# Determination of the Demand and Utilization of Substance Abuse Outpatient Treatment

**By**

**Paul L. Solano***
**And**
**Mary Joan McDuffie****

***Associate Professor**
****Research Policy Analyst**
**Heath Services Policy Research Group**
**School of Urban Affairs and Public Policy**
**University of Delaware**
**Newark, Delaware**

**A Paper Presented At the**
**3rd International Health Economics Conference**
**July 2001**

Little is known about the determinants of clientele utilization of and demand for substance abuse treatment provided through public sector programs. Central to demand is knowledge of how prices of treatment services influence the quantity of treatment consumed by clients. Verification of this relationship could be useful for designing the treatment delivery system, including governmental pricing of services and granting of client subsidies to encourage client treatment participation and retention. Demand estimation is seemingly difficult because market prices are absent or prices do not correspond to service costs. The price obstacle can be overcome by the adaptation of the Travel Cost Demand Model (TCDM) to services for which market prices are absent, nominal or incongruent with service costs. Demand for such goods is estimated by implicit (shadow) prices comprised of travel, transportation, and time costs incurred to consume a service at a fixed location. Since travel to a treatment provider site by individual clients occurs with outpatient services, the TCDM can be applied. The measure of outpatient treatment quantity consistent with the TCDM (which uses recreation site visits) is encounters per episode by individual clients for the various outpatient services at a specific provider location. The TCDM and variations of the model should facilitate:
Estimation of the price elasticity and income elasticity of client demand with a model for two outpatient modalities, --traditional outpatient and methadone maintenance. Since encounters per episode (utilization) is count data of only clients within the outpatient system the adapted TCDM will be tested with both truncated Poission regression models and truncated negative binomial models. Data has been obtained for every outpatient service program delivered by all providers finance through both the SAPTBG and Medicaid programs in the State of Delaware. The time period of the data covers the seven fiscal years of 1993-1999 of the State government.

## I. Introduction

In the U.S., spending on substance abuse treatment through the public sector is twice that of the private sector (Mark, et al., 2000). However, knowledge about clientele demand for public-sector-funded programs is limited (Chitwood, et al., 1999; French et al., 2000). An analysis of demand would entail the joint estimation of the price and income elasticities of clientele of treatment utilization, controlling for the impact of relevant demographic and institutional factors on the quantity of treatment services. Such an inquiry could yield important information for formulating drug abuse treatment policy.

Estimation of the price-utilization and income-utilization relationships is seemingly difficult for most public sector substance abuse programs because of the absence of market prices or, when they are charged, prices do not correspond to the costs of service provision. This obstacle can be overcome for outpatient services by the adaptation of the Travel Cost Demand Model (TCDM) to client utilization behavior.[1] The TCDM will be applied separately to two outpatient modalities --"traditional outpatient" care, and methadone maintenance--to determine clientele demand and the price and income elasticities for substance abuse treatment services. To conduct the demand estimation, seven years of data (1993-1999) has been obtained for all clients in every outpatient program delivered by all providers financed through the SAPTBG in the State of Delaware in the United States.

Section 2 provides a sketch of the significance and value of the study objectives. An overview of the SAPTBG in the Delaware context is presented in Section 3. In Section 4, the basic principles of the Travel Cost Demand Model (TCDM) for outpatient services are delineated. The econometric models are specified along with variable measurement and data are discussed in Section 5. Section 6 reports the empirical findings and their evaluation. A conclusion follows in section 7.

## 2. Significance of Research Objectives

As an economic demand model, the TCDM could generate price elasticity or elasticities that would indicate the sensitivity of client consumption of treatment units to different prices incurred for services. Verification of the negative price-quantity relationship would permit inferences about how reductions in client service costs (prices) would encourage more consumption in treatment units and thus extend the length of client time in treatment. Considerable evidence confirms that length of time and retention in alcohol and drug treatment is associated with more favorable post-treatment outcomes for clients and lower risk of multiple readmission to treatment (McClellan & McKay, 1999; McKay et al., 1993, Stark, 1992, Gottheil et al. 1992, Del Leon, Wexler & Jainchill, 1982; Ball and Ross, 1991; DeLeon, 1984; Hubbard et al., 1989; Simpson and Savage, 1980; Moos et al 1994a, 1994b). Positive outcomes produced by longer length of time in treatment could extend beyond clients. As supported by numerous cost-benefit analysis studies (Cartwright, 1998, 1999), favorable impacts of utilization on drug abusers, treatment can lessen the costs that substance abusers impose upon other individuals, i.e., crime, harm to family members (Sindelar and Manning, 1997; Cartwright, 1998, 1999). Because substance abuse treatment can mitigate deleterious drug-related behavior, society would receive a net gain in efficiency if (a) more drug abusers were treated and (b) and more treatment (units) were available and consumed by clients.

A governmental subsidy is consistent with both the external benefits to be gained from substance abuse treatment and client service duration. As a fiscal instrument, subsidies are expected to foster participation in socially beneficial (treatment) activities that are otherwise undervalued in the market place (Hyman, 1999; Rosen, 1995). Individual drug abusers under

[1] The TCDM has been employed to evaluate household demand for environmental and publicly-owned recreational services (footnotes).

consume treatment since treatment produces positive "external" outcomes (e.g., mitigation of crime and family harms), and that larger gains in outcomes are obtained through longer stays in service. A health care subsidy could correct under consumption by altering the economic incentives of substance abusers so as to encourage their increased involvement in treatment (Hyman, 1999; Rosen, 1995; Santere, 1996). By providing them a subsidy, clients would receive a value, either money or an equivalent in-kind goods/services, to perform or meet specific treatment obligation. In effect, the subsidy would be a reduction in the price clients would pay for consuming treatment units. The extent to which substance abusers will adjust their treatment activities to a price decline, via a subsidy, would be revealed through their price elasticity, i.e., the influence that price changes have on their utilization of treatment units.

Estimation of client demand for substance abuse treatment can also contribute understanding of the equity of treatment services (NIDA, 2000). Differences in treatment outcomes that exist between minorities and Caucasians may be due to disparities in utilization by the two groups (*Ibid*). Racial and ethnic disparities involving treatment may be intertwined with poverty (Horgan and Hodgkin, 1999; Garnick, 1997). Many non-White drug abusers are low income, frequently unemployed, and lack private health insurance coverage. Like White low-income substance abusers, poor minorities encounter financial barriers, including transportation costs, which affect their access to private treatment (Blendon, 1989; Halfron, et al., 1995; Cuffe et al., 1995). Consequently, both poor White and poor minority substance abusers have had to rely upon the State system (SAPTBG) programs or Medicaid to access treatment. Some studies have affirmed differences in utilization between low-income White and low-income minority clients (Blendon, 1989; Halfron, et al., 1995; Cuffe et al., 1995). However, little is known about the extent to and the way in which the costs (prices) that low income and minorities incur for treatment determine their commitment to treatment participation, viz. their retention and consumption of treatment units. Determination of separate price elasticities for minorities and white clients stratified by income would help clarify whether social, cultural and/or other forces influence their access to and utilization of drug treatment (Samuelson and Marks, 1999; Maurice & Thomas, 1995; Feldstein, 1998; Phelps, 1997; Zweifel & Breyer, 1997).

**Since minorities differ from Whites in treatment outcomes, NIDA has stated its objective as the need of understanding treatment utilization by minorities and its impact upon such groups (*Ibid.*). Two issues in NIDA's research agenda are the determination of (a) social, cultural, and medical forces that influence the adherence of racial and ethnic minorities to treatment, (b) factors that account for differences, if any, in access to and utilization in drug treatment in various services systems including managed care.**

**Many non-White drug abusers are low income, frequently unemployed, and lack private health insurance coverage. Like White low-income substance abusers, poor minorities encounter financial barriers, including transportation costs, which affect their access to private treatment (Blendon, 1989; Halfron, et al., 1995; Cuffe et al., 1995). Poverty and the lack of private health insurance has meant that both poor White and minority substance abusers have had to rely upon the State system (SAPTBG) programs or Medicaid to access treatment. Data exist (e.g., Rouse, 1995) on the extent to which low-income and minority groups have entered substance abuse treatment in the public sector, and some studies have affirmed differences in utilization (Blendon, 1989; Halfron, et al., 1995; Cuffe et al., 1995). However, little is known about the extent to and the way in which the costs (prices) that low income and minorities incur for treatment determine their commitment to treatment participation, viz. their retention and consumption of treatment units. The issues of disparities encompassed by substance abusers of racial and ethnic minorities and low-income individuals are compatible with and explored in the proposed research of clientele demand of (outpatient care) in the SAPTBG program.**

There has not been any published study that has documented the price and income elasticities of substance abuse treatment demand for public sector programs. Numerous inquiries of treatment utilization have been undertaken but not within the demand framework. Studies have investigated predictors of individual client retention in substance abuse treatment.[2] Predisposing (demographic factors), enabling (resources that permit greater ability to engage in utilization) and need (health status) characteristics have been included in models but price has not. The three dimensions do serve as a guide to the types of variables that should be incorporated into a demand model of client treatment utilization.

Using survey data, a demand model has been employed to determine whether chronic drug users, injecting drug users, and non-drug users have different pattern of health care utilization (French, et al., 2000a). Price, income (obtained from respondents directly), and with personal characteristics, were specified in the (second stage) regression equation to explain the number of outpatient visits, emergency episodes, and hospital admissions. The price variable was constructed from series of dummy variables derived from "respondents' residential zip code as a proxy of market variation in health care prices. Thus unlike the TCDM, the price of health care was not based upon the "costs" that individuals incur or would incur for each unit of substance abuse services. Consequently, price elasticity of demand cannot be calculated.

One study has been conducted on the demand and utilization of substance abuse (and mental health) services provided to <u>private</u> sector clients as employees of self-insured employers (Goodman, et al., 1999). Various elasticities of demand, including price, of individuals/patients with and without co-insurance were estimated with separate regression models for inpatient and outpatient services. Gender, age and salary status—used as a proxy of permanent income. Demand for treatment was found to be price inelastic without coinsurance, but the price-utilization relationship manifested greater elasticity for individuals with higher coinsurance. The elasticity estimates of price and other variables, based on available private market prices, do provide a basis of comparison for public sector estimates to be generated in the proposed analyses.

**A voucher system is one type of economic incentive that has been employed for treatment services that have direct connections with length of stay. With voucher-based interventions (contingency management interventions), clients have received coupons or retail gift certificates of monetary value as a reward for favorable clientele drug behavior. In a number of applications, voucher-based interventions have been consistently associated with increases in treatment retention, drug abstinence rates (measured by urine-samples), and compliance with treatment regimens. (Higgins, et al., 1991, 1993, 1994, 1995, 2000 (Silverman et al., 1996, 1999 Piotrowski, et al., 1999; Preston et al., 2000), as well as drug users from diverse populations (Higgins and Silverman, 1999; Higgins et al., 1994, 1995, Milby et al., 1996; Silverman et. al., 1996). Therefore clients should have an incentive to extend their abstinence and their participation in treatment. Although many clients in various programs were not responsive to vouchers in terms of abstinence and retention, a sizable number were and their response was enhanced as larger values of vouchers were given to them (Kirby et al., 1998; Silverman et al., 1999).**

**The evidence on vouchers supports the argument that, as an economic incentive, a subsidy could extend clientele length of time in treatment, which in turn is expected to foster positive outcomes for clients and society. Moreover, a subsidy is flexible since, in principle, their value can be increased or decreased to be consistent with client behavior. The research on vouchers does allow insight into several important policy dimensions of implementing a subsidy. One, would a subsidy influence some clients and not others to**

[2] These analyses have been based on the health care utilization model developed by Anderson and colleagues (Deleon, et al., 1997; Aron and Daily, 1976; Condelli, 1994; Kingree, 1995; Westreich, et al. 1994; McClusker et al. 1995; Rove, 1981, Altman, et al. 1978; Anderson and Newman, 1973; Aday and Anderson 1974; 1981; Anderson and Davidson, 1996; Aday, Begley, Lairson, and Slater, 1998).

**enter treatment? Two, is client utilization responsive to "payments" according the type of client substance abuse? Three, does the impact of a subsidy for utilization vary for clientele who differ in social and economic characteristics? Answers to these questions would allow subsidy resources to be employed efficiently, i.e., the largest gain in treatment participation for the subsidy money expended. More specifically, efficient allocation of a subsidy requires that the payment given to clients should be the minimum dollar value to encourage them to consume additional units of treatment. In effect, specific subsidy values should be targeted to clients according to their responsiveness to unit changes in treatment.**

**How the subsidy would be structured depends upon the empirical relationships established through the estimation of clientele demand via the TCDM. With the price elasticity of demand known (price related negatively to encounters and a statistically significant variable), one of two alternative types of subsidy could be implemented. If income is found to be positively related to encounters, verifying treatment as a normal good, then the subsidy could be allocated on a sliding scale, --an interpersonal price discrimination—(Steinberg and Weisbrod, 1998) according to income and the price parameter. An implication of treatment as a normal good may be that if treatment programs, which facilitates obtaining and/or maintaining employment, and thus earning of income, will increase the willingness to participate in services and also to accept a lower subsidy to stay in treatment. The structure of sliding scale subsidy would be more complicated where demand estimates yielded statistically significant relationships of encounters and separate classes of client characteristics---e.g., family and social factors, ethnic/racial backgrounds, types of drug abuse, and drug histories. The usefulness of these characteristics as an allocation criterion depends upon whether the variables (a) are objective observable factors that cannot be manipulated by clients, and (b) do not involve issues of illegal discrimination. If income and all other relevant client characteristics are not statistically significant, then the subsidy would be more effective (have wider impact on more clients) if uniform pricing were applied as an allocation mechanism, --i.e., that is same subsidy for all clients--, based on the price elasticity parameter (*Ibid.*).**

**Traditionally, the focus of TCDM analysis has been on the demand side of a good/service at a fixed site. However, the TCDM could yield insight into how supply factors would directly affect clientele utilization, given, in the model, the importance of geographical distance of provider sites for clients. Several studies have indicated that individual access to health care is restricted by geographical location of health care facilities. (McBride, et al., 1999; Chitwood, et al., 1999; Druss and Rosencheck, 1997; French, McGeary, et al., 2000). Drug abuse clients access could be improved through geographical knowledge in several ways. First, the location of fixed provider sites could be decentralized (additional or relocation of existing ones) so as to give clients greater proximity; both client travel time and costs would be lowered. Second, easier client access to treatment could be obtained through usage of mobile units of service provision. In this way client transportation and travel time costs could be reduced. Support for this position is available. One study using the TCDM has shown that movement of mobile mammogram units increases participation in the service and consumer surplus (Clarke, 1998).**

**In one study not a TCDM analysis, mobile methadone units were found to facilitate access for street-level heroin injectors into methadone maintenance (Brady, 1996, Buning, et al., 1990). Treatment retention of subjects in mobile units in methadone was significantly longer the subjects from the same ZIP codes treated at six Baltimore fixed-sites used for comparison (Greenfield, et al., 1996). Third, transportation to and from existing treatment sites could be provided to clients (as is done for the many state Medicaid programs including Delaware), and consequently their travel costs could be avoided. Each approach in effect would change the price/cost that clients would encounter**

**and therefore influence the quantity of service they would consume. Such analysis could be conducted through simulations using the estimated parameters of the TCDM.**

## 3. Drug Treatment of Outpatient Services

Over the past twenty years in most American states including Delaware, substance abuse treatment in the public sector has been delivered through state systems funded mainly by the Substance Abuse Prevention and Treatment Block Grant (SAPTBG) and the Medicaid programs financed by a matching categorical grant (Pringle, et al., 1999). The SAPTBG program was established for purpose of providing substance abuse treatment for those individuals who did not qualify for Medicaid and could not obtain treatment due to lack of private insurance, or public insurance coverage (Pringle, et al., 1999; Horgan & Hodgkin, 1999; Horgan & Merrick, 2000). SAPTBG supported programs provide a wide range of treatment services, and fees can be charged to clients according to their income level (Rouse, 1995; Horgan and Hodgkin, 1999; Horgan and Merrick, 2000).

The State of Delaware spending on the SAPTBG program is through cost-reimbursement and fees for service contracts with treatment providers, (varying between 20 and 30 from 1993 through 1999). Separate contracts are awarded for each modality delivered at a particular site. The providers have been located geographically throughout the state with most providers situated in high-risk (i.e., high substance abuse prevalence) urban areas (Solano and McDuffie, 2000). Clients are expected to pay for services with fees structured according to a sliding scale based on their ability to pay, but most do not; and the State contracts explicitly prohibit denial of services for non-payment (*Ibid*.). As SAPTBG clients, individuals directed to substance abuse treatment by courts as clients in the Treatment Against Street Crime (TASC) program have their services paid entirely by state funding (*Ibid.*). The SAPTBG has not put strict limits on care beyond the limits specified by the Medicaid program but the Single State Agency that directs the SAPTBG must approve extensions.

Clients addicted to non-heroin substances are assigned to "traditional" outpatient care.[3] These clients receive counseling sessions generally once a week. Heroin addicted clients are assigned to one of two methadone maintenance programs that are located in the northern and southern of the state. These clients must obtain a daily methadone dosage at their provider site and they must pay for the dosage, since it is not covered by state contracts. Counseling sessions occur periodically, generally once a month.

## 4. Principles of the Travel Cost Demand Model (TCDM)

### *4.1 Conceptual Perspective*

**Consistent with the TCDM, since individual clients travel to a fixed (service provider) site to obtain treatment, demand for substance abuse treatment can be estimated by employing an implicit (or shadow) price comprised of client travel (transportation), travel time, and time (on-site) costs incurred to consume treatment services.**

The Travel Cost Demand Model (TCDM) has long been employed in the fields of recreational, environmental and transportation economics to undertake cost benefit analysis to evaluate individual/household visits to fixed sites for which market prices are absent, nominal or incongruent with service cost (Clawson and Knetch, 1966). The TCDM has been a major tool for deriving price and income elasticities, demand curves, and the consumer surplus of government service utilization and has consistently produced results congruent with economic consumer theory (Smith, 1993; Bockstael, McConnel and Strand, 1991; Ward and Loomis,

[3] Individuals who are persistently and severely ill (PSI) are admitted to intensive outpatient programs.

1986). Empirical analyses have continuously confirmed that the quantity of visits is negatively related to consumer (household visitor's) own price. The relative size of income elasticities and the value of consumer surplus estimates have been found to be consistent across studies (*Ibid*).

To date, the TCDM has not been applied to substance abuse treatment utilization. Only recently has the TCDM been used in the field of health care. In the one TCDM study, a cost-benefit analysis was conducted to evaluate the impact of access (travel and time) costs on clients' choice to obtain a mammogram at fixed regional sites or specific mobile sites in rural areas (Clarke, 1998). This research reflects a continuing and recent concern with the importance of distance and time—central components of TCDM—as bases of health care access and utilization. Studies confirm individual access to substance abuse treatment is restricted by geographical location of provider facilities (McBride, et al., 1999; Chitwood, et al., 1999; Druss and Rosencheck, 1997; French, McGeary et al., 2000). Treatment participation (Brady, 1996; Buning, et al., 1990) and longer treatment retention (Greenfield, et al., 1996) in methadone maintenance have been found to be positively associated with provider mobile sites that have shorter distances for client travel than fixed provider sites. Physician visits have been determined to vary in their sensitivity to the price of service time (Vistnes and Hamilton, 1995; Coffey, 1983, and to both travel time and waiting time (Acton, 1976).

Within the context of substance abuse, the TCDM is a revealed preference approach to measuring household utility for treatment and other selected goods through observation of their consumption behavior with respect ton those goods (Smith and Desvouges, 1986; Fletcher, 1990; Braden and Kolstad, 1991). As a demand model, the TCDM is a variant of the economic theory of household production function (HPF). Client visits for substance abuse treatment provided to fixed site without full market prices for entry is a manifestation of the household production and consumption process to maximize utility. Each client, who is a utility maximizer, has preferences represented in a utility function that encompasses valuation of treatment visits at a provider site and the consumption of other goods. Feasible choices among goods are restricted by constraints in the form of the individual's or household's budget determined by available income and prices of both treatment visits and other goods as well as the time to consume any of the goods. When choices are made subject to the constraints to maximize utility, the result is demand functions for other goods and for treatment services. The latter takes the general formulation of:

$$(1)\ ENC = f\ (TTC, HHINC, Xs, Rs, Zs)$$

Where: ENC is the number of outpatient encounters at the fixed provider site within a specified time period—a treatment episode. TTC is a composite of (a) the transportation costs (TRC) incurred by the client for travel to and from the provider site, (b) the costs of time utilized by a client for traveling (TMC), (c) the costs of time consumed by a client for receiving treatment at the provider site, onsite time cost (OSC), and (d) any monetary payments, --fees--required of the client for services, (FEE) (Freeman, 1979; Smith 1993; Fletcher, 1990; McConnell, 1990); HHINC is client individual or household income, Xs is the vector of variables measuring client personal characteristics, Rs is the vector of variables measuring institutional factors, and Zs are attributes of substitutes or complements, if any or if relevant.

TTC is a shadow (implicit) price because it represents the client's opportunity costs for obtaining outpatient treatment. A client engages in the production of inputs--transportation costs, travel time, and time onsite, fees--to consume treatment services that are provided at the site (Bockstael & McConnell, 1991; Cicchetti, et al., 1976; Smith and Kopp, 1980). In so doing, the individual foregoes consumption of alternative good/services that would generate at least equal or less value. It is the value obtained from treatment activities (via its impacts on the client) at the provider site that is the purpose of the trip/travel and that yields the final utility

flows to the client. In effect, the demand for travel is derived from the demand for treatment activities, the consumption of which would produces utility to the client traveler (Smith and Desvouges, 1986; Fletcher, 1990). The consequence of TTC is to shift the client's demand curve to the left.

*4.1 Conceptual Requirements and Measurement Issues*

Estimation of this price-quantity relationship (encounters per episode-implicit prices) can produce information that is comparable to market transactions if it meets certain conditions which are formulated in the TCDM (Smith, 1993; Fletcher, 1990).

1. Consistent with consumer theory, the dependent variable should measure the individual quantities of a good/service consumed by a client within a defined period. The chosen measurement of *outpatient encounters per client episode* conforms to this requirement because it indicates the ability of clients to "purchase" more or less separate and distinct units of the same good (Smith, 1993). The count of encounters per episode captures only in limited way the intensity of services received by clients. Measurement of and data on the depth of client outpatient treatment for each encounter session is intractable and very inaccessible. But some extent of the intensity for an outpatient episode may be inferred from the type of services that are part of a client's treatment regimen. As a consequence, the type of therapy /counseling services to which clients have been subjected within an episode will be introduced in the TCDM as a set of dummy variables. Four counseling/therapy session categories are to be employed reflecting combinations of therapies that have been applied to clients over an episode: individual only, group only, individual and family, and individual and group.

   Research has defined an episode as a time frame between a client's admission to receive treatment and departure from that service regimen (Haas-Wilson, et al., 1989; Keeler, et al., 1988; Kessler, et al., 1980). The number of client encounters in an episode could be the result of a client's completion of the prescribed treatment regimen. Also, a client may leave the program voluntarily or involuntarily (e.g., incarceration) and not be formally discharged. In this situation where discharge date does not exist and the client has not participated in an encounter win eight weeks, the client will be considered to have completed an episode, an approach commonly used in past research (Summerfeldt, et al., 1996). Determination of the separate influence of price (TTC) on utilization—i.e., the number of encounters per episode--requires that the affect of "successful" clientele completion of treatment be taken into account. This control will enter the regression equations as an independent variable that measures the formal certification of a providers discharge action of a client.
2. Consistent with utility maximization, temporal separability should prevail. A client's decision about the nature of trips/visits and the number of them to a provider site are made at one time, and all trips are related (Fletcher, 1990). This temporal perspective fits client's role in outpatient services. Client agreement to enter traditional outpatient care is generally undertaken with knowledge that the services entail a treatment regimen (connected activities) over time, which requires participation until sanctioned successful completion (satisfactory discharge). For methadone maintenance, client entrance into treatment is based on information that services, primarily methadone dosage, would be a "continuous" duration (unless detoxification of heroin usage occurred). Intentional commitment to complete a treatment episode when he/she decides to enter treatment. The temporal perspective is also congruent with clients who are legally required by the judicial process (drug court) to participate in treatment since legal order enters the clients' utility function as another constraint. It the purpose of the TCDM to determine the reasons for client unsatisfactorily completion of outpatient care or discontinuance of methadone maintenance when the

constraint of required client treatment participation is known. Determination of the separate influence of price (TTC) on utilization—i.e., the number of encounters per episode--requires that the affect of "successful" clientele completion of outpatient care treatment, or continuation the methadone maintenance is taken into account. These controls will enter the regression equations as an independent variable that measures the formal certification by a provider of client satisfactory completion (discharge) of outpatient care, and the identification of clients as still enrolled in methadone maintenance program.

3. There must be sufficient spatial variation in the distance clients travel to and from a provider site to allow different prices to be calculated for different individuals, and that a good consumed must be observable in different quantities (Freeman, 1979). As shown below, the traditional outpatient and methadone maintenance data encompasses a wide range of values for encounters, and travel distances vary considerably due to travel by clients residing in suburban areas to the urban located provider sites.
4. If substitute sites are available to clients, then goods and/or prices from them must be included in the TCDM, otherwise the implicit price estimates would have an upward bias (Smith and Karou, 1987; Caulkins et al., 1985; Mullen and Menz, 1987; Rosenthal, 1987). Clients enter the SAPTBG program because private sector treatment alternatives are unavailable, and the Single State Authority assigns clients to a provider based on the client's residence.
5. The shadow prices incurred for a trip to a provider site is for the purpose of accessing and using the activities at the site and the site does not have multiple activities in which the client could choose to engage (Smith & Desvouges, 1986; Fletcher, 1990). If the latter occurs, then the implicit costs of the trip would have to be apportioned separate trips representing each separate activity (good separability). This difficulty is not encountered in the present proposal since, in both SAPTBG and Medicaid programs, clients can only be enrolled in one treatment therapy (modality) at a time.
6. Visits/trips of different duration to a provider site are different goods (goods separability), and because of their heterogeneity, different models should be applied. Encounters per episode are different in content and periodicity for traditional outpatient and methadone maintenance clients. For the former, a client encounter is a counseling/therapy session of the same duration (55 minutes) that generally occurs on a weekly basis. Thus encounters will be measured as the number of sessions received in an episode. For the methadone maintenance program, clients obtain a *daily* dosage of methadone (requiring duration of 15 minutes) during an episode. Each —i.e., the total number—of these daily sessions will be counted as the total number of encounters for an episode. As result of this difference in types of encounters, separate TCDM equations are evaluated for traditional outpatient and methadone maintenance clients.
7. A client's decision to travel to the provider facility should not involve client discretion about the amount of time spent on the provider site. That is, on site time cannot be a choice variable, otherwise, the client faces different relative prices for different choices, each of which are different implicit prices and parameters (Connell, 1990). Client visits to a provider site and onsite treatment activity are set by the treatment provider; therefore the trip (travel cost and time) and onsite time are directly linked and form one implicit price for treatment.
8. A client's trip (inclusive of travel costs and travel time cost) to the provider site should not be separable from the time on site. If the trip to the site does have multiple purposes, then *joint production and joint costs occurs*—treatment and work—with transportation and travel time. As a result, estimated price relationship will have an upward bias (Smith and Desvouges, 1986, McConnell, 1990; Bockstael, et al., 1987; Walsh, 1986). Joint cost and production are addressed below with respect to the measurement of the shadow price for outpatient services, TTC.

9. Since time is a scare resource, the measurement of client time for travelling to and from the provider site and client onsite time should reflect the maximum value of the goods and/or services that the client had to forgo to consume treatment services. In TCDM research, the wage rate of individuals, in various forms, has been employed as a measure of the client's opportunity costs of time. However, there is no consensus to the most valid approach to be taken (e.g., Bockstael, et al., 1991, Chevas, et al., 1989, Fletcher, 1990; Hanley and Spash, 1994). This issue is considered under the discussion of the measurement of TTC.

*4.3 Determination of TTC*:

As the implicit (shadow) price of an encounter per episode, the estimation of the TCDM is expected to produce a negative relationship between ENC and TTC (Fletcher, 1990, Smith, 1993). The implicit price in dollars is the summation of four opportunity costs incurred by a client for outpatient services-- the travel costs to and from the provider site, travel time to the site, onsite time and fees for services when charged.

DISTANCE: Both TRC costs and TMC are based upon the distance a client must travel to and from a provider site and the client's residence, the assumed point of departure and return. A client's travel distance has been estimated with data on the zip code of a client's residence and the client's provider site. Through the use of *ArcView GIS Version 3.1* (1995), a geographical information system (GIS) program, distances were calculated as the miles between the centroids, which is the geographical spatial center of the zip code, of both the provider site and the client's residence. Clients who reside in the same ZIP code areas as their provider's site were assigned a distance value of one mile.

TRANSPORTATION COSTS: A client can make trips to and from a provider site, a round trip, either by automobile or through public transit (or walking) the site and in so doing incurs a transportation cost (TRC) as an out of pocket expense. Two considerations are in order. One, as discussed below, only 50% of the TRC for the provider-residence trip by full time employed clients is allocated due to joint consumption. Two, the data does not allow the determination of the mode of transportation.

An assumption of the analysis is that, clients who have household income at 100 % of or below the Federal Poverty Level (FPL)[4] do not own a motor vehicle. Consequently these clients will use public transit (only a bus system is operational in the State of Delaware). Using the ArcView package, routes from the Delaware Area Rapid transit (DART), --the only public transit authority in the State of Delaware—will be traced out between the provider site and the client's residence. Then the fare costs for the routes will be applied. Bus fares are congruent with maximization of utility by individuals, since they are assumed to compare the marginal utility of an encounter with the marginal cost of consuming travel. If bus system does not have route from residence, it will be assumed that a client used an automobile to obtain services (Hanley and Spash, 1994).

SAPTBG program clientele with incomes above 100% of the FPL will be assumed to use a motor vehicle to travel to and from their provider site. The distance traveled between these two points will be the distance between their two ZIP codes derived from the ArcView GIS package (1995). Gasoline and oil costs have been used to measure the costs of client; the cost of gasoline and oil consumption per mile has been multiplied by distance traveled. As variable

[4] The FPL is based on household income and marital status: a single/divorced client is considered a one-person household and a married client are considered a two-person household.

costs, this measure is more consistent with individual utility maximization since it is the marginal costs of operating a vehicle (Hanley and Spash, 1994). The calculation is based on annual data on the "cost of owning and operating an automobile" that is published yearly in the *United States Statistical Abstract* by the U.S. Census Bureau (1999). The costs are nominal dollar estimate for the cost per mile for variable items and in absolute dollars for fixed costs.

TIME COSTS: Time costs include two productivity losses: travel time cost (TMC) and onsite time costs (OSC). Both measures require the determination of the amount of time consumed by the client in travel and onsite activities, and then assignment of monetary valuation to the quantity of time. The derived dollar value of client time is multiplied by client value of time to produce client time costs.

For clients assigned to bus service, travel time from point to point has been ascertained from the bus schedules of Delaware Area Rapid Transit (DART), the only public transportation facility in the State. With respect to motor vehicle transportation, travel time has been approximated by adapting the average State road speed, in miles per hour (generally 55), to the calculate residence-provider site distance[5]. These data were obtained from public information published by the State of Delaware Department of Transportation, (DELDOT). Onsite time for outpatient services was readily determined since the temporal length of each encounter is given in the provider records that comprise the data sets of the present study. Virtually all encounters of outpatient care have entailed a 55-minute counseling/therapy session. To receive their daily methadone, clients for security reasons have appointments and are serviced rapidly in a typical 15-minute encounter session.

Monetary (dollar) valuation for (TMC) and (OSC) involves some complexity. Agreement prevails that the valuation of client time should be equal to the opportunity costs of the time it takes the client to make a treatment visit. That is, it should be equivalent to the highest value of the alternative goods/services given up to use time to consume outpatient treatment services (e.g., Bockstael, et al., 1991, Chevas, et al., 1989, Fletcher et al., 1990; Hanley and Spash, 1994). Under stringent market conditions (especially freedom to choose the quantity of work hours),[6] the marginal wage rate (per hour) of the clients would indicate the trade-off value for alternative use of a client's time, --gains from additional work or alternatively additional leisure activities such as treatment services (Deaton and Muelbauer, 1980, Gramlich, Boardman, 1996). Because of the limited realism of such a model, disagreement exists on the specific measurement of opportunity costs, an issue that requires continuing research; consequently current research must entail reasonable estimations (e.g., Boardman, 1996; Fletcher, et al., 1990). A major conclusion from past research, however, is that the extent to which the wage rate should be considered the correct value of time depends on what activities are forgone. If work time is traded-off or curtailed for an alternative activity then the wage rate would be a correct representation of the individual's opportunity cost of time. If work is not given up and therefore does not constrain the individual's choice of engaging in leisure, then the market wage rate must be adjusted downward to reflect the lower opportunity costs of an individual's time for participating in non-work activities.

In transportation studies, the focus has been on the value of travel time saved by alternative modes of transportation or road network designs. Work time travel has generally been measured with the pertinent wage rate, and non-work trips valued less than the wage rate.

---

[5] In his analysis of mammogram services, with 93% of the women traveling by private vehicle, Clarke (1998) assumed that all patients traveled at 90/km by automobile.

[6] The conditions are perfectly competitive markets, choice of number of work hours, no structural unemployment, and constant wage rate for the worker (Deaton and Muelbauer, 1980).

The adjustments to the wage rate (measured as proportions of the rate) to evaluate non-work time trips have varied widely among similar types of trips (Boardman et al., 1996). For applications of TCDM, research has produced a consensus that travel and onsite time for household recreational and/or environmental activities should be valued by an adjusted wage rate to indicate choices among alternative leisure options, which are unconstrained by work time requirements or contracts. The adjusted wage rates have manifested a wide range (in the form of fractions of the wage rate) of values for travel and onsite time for activities (Fletcher, et al., 1990; Cesario, 1976; Smith and Desvouges, 1986). In what appears to be, perhaps, a burgeoning consensus in the cost benefit analysis literature, the basic position is that, despite their limitations, wage rates and adjustments to them are a reasonable approximation of the opportunity cost of a client's time (Hargreaves, et al., 1998; Garber, et al., 1996; Luce, et al., 1996, Haddix et al., 1996).

For employed individuals, this perspective is based on an implicit view that wage rates are crudely indicative of an individual's valuation of time because, by engaging in a health care interventions (e.g., outpatient services), they forgo work and thus a monetary value they could have earned approximately equal to their wage rate. Greater precision in estimating opportunity costs can be obtained by using the wage rates that are applicable to the characteristics of the targeted population (e.g., occupation, age, gender) that are subject of the health care intervention, such as outpatient care and methadone maintenance clients (*Ibid.*). Such wage rates could be viewed as a client's maximum valuation of time since it could exceed the client's reservation wage, i.e., the "minimum" wage for which a client would be willing to work and give up leisure.

Clarke (1998) relied upon a similar approach for his TCDM analysis of mammogram services (1998) for employed patients. The value of their time was derived from (Australian) national marginal wage rates that pertained to a patient's occupational classification. Likewise, in the present study, the valuation of time for full time and part time employed clients has been constructed on the basis of the wage rates of their occupation. The relevant hourly wage rates for determining TMC and OSC for full time and part time clients in the two outpatient modalities was obtained from the mean wage by occupation and county of residence of Delaware workers. Data on mean wages were taken from the annual *Delaware Wages*, a survey of earnings and wages of Delaware workers published by the State of Delaware Department of Labor that compiles wage information consistent with the Standard Occupational Classification (SOC) system. Service providers collect SIC classified occupation data on gainfully employed clients based on their current job and for non-employed clients based on their last job.

Implicit in this perspective is that full time employed clients either take time from work to participate in encounters, or adjust their work commute time to obtain treatment. Therefore the valuation of *travel* time (but not *onsite* time) of full time employees is very likely to involve joint cost and production. Full time employed clients are very likely to undertake multi-purpose trips, given that most encounters at providers sites occurs during weekdays. Travel time is comprised of a round trip used for both a journey to work and also obtaining treatment. In this case, the value of travel time for outpatient service would be overstated, and TTC would have an upward bias. To reduce the likely overstatement of the (TMC) of full time workers, the value of *travel* time is divided equally between treatment and work. This same adjustment is made for transportation costs (TRC) incurred by full-time workers.

Numerous clients were not engaged in the work force, i.e., non-workers (25% in outpatient care modality and 55 % in the methadone maintenance program). Some clients were either homemakers, disabled, retired or unemployed. The approach to non-employed persons is

different than Clarke's position in which non-working and retired women, seeking a mammogram, were all assigned the value of social security benefits (1998). Available markets wages have been imputed for homemakers, and for remainder surrogate wage rates were determined for each group to capture the marginal valuation of client time. The interpretations of these wage rates are different than that of employed clients.

Unemployed clients fall into two classes: individuals looking for work and individuals *not* looking for work. For the former clients, since they were actively seeking employment, they were likely to be recipients of unemployment compensation. Thus "compensation" wage rate was derived. Using the Delaware wage rate associated with the client's (former) occupation an annual income was estimated to arrive at the amount of compensation that a client would received. The annual unemployment compensation was transformed into an hourly wage rate adjusted for a 37.5-hour week. Even though these clients are willing to work, they cannot access the labor market; consequently they cannot forgo the value of a market wage (as would be represented by an occupation wage rate). Therefore their activities are constrained to choices of leisure (non-work activities); thus the "compensation" wage rates indicates the trade-off value among leisure activities, inclusive of outpatient treatment encounters. In effect, the choices of activities made may reflect the maximum value that a client places on use of (leisure) time.

A surrogate wage rate has also been determined for unemployed clients *not* looking for work. Given that these clients are not pursuing employment, they would have been ineligible for unemployment compensation. Therefore, these clients were assigned general assistance payments, the most likely source of income. These payments were adapted to a 37.5-hour week to arrive at an hourly wage rate. By intentionally not seeking employment, these clients have deliberately restricted themselves to options involving only leisure activities. Therefore work is not forgone and thus a market wage rate would overstate the value of time. Since they may be willing to receive less in financial assistance and still not seek employment, the general assistance wage could be viewed as an estimate of the maximum value of a client's time.

Homemaker clients are non-market workers of working age who have *chosen not* to enter the labor market for monetary remuneration. To value these clients' time, the selected "reasonable approximation" is the wage rate for maid and housekeeping services. These services are comparable to the activities that the homemakers perform in the home and for which they could at least earn the same wage as the employed housing service workers do (Garber, et al., 1996; Luce, et al., 1996). The dollar value of the mean wage rate was obtained from the same Delaware sources applied to the employed workers. Since the hourly (housing service) wage is insufficient to entice them to accept labor market employment, this wage rate represents the lower bound on the value of homemaker client time. The use of the housing service wage implies that the value of client leisure time exceeds the client's reservation wage, which is the minimum value that clients would place on their of time.

Because of their inability to work, disabled clients were assigned the general assistance wage, as was done for unemployed clients not looking for work. This wage indicates that leisure (non-work) time must be the maximum value of client time since they are unable to access the labor market and receive a wage of greater value. Clients retired from the work force were assigned the average social security benefits for their household status, --as in Clarke's study (1998), --from which hourly wage calculated by assuming a 37.5-hour week, allocated social security benefits. For some retired clients, the social security wage could be the maximum value of their time because they are no longer willing to pursue employment, while for other retirees, the wage could be viewed as a minimum value of time since they may

actually engage in labor market activities, even though penalties are attached to workplace earnings.

FEES. Although fees (FEE) could be charged to clients for counseling/therapy sessions, the data on the traditional outpatient care and methadone maintenance programs of the present study show only a few cases in which fees were levied. In methadone maintenance program, a $3.00 charge/fee per daily dosage (therefore per encounter and per day), irrespective dosage strength, has remained constant over the time frame of the data. The methadone fees have been added to the other components of TTC.

4.4 *A Note on Price and Income Data*

The data (described below) used for the testing the TCDM had missing data on two important variables--household income and occupational code. Rather than estimate the values for missing data, these observations were dropped from the analysis. For outpatient care, 410 observations were deleted from a total of 2,056 client episodes. For methadone maintenance 1428 of 2,684 observations were eliminated.

## 5. TCDM Empirical Analysis

**The demand equations and demand curves to conduct these six analyses will be derived from the estimation of both truncated Poisson and truncated negative binomial regression models. These two models are employed (and compared) because encounters per episode are count data and only those substance abusers who are utilizing the outpatient treatment system are included in the demand estimation. To undertake the analyses of the research aims, data has been obtained for every outpatient service program (traditional outpatient care, intensive outpatient services, and methadone maintenance) delivered by all providers financed through both the SAPTBG and Medicaid programs in the State of Delaware. The time period of the data covers the seven fiscal years of 1993-1999 of the State government.**

*5.1 The Models*

As stated above, the TCDM of outpatient services will be tested separately for traditional outpatient care and for methadone maintenance. The specification of the basic TCDM is the following single-form equation:

(1) $ENC_i = B_0 + B_1TTC_i + B_2\ HHINC_i + B_3DRUG_i + B_4SES_i + B_5INST_i + e_i$

Where: $ENC_i$ represents either the number of counsel/therapy encounters, or the number of daily methadone dosages of an individual client for treatment episode,

$TTC_i$ is the measure of the implicit (shadow) price that an individual client incurs for an outpatient encounter,

$HHINC_i$ is the household income of an individual client,

$DRUG_i$ is a vector of substance abuse characteristics of an individual client,

$SES_i$ is a vector of social, economic, and demographic characteristics that pertain to the individual client,

$INST_i$ is a vector of institutional characteristics or forces,

$B_1$ to $B_5$ are the parameters to be estimated, and $e_i$ is the error term.

The variables, and their measurement, that are to be specified for the TCDM equations are presented in Table 1.

**TABLE 1: VARIABLES OF THE TCDM**

| Variable Name | Variable Measurement | Type of Variable Measurement | Variable Label In The Equation |
|---|---|---|---|
| Encounters per episode of a client | Number of encounters by a client in a treatment episode | Interval (a numerical scale) | ENC |

| | | | |
|---|---|---|---|
| Implicit (or shadow) price of encounters per episode of a client | Travel cost + opportunity costs of travel time + opportunity cost of onsite time<br>+ fees | Interval (a numerical scale) | TTC |
| Household Income of individual client | Annual income in dollars | Interval (a numerical scale) | HHINC |
| Age of client | Date of Application minus birth date | Interval (a numerical scale) | AGE |
| Gender of client | Female = 1,<br>Male = 0, (reference) | Categorical (or Dummy) | GEND |
| Race of client | Black/African American = 1,<br>Hispanic = 1,<br>White/Caucasian = 0 (reference) | Categorical (or Dummy) | BLACK<br>HISPANIC |
| Client Employed | Employed = 1,<br>Other = 0 (reference) | Categorical (or Dummy) | EMPL |
| Marital Status | Single = 1,<br>Married = 1,<br>Widow/Divorced/Separated = 0 (Reference) | Categorical (or Dummy) | SINGLE<br>MARRIED |
| Type of Primary Substance | Alcohol = 1,<br>Crack = 1,<br>Cocaine = 1,<br>Heroin = 1,<br>Marijuana = 1,<br>Other drugs (Sedatives, Stimulants, Analgesics, Inhalants) = 0, (reference) | Categorical (or Dummy) | ALCOHOL<br>CRACK<br>COKE<br>HEROIN<br>DOPE |
| Number of Drug Diagnoses | Two or more drugs =1,<br>drug = 0 (reference) | Categorical (or Dummy) | TDRUG |
| Drug Court Required Treatment | Participant in Treatment Alternative to Street Crime Program<br>TASC = 1,<br>Non-TASC = 0 (reference) | Categorical (or Dummy) | TASC |
| Age of Initial Drug Use | Age when used drugs initially | Interval (a numerical scale) | FIRSTAGE |
| Initial Enrollment in State Program | Designation of client episode as a first time client enrollment.<br>First Time Episode = 1,<br>All other episodes = 0 (reference) | Categorical (or Dummy) | FIRSTIME |
| Type of Discharge<br><br>(Outpatient Care) | Transferred To A Program = 1<br>Client Refused Service = 1<br>Failure = 1<br>Administrative discharge = 1,<br>Still In Program = 1,<br>Unknown = 1,<br>Death/Jail = 1,<br>Satisfactory Completion = 0 (reference) | Categorical (or Dummy) | DISRSON1-<br>DISRSON8 |
| Type of Discharge (Methadone Maintenance) | Transferred To A Program = 1,<br>Satisfactory Completion = 1,<br>Client Refused Service = 1,<br>Failure = 1,<br>Administrative discharge = 1,<br>Unknown = 1,<br>Death/Jail = 1,<br>Still In Program = 0 (reference) | Categorical (or Dummy) | DISRSON1-<br>DISRSON8 |
| Number of Episodes To Date | Number of Prior Episodes Experienced Before Current Episode | Interval (a numerical scale) | EPISODES |

| | | | |
|---|---|---|---|
| Trend Variable | Count of the number of months in the data set, with July 1, 1991 = to 1 | Interval (a numerical scale) | TREND |

There is no consensus on the functional form of the TCDM equation. Two of the commonly tested equations are evaluated here: (a) Log Linear Model, $1nENC_i = B_0 - B_1TTC_i + \ldots B_nX_n$; and (b) Double Log Model, $1nENC_i = lnB_0 - B_1lnTTC_i + \ldots B_nlnX_n$. where ln are natural logs, $B_0$, $B_1$, and $B_n$ are estimated parameters shown with their expected signs. The advantage of these forms is that the price elasticity of outpatient encounters, as well as the encounter elasticities of other variables, can be realized readily from the estimated equation (Gujarati, 1999; Greene, 2000).

The TCDM equations estimated to determine price and other elasticities are tested with a sample comprised of clients within outpatient treatment programs influences the units of treatment they consume, *ceteris paribus*. Thus the sample is truncated (Maddala, 1992; Greene, 2000). That is, potential clients who do not participate in treatment, (and possibly would with certain prices or cost incurred) are excluded from the analysis. With this condition, ordinary least squares (OLS) would produce biased estimates. Likewise without information on non-participation, (zero encounters consumed), Tobit estimation would yield biased parameters. To obtain unbiased estimator, a maximum likelihood estimator (MLE) formulated for truncated data must be applied (Maddala, 1992; Greene, 2000). The MLE have been the most common approach to estimation of TCDM in recreational analysis, and the models have produced empirical findings consistent with economic demand theory.

*5.2. Data and Data Sources*

The data employed for the present analysis is for the outpatient care and methadone programs funded under the SAPTBG and implemented by the State of Delaware. The time frame of both data sources is seven years covering the fiscal years of 1993 (July 1, 1992 to June 30, 1993) through (July 1, 1998 to June 30, 1999). The data includes all individuals (clients) who have received outpatient treatment by every provider of all treatment programs contracted through SAPTBG.

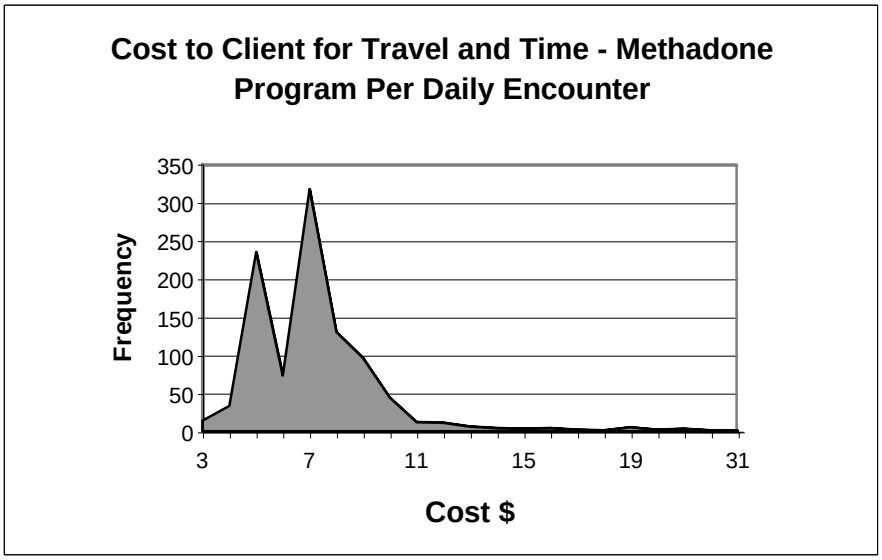
The major data set, referred to as the CRF (for Consumer Reporting Form) data, was provided by the Single State Agency of the State of Delaware, the Division of Alcoholism, Drug Abuse and Mental Health (DADAMH), which is located in the State Department of Health and Human Services. The data is based upon every separate episode (the period inclusive of admission and discharge to any inpatient or outpatient modality. The provider of the treatment modality is responsible completing information/data on each episode, and then forwards it to DADAMH that compiles an annual (fiscal year) data set.

A second data set, encounter/service data, covering the 1992-1999 period, has been integrated into the CRF data through the use of a common identification number (called the multiple classification identification, MCI, number) that is unique to each client. This data is comprised of the billing information for outpatient services to DADAMH. Along with client identification number, it includes records of the provider, the type of outpatient modality, the number of encounters, the types of encounters—family, individual, or group--, the length (time) of session, and the charge to the Single State Agency data for each session.

# TCDM Variables - Methadone Program

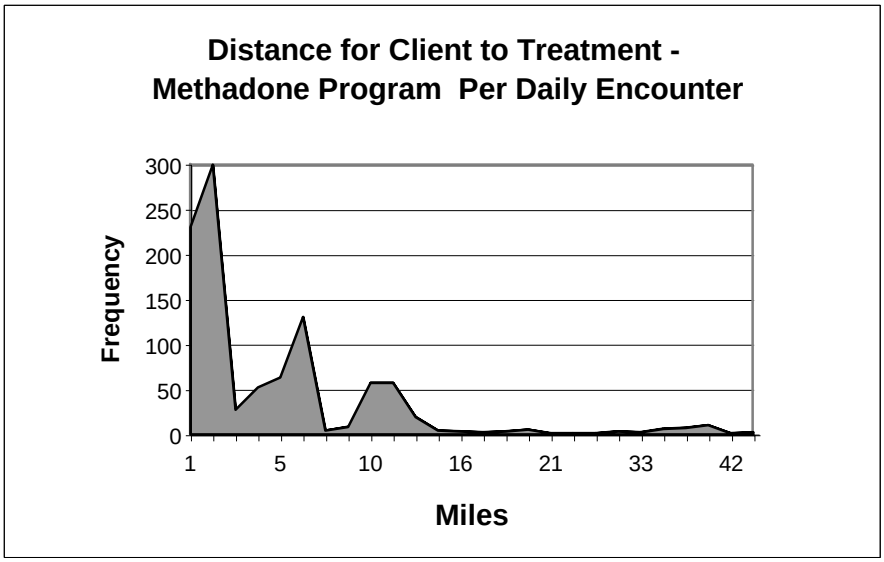
| Variables | Symbol | Measure | Minimum | Maximum | Mean | Std. Dev. | Frequency |
|---|---|---|---|---|---|---|---|
| Gender | GENDER | Dummy, Females=0 | 0 | 1 | N/A | 0.4631 | 334 |
| | | Males=1 | | | | | 740 |
| Race | RACE | Dummy, Non-Blacks=0 | 0 | 1 | N/A | 0.4967 | 601 |
| | | Blacks=1 | | | | | 473 |
| Ethnicity | ETHNIC | Dummy, 0=NonHispanic | | 1 | N/A | 0.2868 | 977 |
| | | 1=Hispanic | | | | | 97 |
| First time in system | FIRSTIME | Dummy, 0=No | 0 | 1 | N/A | 0.3826 | 191 |
| | | 1=Yes | | | | | 881 |
| Client Married | MARRIED | Dummy, 0=No | 0 | 1 | N/A | 0.3924 | 870 |
| | | 1=Yes | | | | | 240 |
| Client Single | SINGLE | Dummy, 0=No | 0 | 1 | N/A | 0.4961 | 468 |
| | | 1=Yes | | | | | 606 |
| Client still in program | STILLIN | Dummy, 0=No | 0 | 1 | N/A | 0.4627 | 741 |
| | | 1=Yes | | | | | 333 |
| Employed | EMPL | Dummy, 0=No | 0 | 1 | N/A | 0.4997 | 512 |
| | | 1=Yes | | | | | 562 |
| Education of grade school or less | GRADESCHO | Dummy, 0=No | 0 | 1 | N/A | 0.2108 | 1,024 |
| | | 1=Yes | | | | | 50 |
| Judicial Order for treatment | TASC | Dummy, 0=No | 0 | 1 | N/A | 0.1095 | 1,059 |
| | | 1=Yes | | | | | 13 |
| Education of High school or more | HIGHSCH | Dummy, 0=No | 0 | 1 | N/A | 0.4302 | 263 |
| | | 1=Yes | | | | | 811 |
| # of people dependent on household income | HINCPND | Count | 1 | 6 | 1.82 | 0.1357 | 1,058 |
| # of Encounters | ENC | Interval | 8 | 837 | 258 | 236.7 | 1,074 |
| Household Income | HHINCGRS | Interval | $1,668 | $65,000 | $13,686 | 11,361 | 1,038 |
| Age of Client | AGE | Interval | 17 | 69 | 36 | 9.7 | 1074 |
| Total Cost to Client | TTLCOST | Interval | $3 | $31 | $7 | $3 | 997 |

**Total Cost in Dollars**




| Cost | Frequency | Cost | Frequency | Cost | Frequency |
|---|---|---|---|---|---|
| 3 | 14 | 10 | 44 | 17 | 2 |
| 4 | 33 | 11 | 12 | 18 | 1 |
| 5 | 235 | 12 | 11 | 19 | 5 |
| 6 | 73 | 13 | 6 | 21 | 2 |
| 7 | 317 | 14 | 4 | 22 | 3 |
| 8 | 130 | 15 | 3 | 26 | 1 |
| 9 | 96 | 16 | 4 | 31 | 1 |

* Rounded to nearest dollar




| Distance | Frequency | Distance | Frequency | Distance | Frequency |
|---|---|---|---|---|---|
| 1 | 230 | 10 | 57 | 21 | 1 |
| 2 | 299 | 11 | 57 | 25 | 1 |
| 3 | 27 | 12 | 19 | 26 | 1 |
| 4 | 52 | 15 | 4 | 28 | 3 |
| 5 | 63 | 16 | 3 | 33 | 2 |
| 6 | 130 | 17 | 2 | 34 | 6 |
| 7 | 4 | 19 | 3 | 38 | 7 |
| 9 | 8 | 20 | 5 | 41 | 10 |
| | | | | 42 | 1 |

*Rounded to nearest miles

**TCDM Variables - Outpatient Program**

| Variables | Symbol | Measure | Minimum | Maximum | Mean | Std. Dev. | Frequency |
|---|---|---|---|---|---|---|---|
| Gender | GENDER | Dummy, Females=0 | 0 | 1 | N/A | 0.4076 | 311 |
| | | Males=1 | | | | | 1,168 |
| Race | RACE | Dummy, Non-Blacks=0 | 0 | 1 | N/A | 0.4464 | 1,073 |
| | | Blacks=1 | | | | | 406 |
| Ethnicity | ETHNIC | Dummy, 0=NonHispanic | 0 | 1 | N/A | 0.1893 | 1,424 |
| | | 1=Hispanic | | | | | 55 |
| First time in system | FIRSTIME | Dummy, 0=No | 0 | 1 | N/A | 0.3539 | 217 |
| | | 1=Yes | | | | | 1,262 |
| Client Married | MARRIED | Dummy, 0=No | 0 | 1 | N/A | 0.4091 | 1,165 |
| | | 1=Yes | | | | | 314 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Client Single | SINGLE | Dummy, 0=No | 0 | 1 | N/A | 0.5001 | 725 |
| | | 1=Yes | | | | | 754 |
| Client completed program | COMPLETE | Dummy, 0=No | 0 | 1 | N/A | 0.4501 | 1,062 |
| | | 1=Yes | | | | | 417 |
| Employed | EMPL | Dummy, 0=No | 0 | 1 | N/A | 0.4281 | 357 |
| | | 1=Yes | | | | | 1,122 |
| Education of grade school or less | GRADESCH | Dummy, 0=No | 0 | 1 | N/A | 0.2636 | 1,368 |
| | | 1=Yes | | | | | 111 |
| Judicial Order for treatment | TASC | Dummy, 0=No | 0 | 1 | N/A | 0.4962 | 637 |
| | | 1=Yes | | | | | 820 |
| Education of High School | HIGHSCH | Dummy, 0=No | 0 | 1 | N/A | 0.4165 | 330 |
| | | 1=Yes | | | | | 1,149 |
| Primary Drug = Cocoaine | COKE | Dummy, 0=No | 0 | 1 | N/A | 0.2440 | 1,385 |
| | | 1=Yes | | | | | 94 |
| Primary Drug = Alcohol | ALCOHOL | Dummy, 0=No | 0 | 1 | N/A | 0.4934 | 618 |
| | | 1=Yes | | | | | 861 |
| Primary Drug = Crack | CRACK | Dummy, 0=No | 0 | 1 | N/A | 0.3526 | 1,264 |
| | | 1=Yes | | | | | 215 |
| Primary Drug = Marijuana | DOPE | Dummy, 0=No | 0 | 1 | N/A | 0.3526 | 1,264 |
| | | 1=Yes | | | | | 215 |
| Primary Drug = Heroin | HEROIN | Dummy, 0=No | 0 | 1 | N/A | 0.1315 | 1,453 |
| | | 1=Yes | | | | | 26 |
| Education of Some College | SOMCOLL | Dummy, 0=No | 0 | 1 | N/A | 0.3278 | 1,298 |
| | | 1=Yes | | | | | 181 |
| Number of Drugs Used | TDRUGS | Category 1=1 | 0 | 1 | N/A | 0.4896 | 891 |
| | | 2= 2-3 | | | | | 588 |
| Group Counseling only | GRONLY | Dummy, 0=No | 0 | 1 | N/A | 0.3029 | 1,328 |
| | | 1=Yes | | | | | 151 |
| Individual and Family Counseling | INFAM | Dummy, 0=No | 0 | 1 | N/A | 0.1737 | 1,433 |
| | | 1=Yes | | | | | 46 |
| Individual and Group Counseling | INGRP | Dummy, 0=No | 0 | 1 | N/A | 0.3892 | 1,204 |
| | | 1=Yes | | | | | 275 |
| # of people dependent on household income | HHINCPND | Count | 1 | 10 | 2.37 | 0.6087 | 1,479 |
| # of Encounters | TTLSESS | Interval | 1 | 85 | 9.09 | 0.301355 | 1,479 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Household Income | HHINCGRS | Interval | $1,560 | $78,000 | $14,260 | 9,571 | 1,397 |
| Age of Client | AGE | Interval | | | | | |
| Total Cost to Client | TTLCOST | Interval | $2 | $48 | $14 | 0.8563 | 1,478 |
| | | | | | | | |

# Methadone Program
# TRUNCATED (MLE) REGRESSION
# Total Cost

The QLIM Procedure

Dependent Variable Log of ENC

Algorithm converged.

Censored Regression Estimates

| | |
|---|---|
| Number of Observations | 958 |
| Log Likelihood | -1206 |
| Maximum Absolute Gradient | 1.78406E-8 |
| Number of Iterations | 5 |
| Optimization Method | Newton-Raphson |
| AIC | 2448 |
| Schwarz Criterion | 2538 |

| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Gradient |
|---|---|---|---|---|---|---|
| Intercept | 1 | 11.8020 | 0.4113 | 28.70 | <.0001 | -736E-15 |
| gend | 1 | -0.0859 | 0.0637 | -1.35 | 0.1777 | -101E-14 |
| black | 1 | -0.0658 | 0.0653 | -1.01 | 0.3131 | -119E-15 |
| hispanic | 1 | -0.0145 | 0.1081 | -0.13 | 0.8935 | -986E-16 |
| firstime | 1 | -0.0550 | 0.0752 | -0.73 | 0.4649 | -626E-15 |
| married | 1 | 0.1265 | 0.0932 | 1.36 | 0.1748 | -239E-15 |
| single | 1 | 0.1150 | 0.0744 | 1.54 | 0.1224 | -464E-16 |
| Stillin | 1 | 1.0103 | 0.0983 | 10.27 | <.0001 | -573E-15 |
| HHINC | 1 | 8.2913E-6 | 3.4507E-6 | 2.40 | 0.0163 | -1.78E-8 |
| TTC | 1 | -0.0215 | 0.0109 | -1.98 | 0.0478 | -635E-14 |
| age | 1 | 0.008930 | 0.003644 | 2.45 | 0.0142 | -33E-12 |
| Employed | 1 | 0.0252 | 0.0681 | 0.37 | 0.7110 | -787E-15 |
| gradesch | 1 | 0.1442 | 0.1734 | 0.83 | 0.4056 | -153E-16 |
| HHINCPND | 1 | -0.0470 | 0.0310 | -1.52 | 0.1293 | -129E-14 |
| TASC | 1 | -0.3995 | 0.2397 | -1.67 | 0.0956 | -661E-17 |
| highsch | 1 | 0.1852 | 0.0712 | 2.60 | 0.0093 | -437E-15 |
| trend | 1 | -0.0740 | 0.003303 | -22.39 | <.0001 | -68E-12 |
| SIGMA | 1 | 0.8523 | 0.0194 | 43.89 | <.0001 | 1.48E-11 |

# OLS REGRESSION
# (Double Log)
# TOTAL COST

**Dependent Variable: Log of ENC**

**Analysis of Variance**

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 16 | 578.16465 | 36.13529 | 48.52 | <.0001 |
| Error | 942 | 701.54355 | 0.74474 | | |
| Corrected Total | 958 | 1279.70819 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 0.86298 | R-Square | 0.4518 |
| Dependent Mean | 5.00289 | Adj R-Sq | 0.4425 |
| Coeff Var | 17.24967 | | |

**Parameter Estimates**

| Variable | Label | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|---|
| Intercept | Intercept | 1 | 10.21132 | 0.77804 | 13.12 | <.0001 |
| gend | male | 1 | -0.09468 | 0.06408 | -1.48 | 0.1399 |
| black | | 1 | -0.06766 | 0.06575 | -1.03 | 0.3037 |
| hispanic | | 1 | -0.02317 | 0.10387 | -0.22 | 0.8235 |
| firstime | | 1 | -0.04001 | 0.07481 | -0.53 | 0.5929 |
| married | | 1 | 0.13599 | 0.08978 | 1.51 | 0.1302 |
| single | | 1 | 0.12122 | 0.07635 | 1.59 | 0.1127 |
| stillin | still in program | 1 | 1.01018 | 0.06193 | 16.31 | <.0001 |
| hhinc | log of hh income | 1 | 0.09416 | 0.04727 | 1.99 | 0.0467 |
| TTC | log of ttlcost | 1 | -0.08445 | 0.10783 | -0.78 | 0.4337 |
| age | log of age | 1 | 0.32144 | 0.12176 | 2.64 | 0.0084 |
| Employed | | 1 | 0.00758 | 0.07412 | 0.10 | 0.9185 |
| gradesch | | 1 | 0.14395 | 0.15444 | 0.93 | 0.3516 |
| highsch | | 1 | 0.18706 | 0.07286 | 2.57 | 0.0104 |
| HHINCPND | log of HHINCPND | 1 | -0.08460 | 0.05999 | -1.41 | 0.1588 |
| TASC | jud/civil order | 1 | -0.42246 | 0.24320 | -1.74 | 0.0827 |
| trend | | 1 | -0.07418 | 0.00355 | -20.89 | <.0001 |

# Outpatient Program
# OLS REGRESSION
# (Double Log)
# TOTAL COST

**Dependent Variable: Log of ENC**

**Analysis of Variance**

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 25 | 232.43817 | 9.29753 | 16.23 | <.0001 |
| Error | 1431 | 819.67565 | 0.57280 | | |
| Corrected Total | 1456 | 1052.11382 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 0.75683 | R-Square | 0.2209 |
| Dependent Mean | 1.87017 | Adj R-Sq | 0.2073 |
| Coeff Var | 40.46880 | | |

**Parameter Estimates**

| Variable | Label | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|---|
| Intercept | Intercept | 1 | 1.50678 | 0.44091 | 3.42 | 0.0006 |
| gend | | 1 | -0.01291 | 0.05306 | -0.24 | 0.8077 |
| black | | 1 | -0.02403 | 0.04905 | -0.49 | 0.6242 |
| hispanic | | 1 | -0.00300 | 0.10916 | -0.03 | 0.9781 |
| firstime | | 1 | -0.18560 | 0.05728 | -3.24 | 0.0012 |
| TASC | jud/civil order | 1 | -0.09287 | 0.04670 | -1.99 | 0.0469 |
| married | | 1 | 0.00665 | 0.06116 | 0.11 | 0.9134 |
| single | | 1 | 0.03258 | 0.05344 | 0.61 | 0.5422 |
| Complete | Completed | 1 | 0.33444 | 0.04611 | 7.25 | <.0001 |
| hhinc | log of hh income | 1 | -0.01434 | 0.02462 | -0.58 | 0.5605 |
| TTC | log of ttlcost | 1 | -0.09210 | 0.04727 | -1.95 | 0.0516 |
| age | log of age | 1 | 0.22683 | 0.09155 | 2.48 | 0.0133 |
| Employed | | 1 | 0.12266 | 0.06320 | 1.94 | 0.0525 |
| hhincpnd | log of hhincpnd | 1 | -0.07399 | 0.03567 | -2.07 | 0.0382 |
| coke | | 1 | -0.33342 | 0.12771 | -2.61 | 0.0091 |
| alcohol | | 1 | -0.29581 | 0.10505 | -2.82 | 0.0049 |
| crack | | 1 | -0.40943 | 0.11473 | -3.57 | 0.0004 |
| dope | | 1 | -0.23065 | 0.11979 | -1.93 | 0.0544 |
| heroin | | 1 | -0.04541 | 0.18355 | -0.25 | 0.8046 |
| gronly | | 1 | 0.14543 | 0.06970 | 2.09 | 0.0371 |
| infam | | 1 | 0.61101 | 0.12022 | 5.08 | <.0001 |
| ingrp | | 1 | 0.85113 | 0.05344 | 15.93 | <.0001 |
| gradesch | | 1 | 0.27237 | 0.15028 | 1.81 | 0.0701 |
| highsch | | 1 | 0.27975 | 0.13370 | 2.09 | 0.0366 |
| somcoll | | 1 | 0.31057 | 0.14178 | 2.19 | 0.0287 |
| trend | | 1 | -0.00210 | 0.00079642 | -2.63 | 0.0085 |

## Outpatient Program
## TRUNCATED (MLE) REGRESSION
## (Double Log)
## Total Cost

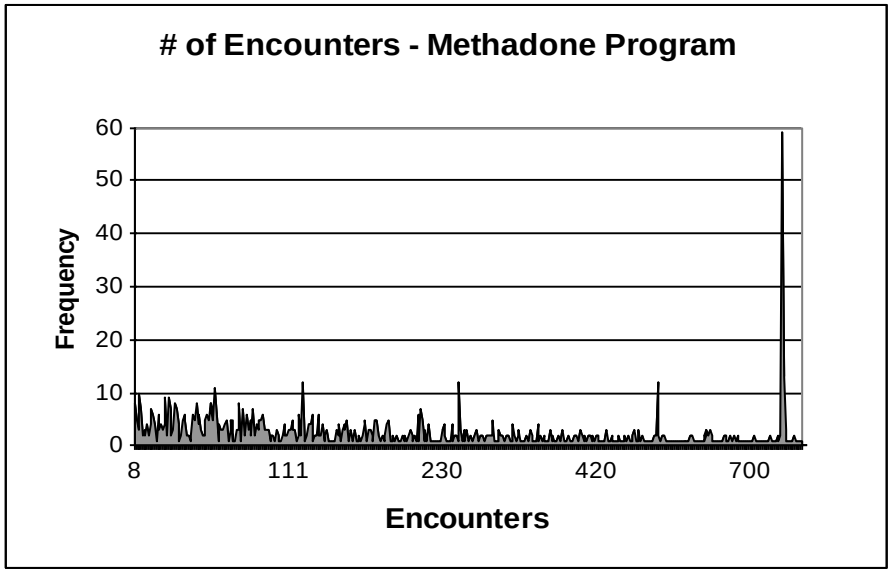
Dependent Variable  Log of ENC

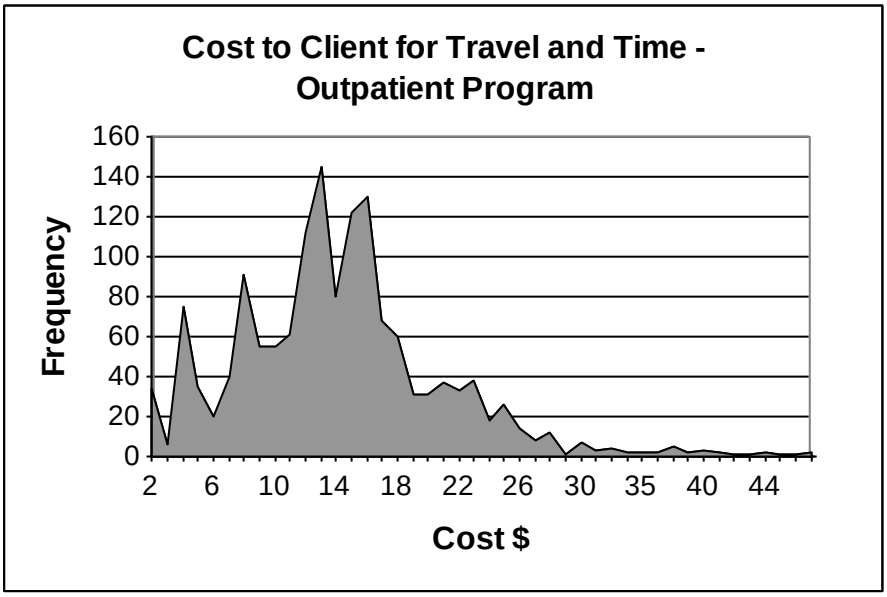
Algorithm converged.

Censored Regression Estimates

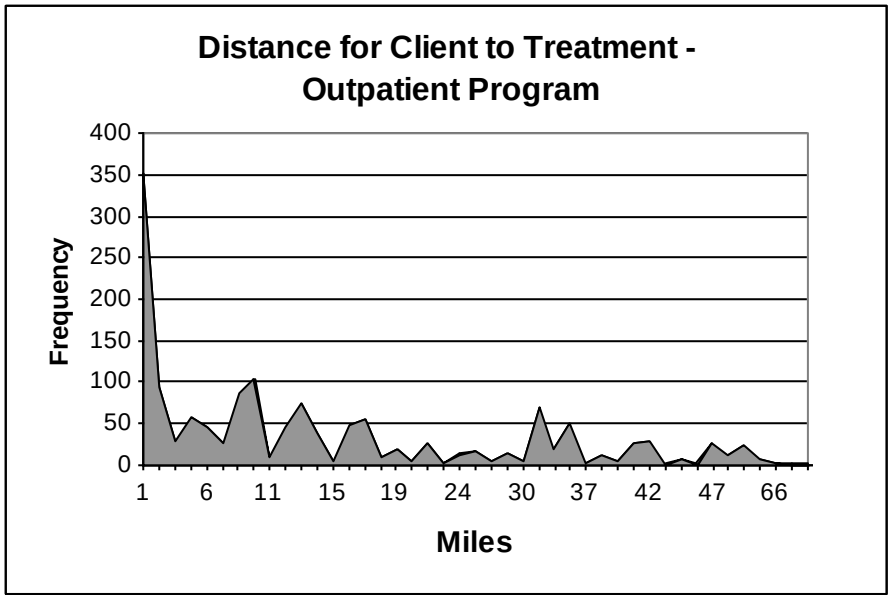
| | |
|---|---|
| Number of Observations | 1457 |
| Log Likelihood | -1737 |
| Maximum Absolute Gradient | 7.09697E-6 |
| Number of Iterations | 5 |
| Optimization Method | Newton-Raphson |
| AIC | 3529 |
| Schwarz Criterion | 3672 |

| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Gradient |
|---|---|---|---|---|---|---|
| Intercept | 1 | 1.5202 | 0.4501 | 3.38 | 0.0007 | 1.26E-12 |
| gend | 1 | -0.0126 | 0.0545 | -0.23 | 0.8170 | 1.16E-12 |
| black | 1 | -0.0275 | 0.0523 | -0.53 | 0.5993 | 4.03E-13 |
| hispanic | 1 | -0.000783 | 0.1300 | -0.01 | 0.9952 | 5.69E-14 |
| firstime | 1 | -0.1978 | 0.0650 | -3.04 | 0.0023 | 1.06E-12 |
| TASC | 1 | -0.0901 | 0.0500 | -1.80 | 0.0715 | 7.29E-13 |
| married | 1 | 0.008283 | 0.0646 | 0.13 | 0.8979 | 3.31E-13 |
| single | 1 | 0.0317 | 0.0573 | 0.55 | 0.5800 | 6.19E-13 |
| Complete | 1 | 0.3466 | 0.0541 | 6.41 | <.0001 | 4.38E-13 |
| hhinc-log | 1 | -0.0141 | 0.0264 | -0.54 | 0.5921 | 1.2E-11 |
| TTC-log | 1 | -0.0971 | 0.0490 | -1.98 | 0.0474 | 2.76E-12 |
| age-log | 1 | 0.2220 | 0.1011 | 2.20 | 0.0281 | 4.61E-12 |
| Employed | 1 | 0.1224 | 0.0683 | 1.79 | 0.0730 | 8.7E-13 |
| hhincpnd-log | 1 | -0.0793 | 0.0380 | -2.09 | 0.0367 | 8.98E-13 |
| coke | 1 | -0.3584 | 0.1106 | -3.24 | 0.0012 | 6.84E-14 |
| alcohol | 1 | -0.3034 | 0.0903 | -3.36 | 0.0008 | 7.84E-13 |
| crack | 1 | -0.4213 | 0.1031 | -4.08 | <.0001 | 1.94E-13 |
| dope | 1 | -0.2485 | 0.1084 | -2.29 | 0.0219 | 1.31E-13 |
| heroin | 1 | -0.0414 | 0.2343 | -0.18 | 0.8597 | 2.35E-14 |
| gronly | 1 | 0.1567 | 0.0819 | 1.91 | 0.0557 | 1.18E-13 |
| infam | 1 | 0.6338 | 0.1240 | 5.11 | <.0001 | 3.73E-14 |
| ingrp | 1 | 0.8735 | 0.0724 | 12.06 | <.0001 | 2.39E-13 |
| gradesch | 1 | 0.2953 | 0.1492 | 1.98 | 0.0477 | 1.33E-13 |
| highsch | 1 | 0.2980 | 0.1255 | 2.37 | 0.0176 | 8.43E-13 |
| somcoll | 1 | 0.3265 | 0.1340 | 2.44 | 0.0149 | 1.84E-13 |
| trend | 1 | -0.002171 | 0.000812 | -2.67 | 0.0075 | 1.07E-10 |
| SIGMA | 1 | 0.7880 | 0.0143 | 55.04 | <.0001 | 7.097E-6 |

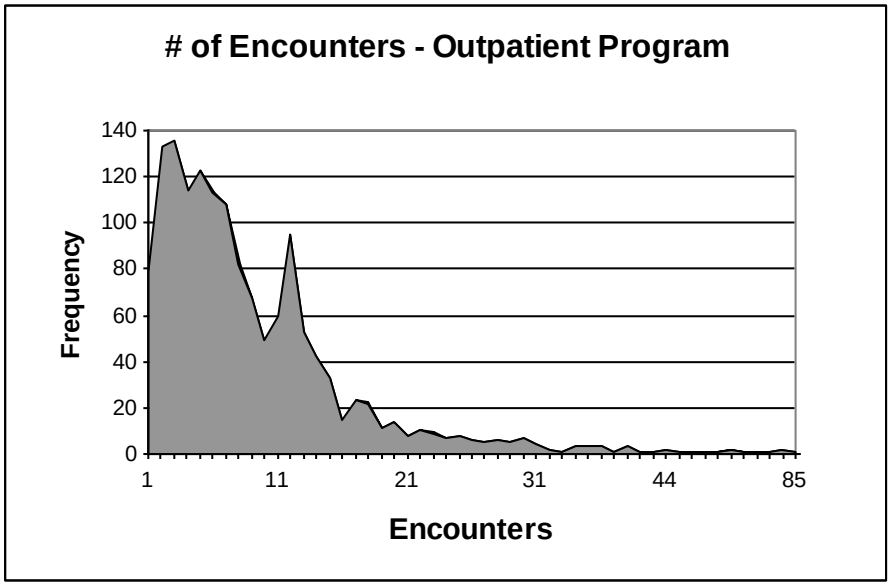

# of Encounters - Methadone Program
Frequency
60
50
40
30
20
10
0
8
111
230
420
700
Encounters




| Cost | Frequency | Cost | Frequency | Cost | Frequency |
|---|---|---|---|---|---|
| 2 | 34 | 17 | 68 | 32 | 4 |
| 3 | 6 | 18 | 60 | 33 | 2 |
| 4 | 75 | 19 | 31 | 34 | 2 |
| 5 | 35 | 20 | 31 | 35 | 2 |
| 6 | 20 | 21 | 37 | 36 | 2 |
| 7 | 40 | 22 | 33 | 37 | 5 |
| 8 | 91 | 23 | 38 | 39 | 2 |
| 9 | 55 | 24 | 18 | 40 | 3 |
| 10 | 55 | 25 | 26 | 41 | 2 |
| 11 | 61 | 26 | 14 | 42 | 1 |
| 12 | 112 | 27 | 8 | 43 | 1 |
| 13 | 145 | 28 | 12 | 44 | 2 |
| 14 | 80 | 29 | 1 | 45 | 1 |
| 15 | 122 | 30 | 7 | 46 | 1 |
| 16 | 130 | 31 | 3 | 48 | 2 |




| Distance | Frequency | Distance | Frequency | Distance | Frequency |
|---|---|---|---|---|---|
| 1 | 353 | 17 | 55 | 37 | 2 |
| 2 | 94 | 18 | 9 | 38 | 12 |
| 4 | 29 | 19 | 20 | 39 | 4 |
| 5 | 58 | 20 | 4 | 41 | 26 |
| 6 | 45 | 21 | 26 | 42 | 29 |
| 8 | 27 | 23 | 3 | 43 | 1 |
| 9 | 86 | 24 | 13 | 44 | 8 |
| 10 | 103 | 25 | 17 | 46 | 1 |
| 11 | 10 | 27 | 4 | 47 | 26 |
| 12 | 45 | 28 | 15 | 48 | 12 |
| 13 | 74 | 30 | 4 | 49 | 23 |
| 14 | 39 | 33 | 69 | 52 | 7 |
| 15 | 5 | 34 | 18 | 66 | 2 |
| 16 | 47 | 35 | 51 | 74 | 1 |
| | | | | 77 | 1 |




**6. FINDINGS**

Another set of issues, also beyond the scope of the present proposal, pertains to the TCDM results. Numerous questions arise regarding the administrative and managerial dimensions of how to deliver a subsidy or the supply side approaches. Should the subsidy be paid directly to the client? Given concerns over some clients having sizeable amounts of cash at any one time, how often should it be paid? Should it be in the form of vouchers that are accumulated and paid as "rewards"? Should the client receive the subsidy through the provider, or through a state as a reimbursement? Should the state decentralized treatment services by funding infrastructure capital for providers, and what other incentives should be used? If a client transportation system or mobile treatment units are implemented, should the state (a) operate its own service, (b) contract out to the private sector, or (c) finance it through provider funding?

## Literature Cited


Aday, L. and Anderson, R. 1974. "A Framework for the Study of Access to Medical Care." *Health Services Research* 9: 208-220.

Aday, L. and Anderson, R. 1981. "Equity of Access to Medical Care: A Conceptual and Empirical Overview." *Medical Care,* 19: (12 supplement), 4-27.

Alexander, J. and Lemak., C. 1997. "Managed Care Penetration in Outpatient Substance Abuse Treatment Units." *Medical Care Research and Review* 54(4): 490-507.

Alexander, J., Wheeler, J., Nahra, T., and Lemak, C. 1998. "Managed Care and Technical Efficiency in Outpatient Substance Abuse Treatment Units." *Journal of Behavioral Health Services Research* 25(4): 377-396.

Anderson, R. and Davidson, P. 1996. "Measuring Access and Trends." In Anderson, R., Rice, T. and Kominski, G. (eds.). *Changing the U.S. Health Care System: Key Issues in Health Services, Policy, and Management*, San Francisco: Jossey-Bass.

Belsley, D. A., Kuh, E and Welsch, R. E. 1980. *Regression Diagnostics, Identifying, Influential Data and Sources of Collinearity*, New York: John Wiley, Inc.

Blendon, R., Aiken, I., Freeman, H., and Corey, C. 1989. "Access to Medical Care for Black and White Americans: A Matter of Continuing Concern." *JAMA*, 261(2): 278-281.

Boardman, A., Greenberg, D., Vining, A., and Weimer D. 1996. Cost-Benefit Analysis: Concepts and Practice. Prentice Hall.

Bockstael, N. and McConnell, K. 1978. "The Estimation and Use of the Household Production Function for Wildlife Recreation." Department of Resource Economics, University of Rhode Island, Discussion Paper No. 15.

Braden, J.B. and Kolstad, C.D., (ed.) 1991. *Measuring the Demand for Environmental Quality,* Amsterdam. Elsevier Science Publishing Co., Inc.

Brown, G. and Mendelsohn, R., 1984. "The Travel Cost Model." *Review of Economics and Statistics,* 66(3): 427-433.

Cartwright, W.S. 1999. "Cost-Benefit Analysis of Drug Treatment Services: A Review of the Literature." NIDA Working Paper.

Cartwright, W.S. 1998. "Cost-Benefit and Cost-Effectiveness Analysis of Drug Treatment Services," *Evaluation Review*. 23(5): 609-636.

Cesario, F. 1976. "Valuation of Time in Recreation Benefit Studies". *Land Economics* 52(1): 32-41.

Chitwood, D., McBride, D., French, M., and Comerford, M. 1999. "Health Need and Utilization: A Preliminary Comparison of Injection Drug Users, Other Non Chronic Drug Users and Non Users." *Substance Use and Misuse* 34: 727-746.

Cicchetti, C., Fisher, A., and Smith V. 1976. "An Econometric Evaluation of a Generalized Consumer Surplus Measure: The Mineral King Controversy." *Econometrica* 44: 1259-76.

Clarke, P. 1998. "Cost-Benefit Analysis and Mammographic Screening: A Travel Cost Approach." *Journal of Health Economics* 17: 767-787.

Cuffe, S., Waller, J., Cuccaro, M., Pumariega, A., and Garrison, C. 1995. "Race and Gender Differences in the Treatment of Psychiatric Disorders in Young Adolescents." *Journal of the American Academy of Child and Adolescent Psychiatry* 34(11): 1536-1543.

Druss, R. and Rosenheck, R. 1997. "Use of Medical Services by Veterans with Mental Disorders." *Psychosomatics,* 38: 451-458.

ERSI, 1995 *ArcView GIS Version 3.1*, Redlands California.

Feldstein, P. 1998. *Health Care Economics*, 5th ed. Delmar Publishers.

Fletcher, J., Adamowicz, W., and Graham-Tomasi, T. 1990. "The Travel Cost Model of Recreation Demand: Theoretical and Empirical Issues." *Leisure Sciences*, 12: 119-147.

French, M., McGeary, K., Chitwood, D., and McCoy C. 2000. "Chronic Illicit Drug Use, Health Services Utilization, and the Cost of Medical Care." *Social Science and Medicine* 50(12): 1703-1713.

Fuguitt, D. and Wilcox, S. 1999. *Cost-Benefit Analysis for Public Sector Decision Makers*, Quorum Books.

Garber, "Theoretical Foundations of Cost-Effectiveness Analysis" in Gold, M. R. et al., *Cost-Effectiveness in Health and Medicine*, New York; Oxford University Press, 1996

Gold, M., Sparer, M., and Chu, K. 1996. "Medicaid Managed Care Lessons from Five States." *Health Affairs* 15: 153-66.

Goodman, A.; Hanken, J.; Nikiura, E.; and Sloan, J. 1999. "Impacts of Insurance on the Demand and Utilization of Drug Abuse Treatment." *International Journal of the Economics of Business*, 6(3): 331-348.

Greene, W. 2000. *Econometric Analysis* 4th ed., Prentice Hall.

Haas-Wilson, D., Cheadle, A., and Scheffler, R. 1989. "Demand for Mental Health Services: An Episode of Treatment Approach." *Southern Economic Journal* 56(1): 219-32.

Gorsky, R., Hadddix, A. C., Shaffer, P. A., "Cost of an Intervention" in Hadddix, A. C., Shaffer, P. A., *Prevention Effectiveness: A Guide Decision Analysis and Economic Evaluation*, New York, Oxford University Press, 1996

Halfon, N., Inkelas, M. and Wood, D. 1995. "Nonfinancial Barriers to Care for Children and Youth." *Annual Review of Public Health* 16: 447-472.

Hargreaves, W. A., Shumway, M., Hu, T., Cuffel, B. Cost-Outcome Methods for Mental Health, San Diego: Academic Press, 1998;

Hanley, Nick and Spash. 1994. *Cost-Benefit Analysis and the Environment*, London: Edward Elgar Publishing.

Health Trends. 1998. "1998 Guide to Managed Care Markets." Health Trends, Inc., Bethesda, MD.

Holahan, J., Zuckerman, S., Evans, A., and Rangarajan, S. 1998. "Medicaid Managed Care in Thirteen States." *Health Affairs*, 17(3): 43-63.

Horgan, C. and Hodgkin, D. 1999. "Mental Illness and Substance Abuse among Low-Income Populations." Access to Health Care: Promises and Prospects for Low-Income Populations. Washington DC.

Jacobs, P. 1991. *The Economics of Health and Medical Care*, Aspen Publishers, Inc.

Johansson, P. 1995. *Evaluating Health Risks: An Economic Approach*. Cambridge University Press. Cambridge.

Johansson, P. 1997. "On the Use of Market Prices to Evaluate Medical Treatments." *Journal of Health Economics* 16: 609-615.

Kaye, N., Pernice, C. and Pelletier, H. 1999. "Medicaid Managed Care: A Guide for the States." Prepared by the National Academy for State Health Policy.

Keeler, E., Manning, W., and Wells, K. 1988. "The Demand for Episodes of Mental Health Services." *Journal of Health Economics* 7: 369-392.

Kessler, L., Steinwachs, d., and Hankin, J. 1980. "Episodes of Psychiatric Utilization." *Medical Care* 8(12): 1219-27.

Kissinger, P., Cohen, D., Brandon, W., Rice, J., Morse, A., and Clark, R. 1995. "Compliance with Public Sector HIV Medical Care." *Journal of the National Medical Association* 87: 19-24.

Luce, B. R., Manning, W.G., Siegel, J. R., and Lipscomb, J., "Estimating Cost in Cost-Effectiveness Analysis" in Gold, M. R. et al., *Cost-Effectiveness in Health and Medicine*, New York; Oxford University Press, 1996

Maddala, G. 1983. "Limited-Dependent and Qualitative Variables in Econometrics." Cambridge University Press.

Mark, T. 2000. *National Estimates of Expenditures for Mental Health and Substance Abuse Treatment, 1997, Volume I: Technical Report*, Contract Report to Substance Abuse and Mental Health Services Administration.

Mathis, S. and Siegel, L. 1993. "Quantitative Toolkit for Economics and Finance." Kolb Publishing Co.

McBride, D., VanBuren, H., Terry, Y., and Goldstein, B. 1999. "Depression, Drug Use and Health Services Need, Utilization and Cost." In J. Levy, R. Stephen and D. McBride (eds.). *Advances in Medical Sociology*. JAI Press, NY.

McFarland, B., Johnson, R., and Hornbrook, M. 1996. "Enrollment Duration, Service Use, and Costs of Care for Severely Mentally Ill Members of a Health Maintenance Organization." *Archives of General Psychiatry* 53: 938-944.

McLellan, A., Woody, G., Metzger, D., McKay, J., Durrell, J., Alterman, A. and O'Brien, C. 1997. "Evaluation the Effectiveness of Addiction Treatments: Reasonable Expectations, Appropriate Comparisons." In Fox, D., Egertson, J., and Leshner, A., (eds.). *Treating Drug Abusers Effectively*. Cambridge, MA. pp. 7-40.

National Institute on Drug Abuse, Strategic Plan on Reducing Health Disparities, April, 2000. http://www.nida.nih.gov/ StrategicPlan/HealthStratinfo.html.

Pallak, M., Cummings, N., Dorken, H., and Henke, C. 1994. "Medical Costs, Medicaid, and Managed Mental Health Treatment: The Hawaii Study." *Managed Care Quarterly* 2(2): 64-70.

Phelps, C. 1997. "The Demand for Medical Care: Conceptual Framework: Time Costs and Travel Costs." *Health Economics*. Addison-Wesley.

Rogers, W., Wells, K., Meredith, L., Sturm, R., and Burnam, M. 1993. "Outcomes for Adult Outpatients with Depression under Prepaid or Fee-for-Service Financing." *Archives of General Psychiatry* 50: 517-525.

Santerre, R. and Neun, S. 1996. Health Economics: Theories, Insights, and Industry Studies. Times Mirror Higher Education Group.

Schoenbaum, M., Zhang, W., and Sturm, R. 1998. "Costs and Utilization of Substance Abuse Care in a Privately Insured Population under Manage Care." *Psychiatric Services* 49(12): 1573.

Sindelar, J. and Manning, W. "Cost-Benefit and Cost-Effectiveness Analysis: Issues in the Evaluation of the Treatment of Illicit Drug Abuse." In Fox, D., Egertson, J., and Leshner, A. (eds.), Treating Drug Abusers Effectively. Cambridge, MA: Blackwell, pp. 187-222.

Smith, V. 1993. "Nonmarket Valuation of Environmental Resources: An Interpretive Appraisal. *Land Economics* 69(1): 1-26.

Smith, V. and Desvouges, W. 1986. "Measuring Water Quality Benefit." Kluwer-Nijhoff Publishing, Boston, MA.

Smith, V.; Desvouges, W., and McGivney, M. 1983. "The Opportunity Cost of Travel Time in Recreation Demand Model." *Land Economic* 54(3): 259-278.

Smith, V. and Kopp, R. 1980. "The Spatial Limits of the Travel Cost Method." *Land Economics* 56(1): 64-72.

Smith, V. and Desvouges, W. 1985. "The Generalized Travel Cost Model and Water Quality Benefits: A Reconsideration." *Southern Economic Journal* 50(2): 422-437.

Smith, V., and Kaoru, Y. 1987. "The Hedonic Travel Cost Method: A View From the Trenches." Land Economics 63(2), 179-192.

Smith, V. 1975. "Travel Cost Demand Models for Wilderness Recreation: A Problem of Non-Nested Hypotheses." Land Economics 51, 103-11.

Solano, P. L. and McDuffie, M. J. 2000. *Treatment Utilization and Resource Study*, Health Services Policy Research Group, University of Delaware, Newark Delaware.

Summerfelt, W., Foster, E., and Saunders, R. 1996. "Mental Health Services in a Children's Mental Health Managed Care Demonstration." *The Journal of Mental Health Administration* 23(1): 80-91.

Sytema, S., Giel, R., and ten Horn, G.H.M.M. 1989. "Patterns of Care in the Field of Mental Health: Conceptual Definition and Research Methods. *Acta Psychiatric Scand*. 79: 1-10.

U. S. Department of Commerce, Bureau of the Census. 2000. *Statistical Abstract of the United States, 1999*, Washington, D.C.

Welsh, R. 1980. "Regression Sensitivity Analysis and Bounded-Influenced Estimation." In: Evaluation of Econometric Models 153-167. Academic Press, NY.

Zweifel, P. and Breyer, F. 1997. "Health Economics." Oxford University Press.