Alcoholism Treatment Offset Effects

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An Insurance Perspective

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Introduction

Alcoholism treatment offset effects measure the reduction in health care costs or other social costs associated with treatment for alcoholism. Potential offset effects are important considerations in policies to expand health insurance benefits for alcoholism treatment. Health insurance benefits for alcoholism (and drug) treatment expanded rapidly during the 1980s as the number of states mandating these benefits doubled (Jensen and Morrisey, 1991). While the number of states which mandated benefits increased, research on the advantages and disadvantages of these mandates as tools for social policy remained limited (Summers, 1989). The extent to which mandates represent prudent social policy depends on several factors including their cost and potential benefits. Jensen and Morrisey (1990) provide evidence indicating that alcoholism (and drug) treatment benefits add significantly to the cost of providing insurance. Mandates to provide alcohol, drug, and mental health treatment benefits, however, may entail substantial offset effects that should be included in any assessment of the mandate (McGuire and Montgomery, 1982; Gruber, 1994).

Previous alcoholism treatment offset studies compared:

- total health care costs of treated and untreated alcoholics before and after their referrals to alcoholism treatment (Reiff, et al. 1981; Sherman, et al. 1979);
- costs before and after alcoholism treatment for the same individuals (Holder and Blose, 1986, Holder and Hallan, 1986, Reutzel, et al., 1987, Hayami and Freeborn, 1981); and
- pre-treatment and post-treatment costs of treated alcoholics and nonalcoholics (Holder and Hallan, 1986, Forsythe, et al., 1982).

Just how much costs decline with alcoholism treatment differs among studies. Most comparisons of alcoholics and nonalcoholics show alcoholics with higher costs before the initiation of treatment. Some studies have shown that with a sufficiently long follow-up period, alcoholics' costs after treatment fall to below the costs of a comparison group during the same time period (Holder and Hallan, 1986, Reutzel, et al., 1987, Reiff, et al., 1981, Hayami and Freeborn, 1981). Forsythe et al. (1982) found that total costs remain higher for the alcoholics than for the comparison group, but that alcoholics incur smaller cost increases (or larger decreases) than do nonalcoholics.

Although these studies have several limitations (Holder, 1987, Jones and Vischi, 1979), their general results have led many to conclude that total health care costs are less after alcoholism treatment than they would be without this treatment (Luckey, 1987). Some studies have failed to find treatment offsets, however, rendering equivocal the conclusion that alcoholism treatment leads to lower health care costs (Institute of Medicine, 1990). There is also an apparent inconsistency between findings suggesting lower health care costs related to alcoholism treatment and the need to mandate alcoholism treatment benefits – in short, if it is obvious that alcoholism treatment lowers treatment costs, why must society mandate (i.e. require) its availability?

The review of the literature suggests several definitions of treatment offset effects. From a societal perspective, the most relevant definition of alcoholism treatment offset effects is the difference in health care costs of treated and untreated alcoholics. Since data are not typically available for untreated alcoholics, insurers measure offset effects by reductions in total health care costs of enrollees receiving treatment compared to either their pre-treatment costs or the costs of demographically similar enrollees.

New Contribution

This study makes two major contributions to the literature. Largely due to the age of our database, the primary contribution is methodological. We illustrate cost differences between alcoholics and a demographically similar comparison group, using statistical methods that explicitly model the relationships in question. We ask specifically where treatment is used, where treatment is located, and what treatment costs.

Our method examines alcoholism treatment offset effects from an insurance carrier's long-term cost perspective in the fee-for-service setting that was common in the 1980s. If short-term alcoholism treatment reduces long-term health care costs, one might expect insurers to offer generous alcoholism coverage without being coerced to do so. Reluctance to offer such care may reflect fears of higher insurance costs due to mandated alcoholism treatment benefits without resulting cost reductions. Clearly, the existence and magnitude of any offset is critical in such a discussion.[1]

We measure offset effects by estimating alcoholics' expected medical care costs (1) prior to

alcoholism treatment (AT) initiation; (2) in a six month period coinciding with AT initiation; and (3) in an extended period after the initial AT period. We then compare these costs with a demographically similar group. The offset hypothesis will be supported if either: (1) expected total costs (treatment costs weighted by probability of treatment) by alcoholics following treatment are lower than their pre-treatment costs; (2) alcoholics' expected total medical care costs decline relative to the comparison group following treatment. Using these methods, we find that offset effects emerge for patients with alcohol abuse and without mental psychosis comorbidities.

Methods

Data Source and Study Setting

The study population consists of employees and non-Medicare retirees of a large Midwestern manufacturing firm who incurred health insurance claims between January 1980 and June 1987. Study participants had all of their health care coverage throughout the study period under a fee-for-service plan. Study participants with alcoholism treatment received at least one treatment with a primary or secondary ICD-9 diagnosis of 303 (alcohol dependence), 305.0 (alcohol abuse) or 291 (alcoholic psychoses) during the study period. All events with these diagnoses were defined as alcoholism treatment events, as distinct from other medical events.[2]

We created a comparison group of nonalcoholics consisting of individuals covered by the same health care plan who had at least one visit to a health care provider during the study period.[3] The comparison group was matched with the alcoholics by age, gender, and length of insurance coverage using a one-to-one scheme. The rationale for this scheme is explained below. These individuals did not receive an alcohol-related diagnosis at any time during the study period.

Since we focus on alcoholism treatment, we define alcoholism treatment narrowly as outpatient visits, hospital days and procedures under an alcoholism diagnosis. All other treatments are grouped together as "nonalcoholism treatment," recognizing that some treatments in this category (including mental health, drug abuse, or physical illnesses caused by alcohol) may be related to alcoholism.

Similarly, we term all of the members of the comparison group as nonalcoholics, since they

did not use alcoholism treatment. This designation begs the extent to which some of the comparison group may have had medical problems caused by alcohol use or may be alcoholics, and hence more like the experimental group than a true control group.[4] Our comparison group is not entirely representative of the general population, because comparison group members have received some medical treatment, whereas members of a random control group might not. If members of the comparison group are less healthy than the general population, comparing them to the alcoholics understates differences between the alcoholics and the general population. These differences would have been even larger if the comparison group had included some individuals who had no health care treatment. Most important to insurers, however, are the cost and utilization differences among those groups that have been identified through a claims database as being different.

The alcoholic's first alcoholism diagnosis was designated as the index AT event. A six-month period beginning with this event defined the initial alcoholism treatment period. Treatment for both groups was determined to have occurred in Period 1, 2, or 3; that is, before, during (6 months in length), or after the initial AT period. By definition, Periods 1, 2, and 3 for the comparison group were based on the initial treatment event of their alcoholic matches.[5]

Using the initiation of alcoholism treatment to organize longitudinal claims data has a distinct advantage. The organization of data into three treatment periods permits us to address different types of offsets and provides a useful description of health services use by alcoholics. Such an organization of claims data also presents some difficulties. Alcoholism treatment may be initiated at any time during the entire 78-month study window, causing the lengths of Period 1 and after Period 3 to differ among individuals. To correct for this problem, the cost analysis uses period length (for Periods 1 and 3) as a control variable in all individual level analyses.

Another problem with this data organization involves comparing alcoholics and nonalcoholics with respect to insurance. Requiring continuous insurance coverage would render sample sizes too small for reliable estimation.[6] Thus, insurance comparisons were based on total months of coverage during the study period. Under this scheme, the length of coverage for a small number of nonalcoholics became too short for valid statistical control. To address this problem, we

imposed inclusion criteria for each analysis period. Any subject who did not have at least 30 days of coverage in any of the three periods was excluded from the analysis in that period. These exclusions caused sample sizes between the groups to differ slightly in each period.

Consequently, 860 alcoholics and 808 members of the comparison group entered the alcoholism treatment period (Period 2). Both groups were almost entirely male (94.7% and 95.0%, respectively). Mean Period 2 age was almost identical for alcoholics and nonalcoholics at 37.7 and 38.8 years. The mean length of insurance coverage for Period 2 was 5.8 months (out of a maximum of 6 months) for both groups.

Period 1, before treatment initiation, consisted of the time between January 1, 1980 (or the date of first coverage if it came later) and the first alcoholism treatment diagnosis. The Period 1 sample included 851 alcoholics and 798 nonalcoholics who had at least 30 days of coverage in both Period 1 and Period 2. The length of Period 1 for alcoholics and nonalcoholics averaged 32.1 and 31.9 months, respectively.

Period 3, after the initial treatment period, consisted of the time between the end of Period 2 and the end of coverage or July 1, 1987 (whichever came sooner). A sample consisting of 777 alcoholics and 762 nonalcoholics had coverage in both Period 2 and Period 3. Mean Period 3 coverage was 34.5 months for the alcoholics and 41.0 months for the nonalcoholics.[7]

Costs and utilization were defined through inpatient and outpatient health care events. Inpatient events consisted of all services provided between and including the first and last dates of a hospital admission involving at least an overnight stay. Outpatient events included all services incurred on the same day as visits to a hospital outpatient department, emergency room, or provider's office, that did not coincide with an inpatient admission. Total charges for all of these services associated with an inpatient or an outpatient event represented the costs of that event. All costs were standardized to 1985 dollars with the Medical Care Index of the Consumer Price Index.

Analytical Framework

We suggest the following framework for analyzing costs and utilization during the study period. Total cost, *C*, is the sum of alcoholism treatment costs AL_2, and AL_3 plus nonalcoholism

treatment costs NA_1, NA_2, and NA_3 where the subscripts denote the three time periods.[8]

We compare total treatment costs with the following cost functions, where superscripts *a* refer to alcoholics and *n* to nonalcoholics:

$C^a = AL_2{}^a + AL_3{}^a + NA_1{}^a + NA_2{}^a + NA_3{}^a$ Costs for Alcoholics (1)

$C^n = NA_1{}^n + NA_2{}^n + NA_3{}^n$ Costs for Nonalcoholics (2)

Subtracting equation (2) from equation (1), the difference is:

G = *Costs for Alcoholics - Costs for Nonalcoholics* = $C^a - C^n$, or:

$G = AL_2{}^a + AL_3{}^a + S_1 + S_2 + S_3$ (3)

where S_1, S_2, and S_3 indicate <u>differences</u> in nonalcoholism treatment costs for alcoholics and nonalcoholics in Periods 1, 2, and 3, respectively.

Equation (3) guides the analyses of the alcoholism treatment cost offset hypothesis consistent with the literature. Clearly AL_2 and AL_3 (alcoholism treatment costs) contribute to higher costs for alcoholics. However, the *S* terms also help determine whether cost offsets exist. First, if S_2, or S_3 (difference in Period 2, or 3 costs) is negative, this suggests <u>lower</u> nonalcoholism treatment costs for alcoholics relative to the nonalcoholics in that period. An important test of the offset hypothesis would be confirmed if alcoholics incurred substantially lower nonalcoholism treatment costs than the nonalcoholics following alcoholism treatment. Thus, in null and alternative hypothesis forms:

<u>Hypothesis 1</u>: $S_3 = 0$ (null) against $S_3 < 0$ (alternative).

Analysts may wish instead to test the hypothesis that alcoholism treatment affects post-initiation treatment costs relative to pre-initiation treatment costs. If alcoholics' Period 3 nonalcoholism costs are less than their Period 1 costs ($NA_3{}^a < NA_1{}^a$), it can be argued that costs were offset from alcoholism treatment. Thus:

<u>Hypothesis 2</u>: $NA_3{}^a = NA_1{}^a$ (null) against $NA_3{}^a < NA_1{}^a$ (alternative).

Finally if differences in alcoholic and nonalcoholic costs decline between Period 1 and Period 3 ($S_3 < S_1$) there may be a decrease in relative (compared to what costs might have been without treatment) costs for alcoholics. Thus:

<u>Hypothesis 3</u>: $S_3 = S_1$ (null) against $S_3 < S_1$ (alternative).

We estimate an econometric model to control for differences in probability of use, treatment location, length of treatment period, and patient characteristics. This will give us two preliminary measures of cost and utilization. Table 1 will indicate the different probabilities of treatment, the different treatment locations, and the different treatment costs between alcoholics and nonalcoholics. Table 2 will decompose the nonalcoholism treatment costs into utilization (visits and days) and cost effects. Table 3 will explicitly decompose the cost difference as derived in equation (3).

Estimating Cost Offsets

We examine the cost offset hypothesis using expected total treatment costs. Expected total treatment costs are based jointly on the probability of incurring any treatment, whether treatment occurs at the inpatient or at the outpatient setting, and the costs of care at each setting (the conditional costs). Higher probability of more expensive (e.g. inpatient) treatments leads to higher expected costs. Thus, in Figure 1 (following Goodman et al., 1996) we determine:

1. Whether the subject has any treatment;
2. If the client has treatment, whether it includes some inpatient treatment, or whether it is outpatient only treatment.

(Figure 1 - Alcoholism Treatment Branches and Costs)

For Period 1, for example, we write costs C_1 as:

$$C_1 = f_1 D_1 + (1-f_1) E_1 \qquad (4)$$

where (suppressing time subscripts) f refers to probability of receiving only outpatient treatment, $(1-f)$ to probability of some inpatient treatment, D to costs if only outpatient treatment is used, and E to costs if some inpatient treatment is used. Values of D and E are conditional on being in either the outpatient or inpatient branch of treatment. Similar expressions obtain for Periods 2 and 3.

The model also defines expected outpatient and inpatient costs as the probability of inpatient (or outpatient) treatment multiplied by the costs (of inpatient or outpatient treatment). Cost differences between alcoholics and nonalcoholics are related to the probabilities of the different types of care, multiplied by the costs if treated.

We prefaced the discussion above by making costs conditional on treatment initiation. Not

all subjects incur costs in all periods. Thus, the expenditures of those who do use services in a given period may provide misleading estimates of total expenditures for an entire sample (which includes those who were not treated). We calculate expected total costs which equals the probability of treatment multiplied by the cost in each period, or:

$$C = h_1 C_1 + h_2 C_2 + h_3 C_3 \quad (5)$$

where h_1, h_2, and h_3 are probabilities of any treatment in each period.[9]

We derive expected total costs for both alcoholics and nonalcoholics in each of the three periods relative to the initiation of alcoholism treatment. Expected costs obtained through multiple regression analyses for alcoholics in Period 2 and Period 3 have been described elsewhere (Goodman et al., 1992a; Goodman et al., 1996). The method involves estimating probabilities and conditional costs in multivariate probit and linear regression models controlling for demographic characteristics, insurance, and comorbidities. The probabilities are estimated with probit functions:

$$f = g_0 + g_M M + g_T T + g_S S + g_F F + u_1 \quad (6a)$$

$$h = b_0 + b_M M + b_T T + b_S S + b_F F + u_2. \quad (6b)$$

$f = 1$ if and only if outpatient care is used, with $f = 0$ otherwise; $h = 1$ if and only if any care is used, with $h = 0$ otherwise. Variables M refer to individual-specific morbidity and comorbidity factors; T to chronological time; S to individual sociodemographic factors such as gender or age, and F to employer factors such as geographic location.

Conditional on usage, we then estimate both inpatient and outpatient cost regressions, measured in the natural logarithm of dollars (following Newhouse et al., 1993):

$$\ln D = f_0 + f_i I + f_o O + f_{ii} I^2 + f_{oo} O^2 + f_{io} IO + f_M M + f_T T + f_S S + f_F F + e_I. \quad (7a)$$

$$\ln E = d_0 + d_i I + d_o O + d_{ii} I^2 + d_{oo} O^2 + d_{io} IO + d_M M + d_T T + d_S S + d_F F + e_O. \quad (7b)$$

In addition to the previous categories, variable O refers to number of outpatient visits, and I refers to inpatient utilization (characterized by both numbers of days and number of stays).

It is important to emphasize the 2 major categories of variable set M. The first is simply the diagnosis of alcohol dependence as opposed to alcohol abuse. If dependence and abuse refer to

substantively different illnesses, then they may be significantly related to treatment costs. The second category refers to mental health and drug comorbidities such as psychoses, non-psychoses, or drug disorders (abuse or dependence). Comorbidities may have substantive effects on costs if they reflect severity of the conditions or the presence of multiple conditions.

In the probability regressions, parameters g and b predict the variable impacts on probability of inpatient use and probability of any use respectively. In the cost functions, parameters f and d indicate the impacts of cost determinants. Coefficients such as f_{io} indicate interactions among types of visits. Coefficients such as f_{ii} capture nonlinear impacts of inpatient I or outpatient O events. Parameters $f_{M,}$ $f_{T,}$ $f_{S,}$ and $f_{F,}$ (and similarly for $d_{M,}$ $d_{T,}$ $d_{S,}$ and d_F) represent the impacts of variables M, T, S, and F; e_I and e_O are error terms.

Expected nonalcoholism treatment costs for alcoholics in any given period result from inpatient probability f, any care h, and 3 cost regressions. The expected costs for nonalcoholics come from 5 similar equations. We establish from the c^2 and from the covariance tests that the underlying equations are different between the alcoholics and the nonalcoholics. This is a necessary condition for expected values to differ (they could not differ if the underlying regressions were the same), but it is not sufficient because there may be covariance among the equations. Moreover, the appropriate confidence intervals are also related to sample means and variances at which costs are evaluated. Deriving analytically meaningful confidence intervals, given the complexity of the expressions, is not analytically tractable.

The linear regression models for conditional costs are log transformed because of the skewness in the distribution of health expenditures. Results are reported on retransformed expenditures accounting for differences in probability of inpatient use, and other treatment branches. We have not included the underlying regression models because of space limitations.[10]

Differences in expected nonalcoholism cost form the basis for evaluating potential offset effects. These differences can also be decomposed into utilization (greater use) or cost effects (more expensive services). By definition total costs multiply average costs AC by utilization U, measured in days or visits:

$C^a = AC^a\ U^a$, and $C^n = AC^n\ U^n$. (8)

Difference *H* can be written as:

$H = C^a - C^n$

$= AC^* \times (U^a - U^n) + U^* \times (AC^a - AC^n)$,

$=$ *Utilization Effect + Cost Effect* (9)

AC^* and U^* are evaluated at mean levels of average costs and utilization.[11] Utilization effects are positive (negative) if alcoholics use more (less) care than nonalcoholics. Cost effects are positive (negative) if alcoholics' costs per unit utilization are higher (lower).

We will present our results in three parts. Table 1 will provide calculated probabilities of usage, costs conditional on usage, and the product, or expected costs, from the underlying regression analyses. Table 2 will decompose the conditional costs into utilization (days and visits), as well as costs per day or per visit for the alcoholics and the members of the comparison sample. Table 3 will explicitly test the three offset hypotheses.

Results

Table 1 (derived from equations 4 through 7) presents the regression-based differences in treatment probabilities and costs for nonalcoholism treatments by alcoholics and nonalcoholics in the three treatment periods (before, during, and after the initiation of alcoholism treatment). These analyses form the basis for all of the hypothesis tests. All costs are standardized in 1985 dollars with respect to date, age of subject, and length of treatment period.[12]

(Table 1 - Conditional Probabilities, Conditional Costs, and Expected Costs)

Alcoholics had much higher nonalcoholism treatment probabilities (ratios exceeding 1.0) than nonalcoholics. In both Periods 1 and 3 (line 1), alcoholics were approximately 30% more likely to receive nonalcoholism treatments than nonalcoholics. In Period 2 (treatment initiation), alcoholics' probability was 70% higher.[13] Conditional on use of some nonalcoholism treatment, alcoholics were also much more likely to receive inpatient treatment in each of the periods. Differences in probabilities for inpatient treatments ranged from 70% to 132% across the three periods.

Lines 3 through 5 report the costs that are conditional on treatment at specific locations. In

Line 5, for example, those nonalcoholics who received Period 1 inpatient treatment incurred mean standardized costs of $2,464 compared to alcoholics who incurred costs of $4,803. In Period 3, the nonalcoholics had higher conditional inpatient costs ($7,969 *v.* $6,071), suggesting hospitalization for more severe conditions and higher daily costs – the severity interpretation is supported by the fact that the mean number of days for nonalcoholics was 2.20 days less than for alcoholics. Some may interpret the differences in conditional inpatient costs in Period 3 as evidence of treatment offset effects. However, these figures ignore the 30% higher probability of alcoholics' incurring any treatment in Period 3 and their 88% higher probability of incurring inpatient treatment.

Lines 6 though 9 provide expected nonalcoholism treatment costs that reflect the differences in treatment probabilities. When treatment costs are weighted by treatment probabilities, the difference in Period 3 costs between alcoholics and nonalcoholics disappear. For example, the nonalcoholics (probability of 0.21) were only 53.2% as likely as the alcoholics (probability of 0.39) to incur inpatient charges. Hence, expected inpatient charges for nonalcoholics, given treatment, were 0.21 * $7,969, or $1,649. This compares to the expected inpatient charges of $2,364, or 0.39 * $6,071 for alcoholics. Adjusting for probability of any treatment leads to higher expected Period 3 nonalcoholism costs for alcoholics ($2,963) than for nonalcoholics ($1,606). In summary, expected total nonalcoholism costs were higher for nonalcoholics than for alcoholics before, during, and after the initiation of alcoholism treatment by 314%, 264%, and 85% respectively.

(Table 2 - Decomposition of Conditional Cost Differences for Nonalcoholism treatment)

Table 2 (derived from equations 8 and 9) decomposes nonalcoholism conditional (for those with treatment) costs reported in Table 1 into cost and utilization effects for alcoholics and non-alcoholics. For example, Period 1 outpatient-only treatment costs for alcoholics were $456 compared to $235 for nonalcoholics. Alcoholics had more than twice as many visits (10.2 v. 4.9), although the visits were slightly less expensive ($45 v. $48). Decomposition of the $221 cost difference indicates that if the costs per visit were equal for the two groups, the alcoholics would spend $243 more because of higher utilization (they had more visits). With equal utilization rates, the cost effect indicates that alcoholics would have spent $22 less, due to the lower costs per treatment.

Consider the patterns across the three types of care and the three periods. The cost effects are mixed. In 4 of 6 outpatient cases the alcoholics have higher costs per visit (positive cost effects). In contrast, cost effects were negative for all inpatient cases, due to higher inpatient costs per day by nonalcoholics in all three periods. In Period 1, nonalcoholics' costs would have been $108 higher if the nonalcoholics had been hospitalized for the same number of days. The cost effects are even greater in Periods 2 and 3.

As noted in Table 2, the utilization effects are positive in all 9 cases; alcoholics used more nonalcoholism services, outpatient or inpatient. A binomial sign test rejects the hypothesis that all 9 differences equal zero. This consistent effect suggests that the expenditure differences are driven by higher usage by the alcoholics, rather than by higher costs per event, given usage.[14]

(Table 3 - Calculation of Difference in Expected Costs for Alcoholics and Nonalcoholics)

We return to the hypotheses regarding expected cost differences. Given the complexity of the analyses, it is important to clarify how the underlying costs and cost differences are calculated:

1. Costs are predicted using the regression analyses described in equations (4) through (7). The equations are then adjusted to hold subject age, date of initial alcoholism treatment, and period length constant. It is as if all alcoholics and their matches were the same age, started treatment at the same time, and had the same Periods 1, 2, and 3.
2. We created four scenarios relating to alcoholism treatment (dependence v. abuse) and mental psychosis comorbidities (defined by ICD-9 codes 290, 293-299). In Period 2, 17.2% of the alcoholics were treated for alcohol abuse, with the remainder treated for alcohol dependence; 14.3% presented mental psychosis comorbidities. Period 2 comorbidities provided the most complete descriptions of the sample and comparison groups, as many members of both groups used no Period 1 or Period 3 care.[15]

		Alcoholism Condition	
		Abuse	Dependence
Mental Psychosis Comorbidity	NO	abuse-no comorbidity Table 3.a	dependence-no comorbidity Table 3.c
	YES	abuse-comorbidity Table 3.b	dependence-comorbidity Table 3.d

The comparison group was also classified according to the presence or absence of a mental psychosis. While comparison group members had no reported alcoholism treatment, 1.0% of the group (and 3.1% of those undergoing outpatient care) did exhibit mental psychosis comorbidities. Since comorbidities are included as binary (0, 1) explanatory variables, all comorbidities other than mental psychoses are controlled by inserting zero values in the appropriate regressions.

Not unexpectedly, alcohol abuse treatment is less costly than alcohol dependence treatment. Mental psychosis comorbidities raise the costs of alcoholism treatment, as well as the costs accruing to those who did not have alcoholism treatment. Hence abuse-no comorbidity is the least expensive treatment for the alcoholics, and dependence-comorbidity is the most expensive.

We return to the three hypotheses stated at the outset. Consider abuse-no comorbidity, the most moderate condition (Table 3.a). Hypothesis 1 compares Period 3 nonalcoholism treatment for alcoholics to Period 3 nonalcoholism treatment cost for the comparison group. The $8 per month difference (meaning higher costs for the alcoholism treatment group) is almost certainly insignificant. A similar monthly difference calculation for those with dependence-no comorbidity (Table 3.c) yields a $17 per month difference. These estimates suggest that subsequent to alcoholism treatment initiation, in the absence of a mental psychosis comorbidity, nonalcoholism treatment costs for those with either alcohol abuse or alcohol dependence treatment fall to about the same level as comparison group (also without mental psychosis) treatment costs.

This analysis also addresses the key role of comorbidities. Comparing costs for alcoholics with mental psychosis comorbidities to members of the comparison sample with the same comorbidities yields a $40 (abuse-comorbidity – Table 3.b) or $61 (dependence-comorbidity – Table 3.d)

per month difference, with alcoholics having higher costs. The substantial differences suggest an interaction between the two conditions that leads to higher costs.

In evaluating Hypothesis 1 (that difference S_3 in Period 3 nonalcoholism treatment costs for alcoholics and nonalcoholics is negative, indicating an offset) respectively for conditions without mental psychosis comorbidities, the differences are small, but always positive (alcoholics have higher costs). Conditions with mental psychosis comorbidities present larger differences. One cannot reject the hypothesis that S_3 equals 0 for those without psychiatric comorbidities, and for those with psychiatric comorbidities one must conclude that S_3 exceeds 0. The Hypothesis 1 requirement (to support offsets) that S_3 be negative, is not fulfilled.

Hypothesis 2 evaluates the "pre-post" comparison of total (alcoholism plus nonalcoholism) treatment costs. Here, the substantive difference is between alcohol abuse and alcohol dependence. For those treated for abuse-no comorbidity (3.a), monthly costs fell by $9; for abuse-comorbidity (3.b), they fell by $29. In contrast, alcohol dependence pre-post costs increased by $14 for dependence-no comorbidity (3.c), and by $17 for dependence-comorbidity (3.d). Thus Hypothesis 2 confirms an offset effect for alcohol abuse, but not for alcohol dependence.

Hypothesis 3 examines whether alcoholics' post-initiation costs decline relative to preinitiation costs. Again we see a difference between alcohol abuse and alcohol dependence. For abuse-no comorbidity, the $9 monthly treatment cost decrease, combined with a $15 increase for comparison nonalcoholics, implied a $24 decrease in the difference (3.a). For abuse-comorbidity the difference fell by $37 (3.b). For alcohol dependence, total treatment costs fell by less than $2 per month for dependence-no comorbidity (3.c), and rose by almost $10 for dependence-comorbidity (3.d). Like Hypothesis 2, this finding suggests an offset effect for alcohol abuse, but not alcohol dependence.

Discussion

We have compared the total costs of alcoholism and nonalcoholism treatments between a sample of alcoholics and a comparison group who received no alcoholism treatment during the data collection period. We standardized treatment costs with regression analyses and then decomposed the cost differences into the alcoholism treatment costs, incurred only by the alcoholics, and the

differential nonalcoholism treatment costs, incurred by both alcoholics and nonalcoholics. We also controlled for mental psychosis comorbidities, which are otherwise likely to confound analyses.

There are three major findings. First, alcoholics are more likely to incur any type of nonalcoholism treatment than the comparison group. They are also more likely to incur the more costly inpatient treatments. Higher expected costs for alcoholics stem from: (1) higher probability of any treatment; (2) higher probability of inpatient treatment, which is more expensive than outpatient treatment; and (3) in most cases, more costly care when treated.

Expected costs, or the conditional treatment costs multiplied by the treatment probability, reflect the financial burden facing insurers when comparing treatment costs of those identified as either alcoholics or nonalcoholics. Looking simply at the costs of those treated (conditional costs) does not account for higher probability of any treatment, and the higher probability of inpatient treatment, both of which suggest higher costs for alcoholics.

Second, both higher utilization and higher costs contribute to the higher nonalcoholism costs for alcoholics. If hospitalized, alcoholics are hospitalized for longer periods of time. Alcoholics with outpatient care have more visits.

These results are consistent with patterns reported in the Eighth Report on Alcohol and Health (1994, Chapter 8), which discusses the adverse impacts of alcoholism on the liver, cardio-vascular system, and immune system, endocrine system, and reproductive function. Alcoholism can inflict major damage on the liver, and can weaken other systems, making them more susceptible to damage. It would be surprising for a short term intervention (alcoholism treatment initiation), particularly for the more serious condition of alcohol dependence, to reverse physical problems that stem from impacts of generally longer term alcoholism.

Third, controlling for treatment probability, treatment location, and psychiatric comor-bidities, alcoholics have higher nonalcoholism costs than nonalcoholics before, during, and after the initial alcoholism treatment period. The differences, however, decrease between Period 1 (before treatment initiation) and Period 3 (after initiation). There are substantial decreases for those treated for alcohol abuse. The decreases are only modest for those who are treated for alcohol dependence.

Our findings are partially supported by researchers using other study designs. Finney and Moos (1991) found rates of hospitalization two to four times higher for remitted and relapsed alcoholics compared to nonproblem drinking community controls at 10-year follow-up. Manning et al. (1991) also found increased rates of hospitalizations related to drinking. Results on outpatient visits, however, were mixed.

Finally, our findings correspond with Jensen and Morrisey (1990) showing increased insurance costs associated with providing alcoholism (and drug) benefits. If providing these services substantially lowered total medical costs, one would expect little change in insurance costs from offering these benefits. This has not occurred, and it is consistent with an interpretation that insurers compare the total costs of treating particular groups, rather than evaluating the incremental costs, or the relative improvements accruing to different types of treatment.

Examining cost and offset effects from the perspective of the insurer provides insight on the mandates for substance abuse treatment. It also highlights the limitations of this perspective. If substantial offsets could be gained, there would be little need to mandate benefits. Our data on alcoholism treatment costs and the costs associated with other health services use, indicate higher costs for alcoholics than those who are not identified as alcoholics. Providing treatment benefits for alcoholism increases the cost to the insurer with little evidence of cost offsets.

Faced with high alcoholism and substance abuse treatment expenditures, insurers sought cost reductions in the form of carve-outs for behavioral services, and it is estimated that over 100 million people are covered under behavioral carve-outs with savings in the range of 40-60% (Ma and McGuire, 1998). However, these specialty carve-outs may achieve savings by shifting costs from providers and locations in mental health and substance abuse (MH/SA) settings to providers in the medical (i.e. non MH/SA) area. If so, one might not see, nor expect to see, cost offsets accompanying carve-out arrangements.

Limitations

There are numerous limitations to our study. We examine a group of largely male employees on a fee-for-service plan with quite comprehensive fee-for-service (FFS) coverage. They

cannot necessarily be generalized to the United States population. We were limited (in both groups) to those receiving treatment during a particular (seven-year) time period, thus biasing estimates of medical care costs. Those using services outside of the plan and those not seeking medical care were not included. Treatment costs could not be compared against a sample of untreated alcoholics nor could past alcoholism or developing alcoholism be measured. Finally, we define initial treatment based on claims reported during the study period; this may not reflect the first treatment ever.

The lack of data on the true prevalence of illness among employees in the nonuser group prevents our comparing the health of nonusers to our comparison group of users. Since the comparison group used care for prevention or treatment of illness, it is likely that comparing them to alcoholics understates the differences between the alcoholics and the general population.

A further limitation involves the inability of the database to describe the nature of treatment (detoxification or assessment, for example, as opposed to rehabilitation). We acknowledge the perils of using diagnostic codes as proxies for treatment.

We are also unable to differentiate successful from unsuccessful treatment. Outcome data could be important, since unsuccessfully treated alcoholics would probably continue to have higher costs, thus reducing any offset effect. In fact, the offset effect is often claimed for a wide range of alcoholism, drug, or mental health treatments for which success is very difficult to measure.[16] Even if one could control for outcome in offset models, however, predicating offset effects on treatment success assumes that offsets apply only for those patients for whom treatment is successful.

Finally, the database covered the years 1980 through 1987. The health care delivery system has changed since the early to mid-1980s, and the once common 28-day hospital programs are now rare. Nonetheless, even in the current managed care environment, costs are still related to probability of treatment, to treatment location, and to costs at the treatment location. Perhaps most importantly, our method can be applied to cost analyses in managed care systems. Moreover, to the extent that substance abuse treatment is less stigmatizing now than in the past, patients may enter treatment for precisely those alcohol abuse conditions that are most susceptible to offset possibil-

ities. Future studies might apply our method to examine nonalcoholism treatment costs with and without behavioral carve-outs to determine whether treatment costs have been shifted.

Conclusions

We have shown that even if alcoholics have lower costs for certain nonalcoholism treatments, they may have higher expected costs than nonalcoholics because of their increased probability of treatment. Thus inpatient and outpatient costs which are conditional on having the treatment provide incomplete information when comparing the costs of alcoholics and nonalcoholics. More relevant, particularly to insurers, is the unconditional (expected) set of costs, the probability of having the treatment multiplied by the costs if treated.

We evaluate three treatment offset hypotheses. We find that offset effects emerge for those treated for alcohol abuse (rather than alcohol dependence) in the absence of mental psychosis comorbidities. Failure to control for the comorbidities confounds the analyses by combining a higher treatment cost group (those with the comorbidities) with a lower cost group.

We interpret our findings in the context of insurers' decisions, and we suggest that insurers who offered traditional FFS coverage may not have offered alcoholism treatment due to the limited extent of offset effects. Although this might have been the case during the time covered by our data, such decisions may have changed under managed care, where annual disenrollment rates of 20 percent or higher are not unusual. Disenrollment can be voluntary due to switching among available plans, but it is more commonly mandated due to termination, layoff, retirement, or changes in available plans or employee status. This may affect the importance that employers and their insurers may attribute to treatments with potentially long term impacts.

By integrating insurance with the provision of health care, the managed care plans receive a fixed payment per enrollee to cover costs in the current period, and over time, for those who remain enrolled. Thus, unlike FFS care, where payment in every period is very likely to cover costs, a managed care organization must consider the timing of expenditures and the financial losses of overspending on patients who may disenroll. One way to "self-insure" against long term losses

attributable to disenrollment is to economize on care for those currently enrolled, particularly care with long term, rather than short term, results.[17]

Our results hold under either interpretation. We show that alcoholics use more health services before, during, and after treatment initiation than a comparison group. This information is useful both to evaluate state mandates to provide alcoholism treatment benefits in group insurance plans, and to address emerging patterns of treatment under managed care. It may be best to justify alcoholism treatment because it improves the health of those treated, even at higher costs. Mandated coverage for alcoholism treatment may provide additional social benefits (reduced drinking-related auto accidents, crime, and property damage) which may exceed treatment costs, but policy-makers must find ways to allow insurers (particularly in the face of potential disenrollment) to internalize these benefits into potential profits.

References

Finney, J.W., and R.H. Moos. 1991. "The Long-Term Course of Treated Alcoholism: I. Mortality, Relapse and Remission Rates and Comparisons with Community Controls." Journal of Studies on Alcohol 52 (1): 44-54.

Forsythe, A.B., B. Griffiths, and S. Reiff. 1982. "Comparison of Utilization of Medical Services by Alcoholics and Non-alcoholics." AJPH 72 (6): 600-602.

Goodman, A.C. 1989. "Estimation of Offset and Income Effects on the Demand for Mental Health." Inquiry 26 (2): 235-248.

Goodman, A.C., H.D. Holder, and E. Nishiura. 1991. "Alcoholism Treatment Offset Effects: A Cost Model." Inquiry 28 (2): 168-178.

Goodman, A.C., H.D. Holder, E. Nishiura, and J.R. Hankin. 1992a. "An Analysis of Short Term Alcoholism Treatment Cost Functions." Medical Care 30 (9): 795-810.

Goodman, A.C., H.D. Holder, E. Nishiura, and J.R. Hankin. 1992b. "A Discrete Choice Model of Alcoholism Treatment Location." Medical Care 30 (12): 1097-1110.

Goodman, A.C., E. Nishiura, J.R Hankin,. H.D. Holder, and J.M. Tilford. 1996. "Long Term Alcoholism Treatment Costs." Medical Care Research and Review 53 (4):441-464.

Goodman, A.C., E. Nishiura, and J.R. Hankin. 1998. "A Discrete Choice Model of Drug Abuse Treatment Location." Health Services Research 33 (1): 125-145.

Goodman, A.C., and M. Stano. 1999. "HMOs and Health Externalities: A Local Public Good Perspective." Manuscript. Wayne State University.

Gruber, J. 1994. "The Incidence of Mandated Maternity Benefits." American Economic Review 84 (3): 622-641.

Hayami, D.E., and D.K. Freeborn. 1981. "Effect of Coverage on Use of an HMO Alcoholism Treatment Program, Outcome, and Medical Care Utilization." AJPH 71 (10): 1133-1143.

Holder, H.D. 1987. "Alcoholism Treatment and Potential Health Care Cost Saving." Medical Care 25 (1): 52-71.

Holder, H.D., and J.O. Blose. 1986. "Alcoholism Treatment and Total Health Care Utilization and Costs: A Four-Year Longitudinal Analysis of Federal Employees." JAMA 256 (11): 1456-1460.

Holder, H.D., and J.B. Hallan. 1986. "Impact of Alcoholism Treatment on Total Health Care Costs: A Six-year Study." Advances in Alcohol and Substance Abuse 6 (1): 1- 15

Holder, H.D., and R.H. Shachtman. 1987. "Estimating Health Care Savings Associated with Alcoholism Treatment." Alcohol Clinical and Experimental Research 11 (1): 66-73.

Institute of Medicine. 1990. "Cost Effectiveness." In: Broadening the Base of the Treatment for Alcohol Problems. Washington, D.C.: National Academy Press.

Jensen, G.A., and M.A. Morrisey. 1990. "Group Health Insurance: A Hedonic Price Approach." The Review of Economics and Statistics 72 (1): 38-44.

Jensen, G.A., and M.A.. Morrisey. 1991. "Employer-Sponsored Insurance Coverage for Alcohol and Drug Abuse Treatment, 1988." Inquiry 28 (4): 393-402.

Jones, K.R., and T.R. Vischi. 1979. "Impact of Alcohol, Drug Abuse, and Mental Health Treatment on Medical Care Utilization: A Review of the Literature." Medical Care 17 (12 Supplement 2): 1-82.

Luckey, J.W. 1987. "Justifying Alcohol Treatment on the Basis of Cost Savings: The 'Offset' Literature." Alcohol Health and Research World 12 (1): 8-15.

Ma, C.A., and T.G. McGuire. 1998. "Costs and Incentives in a Behavioral Health Carve-Out." Health Affairs 17(2): 53-69.

Manning, W.G., J.P. Newhouse, N. Duan, E. Keeler, B. Benjamin, A. Leibowitz, M.S. Marquis, J. Zwanziger. 1988. Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment. Publ. No. R-3225-HHS, Santa Monica: Rand Corporation.

Manning, W.G., E.B. Keeler, J.P. Newhouse, E.M. Sloss, and J. Wasserman. 1991. The Cost of Poor Health Habits. Cambridge: Harvard University Press.

McGuire, T.G., and J.T. Montgomery. 1982. "Mandated Mental Health Benefits in Private Health Insurance." Journal of Health Politics, Policy and Law 7 (2): 380-406.

Newhouse J.P. and the Insurance Experiment Group. 1993. Free for All: Lessons from the Rand Health Insurance Experiment. Cambridge, MA: Harvard University Press.

Reiff, S., B. Griffiths, and A.B. Forsythe. 1981. "Utilization of Medical Services by Alcoholics Participating in a Health Maintenance Organization Outpatient Treatment Program: Three-year Follow-Up." Alcohol: Clinical and Experimental Research 5 (4): 559-562.

Reutzel, T.J., F.W. Becker, and B.K. Sanders. 1987. "Expenditure Effects of Change in Medicaid Benefit Coverage: An Alcohol and Substance Abuse Example." AJPH 77 (4): 503-504.

Room, R. 1991. "The U.S. General Population's Experiences with Responses to Alcohol Problems." in Clark, W.B. and M.E. Hilton, Eds. Alcohol in America. Albany: State University of New York Press: 173-193.

Sherman, R.M., S. Reiff, and A.B. Forsythe. 1979. "Utilization of Medical Services by Alcoholics Participating in an Out-Patient Treatment Program." Alcohol: Clinical and Experimental Research 3 (2): 115-120.

Summers, L.H. 1989. "Some Simple Economics of Mandated Benefits." American Economic Review Papers and Proceedings 79 (2): 177-183.

U.S. Department of Health and Human Services. 1994. Eighth Special Report to the U.S. Congress on Alcohol and Health. Washington DC: Chapter 8.

U.S. Department of Health and Human Services. 1997. Ninth Special Report to the U.S. Congress on Alcohol and Health. Washington DC: Chapters 1, 9, 10.

U.S. Department of Health and Human Services. 1999. "Brief Intervention for Alcohol Problems." Alcohol Alert 43. Rockville, MD.

Wells, K.B., and R. Sturm. 1995. "Care for Depression in a Changing Environment." Health Affairs 14 (3): 78-89.

Abstract

Alcoholism Treatment Offset Effects:

An Insurance Perspective

We investigate whether alcoholism treatment costs are offset by reductions in other medical treatment costs by comparing people treated for alcoholism with a matched comparison group. The alcoholism treatment group is defined by diagnoses of alcohol dependence, abuse, or psychoses from health insurance claims filed between January 1980 and June 1987. A comparison sample was matched on age, gender, and insurance coverage. In this primarily methodological study, expected costs for nonalcoholism treatments were calculated from standardized regressions. Offset effects were measured from the insurer's perspective through differences in expected total nonalcoholism treatment costs in the periods preceding and following alcoholism treatment. Members of the alcoholism treatment group were more likely (than the comparison group) to be hospitalized and to need other (nonalcoholism) medical treatment, thus incurring higher total costs. Offset effects emerged for patients with alcohol abuse and without mental psychosis comorbidities.

Notes

1. It might be argued that insurers' goals are short-term because the enrolled individual may not remain with the plan long enough for any long-term benefits to accrue. Reasons for short-term goals might include a degree of plan switching by employees who remain with a single employer, plan switching by employees who change jobs, and changing of insurers by employers. If this is the case, many treatments with long-term impacts, as well as various forms of well care may be underprovided. We address this issue in more detail in the Conclusions section.

2. It is difficult to determine the true "primary" diagnosis from claims data because alcoholism problems are often treated simultaneously with other conditions. Limiting analysis to primary diagnoses may miss some cases, although secondary diagnoses may overestimate the extent of alcoholism treatment. One must also use caution with diagnostic codes to proxy for treatment. Alcohol detoxification and assessment, for example, may not constitute rehabilitation services and may not be expected to contribute to an offset effect. It may be impossible to differentiate treatment for alcoholism itself from services provided to treat problems associated with alcoholism using claims data.

3. The database was derived from claims paid rather than all covered lives during the study.

4. Chapter 1 of the Ninth Report indicates that approximately 7.4% of the U.S. population could be classified as having alcohol abuse and/or alcohol dependence in the past year. Calculations from Chapters 9 and 10 suggest that no more than 1.7% were in treatment in a given year. This agrees with Room (1991) who reports a 1.3% rate of current treatment, and a 3.4% rate of lifetime treatment. They suggest that at any time between 4 to 6% of an untreated population may suffer from alcohol abuse and/or alcohol dependence.

5. A reviewer has suggested the possibility of using the concept of treatment engagement, which examines a specified number of events within a specified timeframe (e.g., three or more visits

within one month of an initial diagnosis). Although this is a thoughtful alternative perspective, it is simply beyond our means to reformat and reanalyze our database in this manner. We note that a recent Alcohol Alert (1999) summarizes the results of brief intervention therapy (which may involve only one session). While this treatment is being promoted now and is particularly important in the current managed care era, it is not yet widely being performed in primary care, and was probably even less likely during the time period of our study.

6. Requiring continuous insurance coverage throughout the study may not be desirable since it could exclude people whose alcoholic conditions cause them to lose their jobs. This sample attrition would bias estimates of health care costs downwards.

7. Truncation bias may occur if treatment continues past the data collection period. Using the same database, Goodman et al. (1996) estimate truncation adjustments and find mean Period 3 outpatient period length to increase by 20.3%, and mean Period 3 inpatient treatment period length to increase by 21.1%. Adjusting period lengths does not help here, since we cannot predict level of usage outside the period observed. Further, since both alcoholics and nonalcoholics are subject to truncation biases, our differencing of the two cost aggregates alleviates the truncation problem.

8. This analysis may refer to all costs, including treatment charges, transportation costs, foregone wages and salaries, and/or foregone productivity. The exposition and forthcoming analysis refer to treatment costs only. Goodman (1989) proposes a similar model for mental health care.

9. Substituting equation (4) for each period into equation (5) yields:

$$C = h_1 [f_1 D_1 + (1-f_1) E_1] + h_2 [f_2 D_2 + (1-f_2) E_2] + h_3 [f_3 D_3 + (1-f_3) E_3]$$

All *h*, *f*, *D*, and *E* equations are estimated econometrically.

10. Reporting regression estimates for nonalcoholics in Period 1 alone requires 5 regressions (probability of use, probability of inpatient use, outpatient expenditures in the outpatient branch, outpatient expenditures in the inpatient branch, and inpatient expenditures).

11. The standard difference expansion would involve differentials evaluated at the original cost and utilization levels, yielding a product of differences that is not easily interpreted since the impacts depend on which group (alcoholics or nonalcoholics) is used as the base. Evaluating the difference at means provides an easily interpreted measure that is invariant to the base. For further discussion, see Goodman, Nishiura, and Hankin (1998).

12. The full set of underlying cost regressions is available from the senior author.

13. To the extent that the comparison group contains untreated alcoholics, and the extent that non-alcoholics are more likely to have treatment, the true differences between groups are understated.

14. This binomial sign test follows Manning et al. (1988).

15. The database also contained four other comorbidity categories for the alcoholics:

drug abuse or drug dependence (ICD-9 codes of 292, 304, 305.1-305.9) – 11.6%;

nonpsychotic mental disorders (300-302, 306-319) – 25.0%;

liver disorders (570) – 2.9%;

other alcohol-related disorders (265.2, 357.5, 425.5, 535.3, and 572.3) – 1.3%.

16. Wells and Sturm (1995) revisit the problems of finding and measuring offset effects in the context of mental health treatment.

17. Goodman and Stano (1999) provide a detailed model that considers such plan switching and disenrollment.

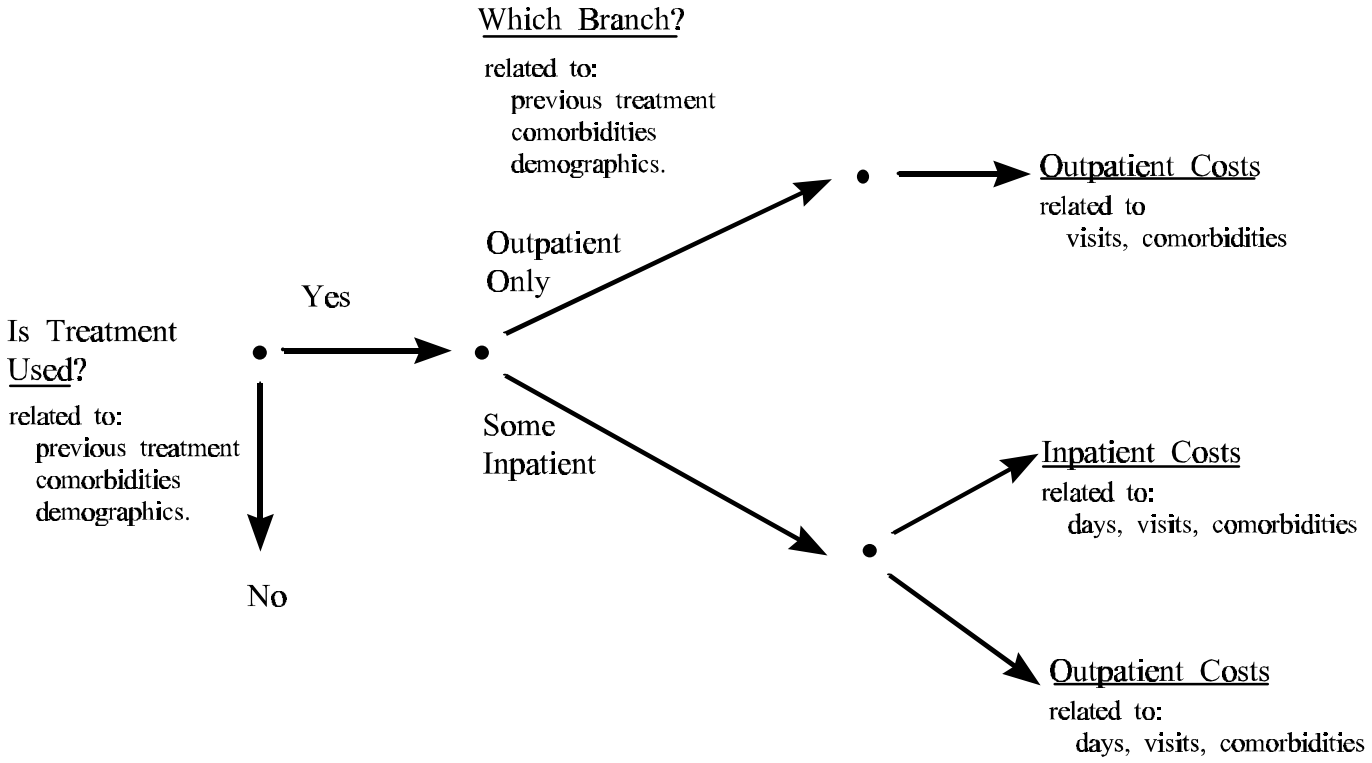

Figure 1: Alcohol Treatment Branches and Costs

Table 1 - Differences in Conditional Probabilities, Conditional Costs, and Expected Costs of Nonalcohol Treatment

	Period 1			Period 2			Period 3		
	Alcs	Nonalcs	Ratio	Alcs	Nonalcs	Ratio	Alcs	Nonalcs	Ratio
CONDITIONAL PROBABILITIES									
1. Probability of treatment	0.94	0.71	1.32	0.61	0.36	1.70	0.92	0.71	1.30
2. Probability of IP treatment given any treatment	0.45	0.26	1.72	0.23	0.10	2.32	0.39	0.21	1.88
CONDITIONAL COSTS (in $)									
3. Cost of OP treatment if OP-only treatment	456	235	1.94	185	146	1.27	470	328	1.43
4. Cost of OP treatment if some IP treatment	688	196	3.52	260	83	3.14	1458	1735	0.84
5. Cost of IP treatment	4804	2464	1.95	2673	2422	1.10	6071	7970	0.76
EXPECTED COSTS (in $)									
6. Expected OP costs	561	224	2.50	202	140	1.45	855	619	1.38
7. Expected IP costs	2179	650	3.35	608	237	2.56	2364	1649	1.43
8. Expected total costs, given treatment	2740	875	3.13	810	377	2.15	3219	2269	1.42
9. Expected total costs for period	2581	624	4.14	495	136	3.64	2964	1606	1.85

Ratio greater (less) than 1.0 indicates larger value for alcoholics (nonalcoholics).

Table 2 - Decomposition of Conditional Cost Differences for Nonalcohol Treatment

	Period 1		Period 2		Period 3	
	Nonalcs	Alcs	Nonalcs	Alcs	Nonalcs	Alcs
OUTPATIENT ONLY						
Costs	235	456	146	185	328	470
Visits	4.9	10.2	3.7	4.6	9.5	11.1
Average Cost per visit	48	45	40	41	34	42
Difference	221		39		142	
Utilization Effect	243		35		60	
Cost Effect	-22		4		81	
OUTPATIENT-SOME IP						
Costs	196	688	83	260	1735	1458
Visits	12.8	19.4	3.7	4.9	21.6	22.1
Average Cost per visit	15	35	22	54	80	66
Difference	492		177		-277	
Utilization Effect	166		44		37	
Cost Effect	326		133		-314	
INPATIENT-SOME IP						
Costs	2464	4804	2422	2673	7970	6071
Days	9.5	19.1	5.5	9.3	17.6	19.8
Average Cost per day	259	251	444	288	454	307
Difference	2340		251		-1898	
Utilization Effect	2447		1398		838	
Cost Effect	-108		-1147		-2736	

All costs are calculated from standardized regression models.

Positive (negative) effects indicate that alcoholics' treatment costs are greater (less) than nonalcoholics' costs.

Cost and utilization effects may not sum to difference due to rounding.

Table 3 - Difference in Expected Monthly Costs for Alcoholics and Nonalcoholics

Hypothesis 1 test = (H1)
Hypothesis 2 test = (H2)
Hypothesis 3 test = (H3)

Negative value is favorable to offset hypothesis.

a. Alcohol Abuse -- No Comorbidities

	Nonalcohol Costs			Alcohol Costs	Total Costs		
	Alcs	Nonalcs	Difference	Alcs	Alcs	Nonalcs	Difference
Period 1	57	16	41	0	57	16	41
Period 2	61	23	39	121	182	23	160
Period 3	39	32	8 (H1)	9	48	32	16
Difference between Period 1 and Period 3 Total Monthly Costs					-9 (H2)	15	-24 (H3)

b. Alcohol Abuse -- Mental Psychosis Comorbidities

	Nonalcohol Costs			Alcohol Costs	Total Costs		
	Alcs	Nonalcs	Difference	Alcs	Alcs	Nonalcs	Difference
Period 1	131	35	95	0	131	35	95
Period 2	110	23	87	235	345	23	323
Period 3	84	43	40 (H1)	18	102	43	59
Difference between Period 1 and Period 3 Total Monthly Costs					-29 (H2)	8	-37 (H3)

Figures rounded to nearest dollar.

Table 3 (cont.) - Difference in Expected Monthly Costs for Alcoholics and Nonalcoholics

Hypothesis 1 test = (H1)
Hypothesis 2 test = (H2)
Hypothesis 3 test = (H3)

Negative value is favorable to offset hypothesis.

c. Alcohol Dependence -- No Comorbidities

	Nonalcohol Costs			Alcohol Costs	Total Costs		
	Alcs	Nonalcs	Difference	Alcs	Alcs	Nonalcs	Difference
Period 1	57	16	41	0	57	16	41
Period 2	78	23	55	424	502	23	479
Period 3	48	32	17 (H1)	22	71	32	39
Difference between Period 1 and Period 3 Total Monthly Costs					14 (H2)	15	-2 (H3)

d. Alcohol Dependence -- Mental Psychosis Comorbidities

	Nonalcohol Costs			Alcohol Costs	Total Costs		
	Alcs	Nonalcs	Difference	Alcs	Alcs	Nonalcs	Difference
Period 1	131	35	95	0	131	35	95
Period 2	144	23	121	618	762	23	739
Period 3	104	43	61 (H1)	44	148	43	105
Difference between Period 1 and Period 3 Total Monthly Costs					17 (H2)	8	10 (H3)

Figures rounded to nearest dollar.