffey, 1983; Cauley, 1987; and Headen, 1991; Iversen, 1993 and 1997]. For example, Coffey's study of demand for ambulatory female-care services shows that an increase in time required to obtain medical care decreases the probability of choosing a public provider (vs. private provider) as well as the probability of seeking care during a year, but the number of visits per year is not affected by time price of medical care in her study [Coffey, 1983]. However, the value of waiting time to patients is not *directly* established in any of the previous studies. For example, Cauley [1987] has *imputed* the value of waiting time from his estimate of the demand for medical care. Furthermore, the wage rate data used by Cauley were not collected from the interviewed individuals (subjects). In this paper, survey methodology is used to determine respondents' willingness-to-pay (WTP) to avoid delays at medical practices. Therefore, this is the first study to estimate time value of medical care using direct solicitation (stated preferences) methods. The estimated loss of consumer surplus from waiting could be used in the debate over a universal health care system for the country.

Waiting lists and queues are norms in countries such as the U.K., Sweden, and Canada, where the health care system is nationalized and money price is rather insignificant. Appointment delays for surgeries and search for a private alternative in these countries has been the subject of debate for some time. For example, in the United Kingdom, the National Health Service (NHS) has been the topic of several studies. One notable study is conducted by Lindsay and Feigenbaum [1984], who develop a model explaining the waiting list in NHS hospitals. The authors then use a 1974 data set of NHS waiting lists for fourteen medical conditions and find that the rate of joining the list is negatively related to the expected delay in receiving medical care and to the rate at which demand decreases over time (i.e., the decay rate). However, Lindsay and Feigenbaum's study has been questioned because of the model selected and suitability of the data [Cullis and Jones, 1986]. Elsewhere, Cullis and Jones [1985] develop a math model to explain waiting lists in the NHS and to deal with public policy

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issues such as price subsidies for private care to reduce numbers on the waiting list. Acknowledging the problem with the data from the NHS system, Propper [1995] generates a data set based on the respondents' choice of alternative attributes of a hypothetical health care system for the U.K. Using this stated preferences method, she estimates the disutility of the time spent on waiting lists for non-urgent treatments. She argues that delay in receiving medical care brings disutility, in addition to losses due to delay in treatment, because of the opportunity cost of the time spent in waiting. Her estimation results lead to the conclusion that there is a positive cost for being on the waiting list even for illnesses with a zero decay rate.

Estimation of the WTP here uses the contingent valuation (CV) method, which is a well-established technique relying upon survey instruments to elicit information on the value of non-market goods. The CV method has been used to estimate willingness-to-pay for non-marketable public goods such as clean water or air, and for the opportunity to hunt animals or to enjoy outdoor recreation [e.g.; Johannesson, 1990; Dickie and Gerking, 1991; Adamowicz and Tomasi, 1991; and Jordan and Elnagheeb, 1993]. The CV method is also applied to health care issues. For example, Johannesson et al. [1993] applies logistic regression to measure WTP for antihypertensive therapy. Propper [1990], on the other hand, uses the probit method to estimate the CV of time spent on the waiting list in the U.K. public health care system. The results of her statistical analysis of patients' responses to an open-bid type of question show that the British are willing to pay £40 for a one-month reduction in waiting time for non-urgent treatments. The WTP is smaller for the lower income groups than for the higher income groups. Also, the WTP among housewives is less than that of the employed or the retired. But the coefficient of uncertainty with regard to the length of waiting time turns out to be statistically insignificant in Propper's models.

While the CV method is widely used to estimate WTP, lack of reliability and validity of survey instruments can bias these estimates [Cummings et al., 1986; Coursey et al., 1987; Mitchell and Carson, 1989; Hanemann, 1991; Smith, 1993; Freeman, 1993, Arrow et al., 1993; Larson, 1993; Diamond and Hausman, 1994; and Clarke, 2002]. For example, the existence of outliers and protesters among respondents decreases the reliability of the instruments. Also, individuals are likely to receive a "warm glow" or to "purchase moral satisfaction" by overstating their support for good causes such as protecting the environment. Other potential sources of concern for the reliability of survey instruments are caused by individuals' strategic responses, the hypothetical nature of WTP questions, the design of the questions, and the type or amount of information provided about the issue. Another methodological problem in the use of the CV method is related to the choice between WTP and willingness-to-accept (WTA) questions. Formulation of these questions is a matter of property rights and their divergence is debated [Mitchell and Carson, 1989; Boyce et al., 1992; and Shogren et al., 1994]. Controlled experiments could reduce potential problems associated with reliability and validity issues. Outliers and protest responses are usually identified and discarded from the sample. Outliers are identified as the lowest-income individuals who bid the highest, i.e., their affordability is in doubt. The protest responses, on the other hand, typically question the institution of WTP.

While some critics of the CV method maintain that surveys add little information for informed policy making [Diamond and Hausman, 1994], others are optimistic and offer suggestions to improve it [Boyce et al., 1992; Portney, 1994; Carson et al., 1996; Johannesson et al., 1998; Cummings and Taylor, 1999; List and Gallet, 2001; Carson et al., 2001; and Cooper, 2002]. Nevertheless, it must be noted that application of the CV method to the health care issues in this paper does not suffer from some of the potential shortcomings of typical studies which attempt to determine the value of environmental goods based on survey instruments. Here, patients are expressing their preference for the value of their time to engage in other activities rather than waiting in medical practices. Naturally, patients have more information about their benefits from waiting time reductions (as long as they receive the same quality of medical services) than individuals who respond to a survey of an environmental issue. Also, due to the nature of the activity, some of the other potential problems associated with the environmental goods surveys such as the "warm glow" effect are likely to be absent or minimal in the survey conducted in this study.

The remainder of this paper is organized as follows. In Section II, a theoretical model which applies the CV method to the customer delay in medical services is briefly explained. The data and design of the survey are discussed in Section III. Section IV includes analysis of the results of the CV method. Some concluding remarks are presented in Section V.

METHODOLOGY

Here, the CV method is applied to estimate willingness-to-pay to avoid delays at medical practices. In order to understand the nature of the problem faced by an individual seeking medical care, suppose that his indirect utility function is specified as follows:

$$V[Y - Q(W \bullet T + F), H(Q)(L - T \bullet Q)], \tag{1}$$

where Y is individual's income, Q is number of office visits, $(W \bullet T + F)$ is the full-price of an office visit which includes the physician fee of F and opportunity cost of delay per visit of $W \bullet T$, $H(Q)$ is the amount of medical care used, and $(L - T \bullet Q)$ is leisure. Therefore, in this equation $Y - Q(W \bullet T + F)$ measures the quantity of other goods consumed by an individual. A reduction in delay implies that the full-price of an office visit has dropped. Thus, the Hicksian compensating surplus (CS) in this context is defined as the amount of money an individual is willing to pay to be examined by a physician without any delays such that he remains on the same indifference curve.[1] In other words, the CS measures a reduction in income in exchange for no delay in receiving medical services. Accordingly, CS can be solved by equating two states of the utilities as:

$$V[Y - CS - Q \bullet F, H(Q), L] = V[Y - Q(W \bullet T + F), H(Q), (L - T \bullet Q)]. \tag{2}$$

Since the survey question elicits WTP per visit[2], assuming that visits are independent, WTP *per visit* is derived as:

$$V_1[0, Y - \text{WTP}, F, L] = V_1[T, Y, F, (L - T)]. \tag{3}$$

However, to allow for a linear estimation of the actual valuation function, the function used is assumed to be a local approximation of some utility function and has the following form:

$$g(\Pr(\text{WTP} \le i \mid X)) = \alpha + \beta X \qquad 1 \le i \le k, \tag{4}$$

where $g(\Pr(WTP \le i \mid X))$ is the WTP response probability; X is a vector of explanatory variables which includes the actual delay, patient's attitude towards delays at the medical practice, patient's satisfaction with his experience at the medical practice, patient's demographic and socio-economic characteristics, physician fees, and city; β is a parameter vector; and i is the possible values of the response. LIMDEP software is used for the statistical analyses of the data.

Since the range of the dependent variable is completely censored, the Grouped Data regression model is employed. Among the explanatory variables in vector X, patients with longer waiting times are expected to choose a higher WTP response. Patients' perceptions of whether they have waited excessively in the reception area or in the examination room are also likely to positively affect their WTP response. Patients who are more satisfied with their experience at the medical practice are more likely to pay in order to avoid delays, perhaps because of their interest in receiving care at a particular medical practice. However, since patients with appointments anticipate more timely care, they are not as likely to be willing to pay to avoid delays.

The effect of some socioeconomic characteristics such as gender, education, and age on the WTP response cannot be determined a priori. Although one might anticipate that patients who work and those with higher income will be willing to pay more to avoid delays than others, Shaw [1992] argues that positive correlation between income and working outside of home variables and value of time ignores, or perhaps confuses, the difference between value and cost of time. Patients' impressions of the level of knowledge and skill of the physician or patients' overall satisfaction with their experience at the medical practice are likely to positively influence their WTP responses. Those with health insurance, Medicaid, or Medicare may be willing to pay more because of their smaller direct cost of seeking medical care. For the same reason, physician fees should have a negative impact on patients' WTP. Of course, hidden elements in Medicaid and Medicare such as age, disability, and income are likely to reduce predictability of the sign for these variables.

DATA AND SURVEY DESIGN

The statistical analysis for this study is based on data from a survey of patients in Greenville, North Carolina, and in Houston, Texas, in 1990 and 1993 respectively. A

total of 2200 questionnaires with self-addressed stamped envelopes were equally distributed among patients at eleven medical practices in each city.[3] Since Greenville is a small city, to make sure that various medical specialties were represented in the sample, a mixture of quota and convenience sampling was used. In Houston, however, distribution of questionnaires was random within each specialty. Each specialty was represented by one medical practice in each sample. The response rate for the Greenville sample was approximately 50 percent, while the Houston sample had a response rate of only 23 percent.

After the traditional introductory paragraph, which explained the purpose of the questionnaire and assured respondents of anonymity, several standard questions regarding the socioeconomic characteristics of patients were asked. Also, patients were asked about their opinion on whether they had waited too long to be examined and their WTP to avoid any delays at the medical practice. The WTP question was phrased as follows:

> Suppose you had the option to pay for not waiting in either reception area or the examination room and this payment would not be covered by insurance. How much are you willing to pay (in addition to regular physician fees) to be examined by the nurse and the physician immediately upon arrival?
>
> a. None
> b. $1 to $5
> c. $6 to $10
> d. $11 to $15
> e. $16-$20
> f. $21-$25
> g. $26-$30
> h. more than $30

To improve the results of the statistical analysis, the data collected from the two samples were pooled. Consequently, the initial sample size for this study was 796. Based on the written comments of some of the respondents who objected to the institution of the WTP and to the implicit assignment of the property rights in the wording of the WTP question, 40 responses were eliminated from the pooled sample as protest bidders.[4] Also, three responses were identified as outliers because they marked the lowest income category in the questionnaire (below $10,000 annual income) and the highest willingness-to-pay option (more than $30). The outliers were also deleted from the pooled sample. As a result, the sample size was reduced to 753.[5]

The response profile of those who chose to answer the WTP question is presented in Table 1. If the patient is not an adult, then the questions were addressed to the adult accompanying the patient. More than half of the patients were not willing to pay anything to eliminate their waiting at the medical practice. Expectedly, the percentage of patients willing to pay a higher amount to avoid delays at the medical practice decreased with the increase in the payment.

Table 2 includes the mean and the standard deviation of the variables. The mean WTP was $4.88 with a standard deviation of $8.49. The mean waiting time in the reception area was 18.36 minutes and in the examination room was 11.05, with rather large standard deviations. The mean total waiting time was 29.57 minutes. Patients' WTP for not waiting was on average $0.17 per minute or $10.00 per hour ($0.081 per

minute or $4.86 per hour for the protesters and outliers), which is compatible with the national hourly earnings of production or non-supervisory workers on private non-farm payrolls for 1990 and 1993 of $10.01 and $10.83, respectively (Employment and Earnings, U.S. Department of Labor, various issues).[6]

TABLE 1
Response Profile for Willingness-to-Pay

Response Value	Frequency	Percent
0	436	61.1
$ 1 - $5	84	11.8
6 - 10	53	7.4
11 - 15	33	4.4
16 - 20	42	5.9
21 - 25	26	3.6
26 - 30	20	2.8
More than $30	20	2.8
Total	714	100

In spite of an approximate half-hour delay at the medical practice, only 14 percent of the patients considered their waiting time in the reception area to be long, while an even slightly smaller percentage of patients believed that they waited too long in the examination room. In fact, when the actual waiting times in the reception area and the examination room were correlated with the patients' perception of waiting long in these areas, the simple correlation coefficient was 62 percent for the reception area and 47 percent for the examination room. This implies that patients' tolerance for delays at medical practices was perhaps affected by other factors as well as their actual waiting time. For example, it is likely that perception of an excessive delay by a patient was affected by his impression of the level of knowledge and skill of the physician or by patient's overall satisfaction with the visit. On a one-to-ten scale, the mean ranking of the physician's knowledge and skill was 9.41 and the mean of patient's overall satisfaction was 9.02. Of course, direction of the causality between a patient's rating of his experience at a medical practice and his perception of an excessive delay, which is suggested here, could be questioned. Another factor that may influence the reaction to waiting time, and consequently WTP, is the physical environment where the waiting occurs. For example, if patients find the reception area for dentists less agreeable than other types of medical practices, they may be willing to pay more to avoid waiting at a dentist's office. To examine whether WTP varies for dentists relative to other medical practices, a dummy variable was created to distinguish dental practices from others. Table 2 shows that approximately 8 percent of the patients were visiting a dentist.

Based on the responses about patients' advance appointments, 95 percent of the respondents were non-emergency cases. Females seem to be somewhat over-represented in the sample because 67 percent of the patients were females whereas 51.5 percent of the Greenville population and 50.4 percent of the Houston population were females [U.S. Bureau of Census, 1994]. To avoid a potential bias in the regressions

TABLE 2
Definition of Variables and Descriptive Statistics

Variable	Definition	Mean (Standard Deviation)
WTP	Mid-point of willingness-to-pay (none, $1-$5, $6-$10, ..., $26-$30, and more than $30)	4.88 (8.49)
TWT	Total waiting time	29.57 (27.05)
WT	Waiting time in the reception area in minutes	18.36 (21.65)
WTE	Waiting time in the examination room in minutes	11.05 (11.84)
WTL	Patient's perception of having waited in the reception area for too long (yes=1, no=0)	0.14 (0.35)
WTEL	Patient's perception of having waited in the examination room for too long (yes=1, no=0)	0.13 (0.34)
RN	Patient's ranking of the physician knowledge and skill on a zero-to-ten scale (ten being the best)	9.41 (1.07)
RO	Patient's ranking of his/her overall experience on a zero-to-ten scale (ten being the best)	9.02 (1.42)
AP	Appointment made (yes=1, no=0)	0.95 (0.22)
S	Gender (male=1, female=0)	0.33 (0.47)
AG	Mid-points of age group of the patient or the adult accompanying the patient (10-20, 21-30, ..., 61 or older)	46.40 (16.17)
WK	Patient or the adult accompanying the patient working outside home (yes=1, no=0)	0.58 (0.50)
I	Mid-point of income category of the patient or the adult accompanying the patient (less than $10,000, $10,000-$19,999, ..., and $100,000 or more)	35,864.83 (25,707.19)
ED	Years of formal education completed	14.12 (2.80)
MC	Medicare recipient (yes=1, no=0)	0.27 (0.44)
MD	Medicaid recipient (yes=1, no=0)	0.07 (0.26)
INS	Health insurance (yes=1, no=0)	0.90 (0.30)
F	Physician fees for an intermediate visit with an established patient	45.86 (22.22)
DEN	Type of medical practice (dental=1, otherwise=0)	0.08 (0.27)
CITY	The city questionnaire distributed in (Greenville=1, Houston=0)	0.69 (0.25)

resulting from misrepresentation of genders in the sample, responses were weighted by the proportion of genders in the population.[7] Midpoints of age categories were used to represent the respondent's age. The results of the calculations showed that the mean age for the patient or the adult accompanying the patient was in the mid-forties. More than half of the patients, or those who accompanied them, worked. Using midpoints again, the mean annual income of the respondents was $35,865 with a relatively wide standard deviation. The level of education among respondents was mea-

sured by years of formal education completed. On the average, patients had completed 14.12 years of formal education. A high percentage of patients had health insurance. Medicare patients made up 27 percent of respondents, while Medicaid patients made up only 7 percent. Finally, physician fees for an intermediate visit with an established patient had a mean of approximately $46.

RESULTS

Before estimating the willingness to pay for avoiding delays in medical practices, the functional form of the model needs to be determined. For this purpose, the Box-Cox transformation for a general form of Equation (4) as $\mathrm{WTP}^{(\theta)} = \alpha' + \beta_1' x^{(\lambda)} + \beta_2' Z + \varepsilon$ is estimated. Box-Cox allows different transformations of the dependent variable and the independent variables. Values of θ and λ determine whether the WTP or x should be in log or natural form. Since most of the independent variables are dummies, only the functional form of income is tested here. The value of one for θ (or λ) indicates that the appropriate functional form for the variable is natural and the value of zero suggests that log is the appropriate functional form. Thus, four alternative null hypotheses to be tested are $\theta = 0$, $\theta = 1$, $\lambda = 0$, and $\lambda = 1$. The maximum likelihood method is used for estimation of θ and λ. The test statistic for $\theta = 0$ and $\theta = 1$ turns out to be 0.00 and 15.96 for the screened sample. The test statistic for $\lambda = 0$ and $\lambda = 1$ turns out to be 1.04 and 5.36. Consequently, the log form for WTP and income is rejected at the 1 percent level and natural form is chosen as the proper functional form. It must be noted that, in testing the functional form of the WTP and income variables, the other variable is assumed to be in natural form. However, allowing the second variable to take a logarithmic form did not change the results.

The efficient maximum likelihood technique, which explicitly accommodates intervals in the dependent variable, is used for the estimation of Equation (4). The weighted estimates of the CV method for three alternative model specifications are provided in Table 3. Variations among models are based on breakdown of the waiting time based on location and inclusion of a dummy variable for the city in which questionnaires are distributed. In the initial model reported, total waiting time and city dummy are used. Both variables turn out to be statistically insignificant, while a few other explanatory variables are statistically significant. Multicollinearity diagnostics for all explanatory variables in model 1 show no signs of concern based on simple correlation coefficients. However, the Variance Inflation Factor (VIF) for city is 5.00 using the OLS technique. Given the binary nature of the city variable, a Probit model is used to estimate the explanatory power of the city with respect to all other explanatory variables. Although the Probit model does not generate an R^2, singularity of the variance and covariance matrices suggest a linear dependency between the dummy variable for the city and all other explanatory variables in the model. In other words, it appears that all other explanatory variables for the patients in the two cities already take into account differences between the patients in the two cities. As a result, model 1 is abandoned. In model 2, city is dropped from the list of explanatory variables; consequently, the log likelihood is slightly improved. The coefficient of total waiting

TABLE 3
Maximum Likelihood Estimates of Contingent Valuation (Weighted)*

Variables	Model 1	Model 2	Model 3
Constant	-4.7025	1.5234	2.5883
	(11.7931)	(10.6890)	(10.7068)
TWT	0.0397	0.0684[b]	
	(0.0425)	(0.0359)	
WT			0.0215
			(0.05041)
WTE			0.1797[b]
			(0.0916)
WTL	0.1303	-0.1739	0.0663
	(2.1600)	(1.6215)	(2.0943)
WTEL	1.3492	0.1739	-1.4119
	(1.8680)	(1.6215)	(2.0184)
RN	0.9635	0.8988	0.8171
	(0.9052)	(0.9080)	(0.9090)
RO	1.3073[b]	1.2659[b]	1.2577[b]
	(0.7143)	(0.7155)	(0.7134)
AP	-14.0679[a]	-14.2539[a]	-14.1368[a]
	(3.7244)	(3.7377)	(3.7400)
S	5.8251[a]	5.6165[a]	5.5251[a]
	(1.9921)	(1.9901)	(1.9906)
AG	-0.1750[a]	-0.1743[a]	-0.1783[a]
	(0.0652)	(0.0652)	(0.0653)
ED	0.0714	0.1021	0.0895
	(0.3594)	(0.3596)	(0.3591)
I	0.0001[c]	0.0001[c]	0.0000[c]
	(0.0000)	(0.0000)	(0.0000)
WK	1.3258	1.3366	1.3197
	(2.1017)	(2.1044)	(2.1039)
MC	-4.3875[c]	-4.7308[c]	-5.0301[c]
	(3.0948)	(3.0906)	(3.0993)
MD	10.4306[a]	10.5301[a]	10.4294[a]
	(4.3359)	(4.3481)	(4.3424)
INS	-5.5873[c]	-5.9171[b]	-6.2363[b]
	(3.6193)	(3.6204)	(3.6209)
F	-0.0285	-0.04910	-0.0448
	(0.0467)	(0.0438)	(0.0439)
DEN	5.0985[b]	5.2788[b]	4.9196[b]
	(2.8359)	(2.8433)	(2.8555)
CITY	4.9325		
	(3.9778)		
Log-likelihood	-758.82	759.59	-758.72
N	577	577	577

* Standard deviations are in parentheses.
[a] Significant at the 0.01 level.
[b] Significant at the 0.05 level.
[c] Significant at the 0.10 level.

time in model 2 is statistically significant at the 5 percent level with the expected sign. Breakdown of waiting time locations in model 3 explores patients' reaction to "where you wait." The coefficient for actual waiting time in the reception area is statistically

insignificant. It appears that the actual number of minutes that the patients spend waiting in the reception area does not affect their WTP. However, the coefficient of actual waiting time in the examination room is statistically significant at the 5 percent level. Estimated parameters and their significance in models 2 and 3 are rather close except for the waiting time variables, but the log likelihood is a little better in model 2. As a result, model 2 is selected as the best fit and analysis of the results will continue according to this model. The coefficient of the perception of whether waiting time was long in the reception area or in the examination room is not statistically significant. While patients' assessment of the skill and knowledge of their physician does not seem to influence their WTP, their overall ranking of their experience at the medical practice positively affects WTP. The simple correlation coefficient between the two variables is examined for the possibility of multicollinearity. It turns out to be 0.53. To explore the impact of the patient's ranking of physician knowledge variable (*RN*) in the absence of the patient's ranking of his/her overall experience variable (*RO*), *RO* is dropped from the model. As a result, the coefficient of *RN* becomes statistically significant at the 5 percent level (the results are not reported here). Based on the results for the *RN* and *RO* variables, perhaps one can conclude that dissatisfied patients are more likely to decide not to see a physician at all (if their illness is not serious), or to be examined by a physician who makes a better impression on them.

The coefficient of the appointment variable is statistically significant at the 1 percent level with a negative sign, which confirms that since patients with an appointment may expect to be examined on time, they are less likely to be willing to pay for a timely visit with the physician. The results for the gender variable indicate that, at the 1 percent level, males are more willing to pay to avoid a delay than females. Also, younger patients are more likely to be willing to pay to avoid delays than older patients. It must be noted that the mean age of the patient or the adult accompanying the patient in this study is in the mid-forties. Education does not seem to play a role in patients' WTP. Also, the coefficient of the income variable is statistically significant only at the 10 percent level. Of course, the size of the income coefficient is nearly zero. The coefficient of another socioeconomic characteristic that has turned out to be statistically insignificant is work. The statistical results of the work and the income variables seem to agree with Shaw's argument that correlation between these variables and WTP is not robust. Furthermore, as studies have shown in the past, patients' awareness of the hypothetical nature of the WTP question could have affected their responses even though outliers have been dropped from the sample.

The coefficients of various types of private and public health insurance are statistically significant at least at the 10 percent level. The negative sign for the coefficient of Medicare suggests that, similar to the age variable, older patient are less willing to pay to avoid delays at medical practices. Patients with private health insurance are also less willing to pay. Ironically, Medicaid patients are more willing to pay for a timely visitation with a physician. The coefficient of physician fees is statistically insignificant. Finally, the coefficient of the dummy variable for dentists is statistically significant at the 5 percent level, which implies that the location of waiting affects the WTP among patients. In other words, patients dislike waiting in dentists' offices more than they dislike waiting in physicians' offices.[8]

Various approaches have been used to extrapolate the contingent valuation results to the general public.[9] A popular approach is chosen here where the mean and the median for WTP from the sample are used as statistical inferences. According to Table 2, the mean WTP is $4.88 per visit.[10] The median calculated turns out to be zero due to the high frequency of the zero response in Table 1. The total number of office visits to physicians and dentists in the U.S. for 1992 (mid-year of the years questionnaires were distributed in the two cities) are 1,513 million and 594 million, respectively.[11] Since the median WTP is zero for both data sets, loss of the consumer surplus based on the median turns out to be none. However, because of the asymmetric distribution of WTP, interpretation of the aggregate losses calculated with the median is difficult, and perhaps unacceptable. Therefore, the mean might be a more reasonable reference point. Multiplication of the mean WTP response by the total number of visits with physicians and dentists combined puts the annual loss of consumer surplus at approximately $10.3 billion.[12]

CONCLUSIONS

Here, the stated preferences method is used to derive an individual's willingness to pay for no delay in receiving medical care upon arrival at a physician's office. Contingent valuation of delays at medical practices shows the actual length of the waiting time to be an important determinant of WTP. The results from the breakdown of waiting time, and arguably the dentist variable, suggest that the location of waiting or physical environment of the surrounding also influences patients' dislike towards delays at medical practices. While some socioeconomic variables such as income and education are statistically insignificant, others show that there is some predictability based on age and gender. Also, patients' indication of their WTP may, in part, be a symbolic gesture which represents their dissatisfaction with medical practices when, in spite of an advance appointment, patients often are not examined on time. Different conclusions can be drawn from the extrapolation of the statistical results in this paper. Using the mean WTP as a statistical inference, one may conclude that loss of the consumer surplus due to delays at medical practices could be considerable. Without a comparison with the size of the subsequent gain in the producer surplus, however, the net welfare impact of delays at medical practices cannot be assessed. Yet, there may be some broad policy implications that can be drawn. For example, any evaluation of the merits of expanding health care coverage in the U.S., given the existing resources in the industry, must consider deterioration of quality in terms of increases in delays to receive an appointment as well as delays in being examined by the medical staff. In other words, losses due to the rise in waiting time are likely to offset some of the gains due to the expansion of health care coverage through a more inclusive health care system. Similarly, if price controls are imposed on physicians to improve access to health care, the subsequent rise in demand for medical care is likely to prolong customer delay. As a result, to the extent that waiting time adversely affects the quality of health care and the welfare of the patients, patients are likely to alter their choice of provider from the public and the private. While the Canadian and the British experience shows such reaction to appointment delays, and even encour-

ages some patients to use providers outside of the country, office delays are not likely to cause such dramatic responses especially for more routine medical exams.

NOTES

1. There are various measures of consumer's surplus. The concept of consumer's surplus was initially introduced by Alfred Marshall. Later, Hicks identified four measures of consumer's surplus, which are known as compensating surplus, equivalent surplus, compensating variations, and equivalent variations [Hicks, 1943]. Hicks referred to the first two measures as 'quantity-compensating variations' because the consumer is constrained to the same consumption bundle in the initial and subsequent situations. In contrast, 'price-compensating variations' are income adjustments that maintain the consumer's welfare at a particular level. For example, compensating variation is the amount a consumer would be willing to pay after a price drops in order to be as well off as before, whereas equivalent variation is the amount the consumer would receive which makes him as well off as he would be if price had dropped. Compensating and equivalent variations measures of consumer's surplus have gained popularity because of their relevance to policy decisions as they allow the consumers freedom to respond to changes in economic environment [Just et al., 1998, and Willig, 1976]. Compensating variation, which is used in this study, is often defined through an indirect utility function and is commonly used in welfare economics and social policy issues related to the public's environmental and health concerns. For additional information on measures of consumer's surplus, see Silberberg [2001], Henderson and Quandt [1980], Hausman [1981], and Deaton and Mullbauer [1986].
2. The survey question on WTP is not directly inquiring about respondents' WTP per visit as opposed to total WTP. However, the wording of the question and the amount of WTP options are assumed to be interpreted by the respondents such that the WTP per visit is elicited as intended.
3. Choice of the cities was based on the author's residence at the time. The list of the medical practices in this study contains a wide range of specialties including Cardiology, Dentistry, Family Practice, Internal Medicine, Obstetrics and Gynecology, Orthopedics, Ophthalmology, Otorhinolaryngology, Pediatrics, Plastic Surgery, and Urology.
4. A further explanation of the process by which protest bidders are identified in this survey is as follows: patients are believed to be protesting if they did not respond to the WTP question or if they chose the value of zero along with some written comments about their rights to be seen by the physician quickly without any compensation.
5. However, since the questionnaires were only distributed among patients, potential bias due to the exclusion of non-users exists. Also, it must be noted that the actual number of observations used in each model is dependent upon the number of complete responses for all variables.
6. Comparison of the estimates of the value of waiting time in medical practices with the estimate of the value of time in travel cost studies of recreational uses of natural resources is not justified because of the tendency for the individuals to underestimate the value of their travel time, especially if they enjoy traveling through picturesque places. Of course, it can be argued that the notion that people underestimate the value of travel time in recreational studies is incorrect because, at the equilibrium, the value of time at the margin must be the same across activities regardless of their physical environment.
7. It must be noted that females typically visit more often with physicians than males, especially with specialists such as Obstetrics and Gynecology, and Pediatrics. In 1995, for example, females visited 3.4 times with office based physicians and hospital outpatients departments in the country, while the figure for males was 2.4 (National Center for Health Statistics, Advance Data). In other words, ignoring the gender ratio in the U.S. population, the probability of a randomly selected patient who has an office visit with a physician being a female is 0.59 and being a male is 0.41. However, such data is not available for the two cities in the sample for the study period.
8. Additional explanatory variables are tested in alternative specifications of the model including interaction variables between appointment and waiting times, and patients' overall satisfaction and waiting times. However, simple correlation coefficients and VIF between these variables and other explanatory variables are rather high. Consequently, because of multicollinearity concerns, these variables are dropped from the models.

9. Of course, exclusion of non-users, which is common in the use of the CV method, creates a bias in extrapolation of results to the general public.
10. These results are compatible with the estimated implied marginal value of waiting time ($5.86 for employed individuals, and $3.53 for housewives) in the demand for medical care by Cauley [1987] using a 1975 data set for Southern California. However, Cauley used earnings data from the previous year and acknowledges limitation of his research in estimating value of time and in generalization of his results.
11. The total number of visits with physicians is arrived at by multiplying the average number of visits by the population. The source of data for the average number of visits with physicians and the population is the U.S. Statistical Abstract, 1996. A different approach is used for the calculation of the total number of visits with dentists because of the availability of data. In this case, the total number of dental visits per dentist in 1992 is multiplied by the number of dentists practicing in that year. However, since data on the total number of dentists is not collected each year, the available data for 1991 and 1995 are used to extrapolate the 1992 figure (assuming a constant growth rate between the two years). The data for dental visits and number of dentists are, respectively, from *Survey of Dental Practices* and *Distribution of Dentists in the U.S.*, published by the American Dental Association Survey Center in Chicago.
12. Since screening of the responses involved some subjectivity, the full sample is used as an alternative in the statistical analysis in order to examine the impact of omitting protesters and outliers from the sample. Contingent valuation estimates for the full sample in terms of size of the coefficients and their significance are similar to the results from the screened sample and, consequently, are not reported here. Although mean and standard deviation of some of the characteristics of the protesters and outliers are distinctly different from those of the screened sample, due to their relative size (approximately 5 percent of the total responses), the screened sample does not demonstrate any characteristic significantly different from the full sample. For example, the mean WTP for the full sample is $5.04 whereas for the screened sample is $4.88. As a result, if the full sample were to be used for the calculation of the annual loss of consumer surplus, the figure would be approximately $10.6 billion. Meaningful statistical results could not be generated for the protesters and outliers as a separate group due to the small degrees of freedom caused by a relatively small sample size and a large number of explanatory variables.

REFERENCES

Acton, J. P. Nonmonetary Factors in the Demand for Medical Services: Some Empirical Evidence, *Journal of Political Economy*, June 1975, 595-614.

Adamowicz, W. L., and Tomasi, T. G. Revealed Preference Test of Nonmarket Goods Valuation Methods. *Journal of Environmental Economics and Management*, January 1991, 29-45.

Arrow, K., Solow, R., Portney, P. R., Leamer, E. E., Rander, R. and Schuman, H. Report of the NOAA Panel on Contingent Valuation, *Federal Register*, January 1993, 4602-4614.

Bishop, R. C., and Heberlein, T.A. Measuring Values of Extra-Market Goods: Are Indirect Measures Biased? *American Journal of Agricultural Economics*, December 1979, 926-930.

Boyce, R. R., Brown, T. C., McClellend, G. H., Peterson, G. L., and Schulze, W. D. An Experimental Examination of Intrinsic Values as a Source of the WTA-WTP Disparity. *American Economic Review*, December 1992, 1366-1373.

Cameron, T. A., and Hupper, D. D. OLS versus ML Estimation of Non-market Resources Values with Payment Card Interval Data, *Journal of Environmental Economics and Management*, November 1989, 230-246.

Carson, R. T., Flores, N. E., Martin, K. M., and Wright, J. L. Contingent Valuation and Revealed Preference Methodologies: Comparing the Estimates for Quasi-Public Goods. *Land Economics*, February 1996, 80-99.

Carson, R. T., Flores, N. E., and Meade, N. F. Contingent Valuation: Controversies and Evidence, *Environmental and Resource Economics*, June 2001, 173-210.

Cauley, S. D. The Time Price of Medical Care, *Review of Economics and* Statistics, February 1987, 59-66.

Clarke, P. M. Testing the Convergent Validity of the Contingent Valuation and Travel Cost Methods in Valuing the Benefits of Health Care, *Health Economics*, March 2002, 117-127.

Coffey, R. M. The Effect of Time Price on the Demand for Medical-Care Services. *Journal of Human Resources*, Summer 1983, 407-424.

Cooper J. C. Flexible Functional Form Estimation of Willingness to Pay Using Dichotomous Choice Data, *Journal of Environmental Economics and Management*, March 2002, 267-279.

Coursey, D. L., Hovis, J. J. and Schulze, W. D. The Disparity Between Willingness to Accept and Willingness to Pay Measures of Value, *Quarterly Journal of* Economics, August 1987, 679-690.

Cullis, J. G., and Jones, P. R. National Health Service Waiting Lists: A Discussion of Competing Explanations and a Policy Proposal, *Journal of Health Economics*, June 1985, 119-135.

Cullis, J. G. and Jones, P. R. Rationing by Waiting Lists: An Implication, *American Economic Review*, March 1986, 250-256.

Cummings, R.G., Brookshire, D. S., and Schulze, W. D., ed. *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method*. Totowa, N.J.: Rowman & Allanheld Publishers, 1986.

Cummings, R.G., and Taylor, L. O. Unbiased Value Estimates for Environmental Goods: A Cheap Talk Design for the Contingent Valuation Method, *American Economic Review*, June 1999, 649-665.

Deacon, R. T., and Sonstelie, J. The Welfare Cost of Rationing by Waiting, *Economic Inquiry*, April 1989, 179-196.

Deaton, A., and Mullbauer, J. *Economics and Consumer Behavior*. Cambridge: Cambridge University Press, 1986.

DeVany, A., House, D., and Saving, T. The Role of Patient Time in the Pricing of Dental Services: The Free-Provider Density Relation Explained. *Southern Economic Journal*, January 1983, 669-680.

Diamond, P. A., and Hausman, A. J. Contingent Valuation: Is Some Number Better Than No Number. *Journal of Economic Perspective*, Fall 1994, 45-64.

Dickie, M., Fisher, A., and Gerking, S. Market Transactions and Hypothetical Demand Data: A Competitive Study. *Journal of the American Statistical Association*. March 1987, 1-16.

Dickie, M. and Gerking, S. Willingness to Pay for Ozone Control: Inference from the Demand for Medical Care. *Journal of Environmental Economics*, July 1991, 69-75.

Freeman, M. A. *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington, D.C.: Resources for the Future, 1993.

Hanemann, M. W. Willingness to Pay and Willingness to Accept: How Much Can They Differ? *American Economic Review*, June 1991, 635-647.

Hausman, J.A. Exact Consumer's Surplus and Deadweight Loss. *American Economic Review*, September 1981, 662-76.

Headen, A. E. Productivity Enhancing Customer Delay: Estimates from Physician Data Corrected for Measurement Error. *Southern Economic Journal*, October 1991, 445-458.

Henderson, J. M., and Quandt R. E. *Microeconomic Theory: A Mathematical Approach*, McGraw-Hill Book Company, New York, 1980.

Hicks, J. R. The Four Consumer's Surpluses. *Review of Economic Studies*, Winter 1943, 31-41.

Holtmann, A.G. Price, Time, and Technology in the Medical Care Market. *Journal of Human Resources*, Spring 1972, 179-190.

Johannesson, P. Willingness to Pay Measures and Expectations: An Experiment. *Applied Economics*, March 1990, 313-329.

Johannesson, M., Johannesson, P., Kritröm, B., and Gerdtham, U. Willingness to Pay for Antihyertensive Therapy - Further Results. *Journal of Health Economics*, March 1993, 95-108.

Johannesson, M., Johannesson, P., and Soderqvist, T. Time Spent on Waiting Lists for Medical Care: An Insurance Approach. *Journal of Health Economics*, 1998, 627-644.

Jordan, J. L., and Elnagheeb, A. H. Willingness to pay for Improvement in Drinking Water Quality. *Water Resources Research*, February 1993, 237-245.

Iversen, T. A Theory of Hospital Waiting Lists. *Journal of Health Economics*, March 1993, 55-71.

Iversen, T. The Effect of a Private Sector on the Waiting Time in a National Health Service. *Journal of Health Economics*, August 1997, 381-396.

Just, R.E., Hueth, D. L. and Schmitz, A. *Applied Welfare Economics and Public Policy*. Englewood Cliffs, N.J., 1998.

Knetsch, J. L. Environmental Policy Implications of Disparity between Willingness to Pay and Compensation Demanded Measures of Values. *Journal of Environmental Economics and Management*, May 1990, 227-237.

Larson, D. M. On Measuring Existence Value. *Land Economics*, November 1993, 377-388.

Lindsay, C. M., and Feigenbaum, B. Rationing by Waiting Lists. *American Economics Review*, June 1984, 404-417.

List, J. A., and Gallet, C. A. What Experimental Protocol Influence Disparities Between Actual and Hypothetical Stated Values? *Environmental and Resource Economics*, November 2001, 241-254.

Mitchell, R. C., and Carson, R.T. *Using Surveys to Value Public Goods: The Contingent Valuation Method*, Washington, D.C.: Resources for the Future, 1989.

Mohring, H., Schroeter, J., and Wiboonchutikula, P. The Values of Waiting Time, Travel Time, and a Seat on a Bus. *Rand Journal of Economics*, Spring 1987, 40-56.

Phelps, C., and Newhouse, J. Coinsurance, the Price of Time, and the Demand for Medical Services. *Review of Economics and Statistics*, August 1974, 334-342.

Portney, P. R. The Contingent Valuation Debate. *Journal of Economic Perspective*, Fall 1994, 3-17.

Propper, C. Contingent Valuation of Time Spent on NHS Waiting Lists. *Economic Journal*, Supplement 1990, 193-199.

_____. The Disutility of Time Spent on the United Kingdom's National Health Service Waiting Lists. *Journal of Human Resources*, Fall 1995, 677-700.

Shaw, D. W. Searching for the Opportunity Cost of an Individual's Time. *Land Economics*, February 1992,107-115.

Shogren, J. F., Shin, S. Y., Hays, D. J., and Kliebenstein, J. B. Resolving Differences in Willingness to Pay and Willingness to Accept. *American Economic Review*, March 1994, 225-270.

Silberberg, E. *The Structure of Economics: A Mathematical Analysis*. New York: McGraw-Hill Publishing Company, 2001.

Smith, V. K. Nonmarket Valuation of Environment Resources: An Interpretive Appraisal. *Land Economics*, February 1993, 1-26.

Whitehead, J. C. Ex ante Willingness to Pay with Supply and Demand Uncertainty: Implications for Valuing a Sea Turtle Protection Programme, *Applied Economics*, September 1992, 981-988.

Willig, R. D. Consumer's Surplus Without Apology. *American Economic Review*, September 1976, 89-97.

U.S. Bureau of Census. *Current population Reports*, 1994.

U.S. Department of Labor. *Employment and Earnings*, various issues.