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The Brief Treatment Cost Analysis Tool (TCAT-Lite) for Substance Abuse Treatment: Reliability and Application

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Abstract

Although several costing instruments have been previously developed, few have been validated or applied systematically to the delivery of evidence-based practices (EBPs). Using data collected from 26 organizations implementing the same EBP, this paper examined the reliability, validity, and applicability of the brief Treatment Cost Analysis Tool (TCAT-Lite). The TCAT-Lite demonstrated good reliability—correlations between replications averaged 0.61. Validity also was high, with correlation of treated episodes per \$100,000 between the TCAT-Lite and independent data of 0.57. In terms of applicability, cost calculations found that if all organizations had operated at optimal scale (124 client episodes per year), existing funds could have supported 64% more clients.

Keywords

treatment; adolescent; cost; efficiency; cost function; reliability; validity

Introduction

In treatment of alcohol and drug abuse, collecting and analyzing economic and financial data is critical to improving the delivery and financing of care. Such data can strengthen both program management and policy development.(Cartwright, 2008). Information on unit cost of services helps managers in preparing budgets, obtaining reimbursement from federal, state, and private programs, applying for grants, and supporting policy makers in examining economic trade-offs. As spending on substance abuse treatment has been declining as a proportion of all health spending by most payers(Mark, Levit, Vandivort-Warren, Buck, & Coffey, 2011), costing tools could help policy makers and funders allocate limited resources

and the introduction of new evidence-based practices (EBPs) (Beaston-Blaakman, Shepard, Horgan, & Ritter, 2007; Sindelar & Ball, 2010).

To help meet the needs of program managers and policy makers, several costing tools and methods have been developed and implemented to collect, estimate and analyze treatment costs (Cartwright, 2008). These include, in order of publication, the Drug Abuse Treatment Cost Analysis Program (DATCAP) (French, Dunlap, Zarkin, McGeary, & McLellan, 1997), Cost Data Audit Instrument (CDAI) of the Alcohol and Drug Services Study (ADSS) (Beaston-Blaakman et al., 2007; Horgan, Reif, Ritter, & Lee, 2001); the Substance Abuse Services Cost Analysis Program (SASCAP) (Zarkin, Dunlap, & Homs, 2004); and the Treatment Cost Analysis Tools (TCAT) (Flynn et al., 2009).

Establishing the reliability and validity of these costing tools is critical to providing accurate resource and cost estimates for the economic and financial analysis of substance abuse treatment. Data gathered using these tools may vary in completeness, consistency and accuracy, as the information is typically collected from treatment program staff who rely heavily on recall and estimates rather than objective measurements, in completing much of the instrument (e.g., the allocation of staff time, staffing) (Beaston-Blaakman, 2005). While each of these costing tools has been used at many facilities, opportunities for validation have been limited. The only published study in this area, to the authors' knowledge, examined the reliability of cost data collected with the DATCAP and the CDAI (a precursor of the TCAT) (Beaston-Blaakman, 2005). Findings showed that each instrument had strengths. Greater structure (e.g., listing personnel by name and position) and consistency checks (e.g. comparing revenues and expenses) were both associated with improved accuracy (Beaston-Blaakman, 2005).

Furthermore, most of these costing methodologies have had a broad research or policy purpose, directed at treatment programs as a whole, rather than on a specific intervention (Cartwright, 2008). Thus, many tools do not provide needed information for determining the costs of implementing an EBP. Limited budget and resources are one of the main impediments against implementation of EBPs (Rowan-Szal, Greener, Joe, & Simpson, 2007). An appropriate costing tool could help policy makers and managers better understand the costs of an EBP and the most efficient arrangement for delivering that practice, as well as help to obtain the necessary funding.

For this study, we adapted the TCAT, a Microsoft Excel-based workbook built on lessons from previous costing tools, to collect and estimate costs of implementing the Adolescent Community Reinforcement Approach and Assertive Continuing Care (A-CRA/ACC; see methods section for description) as part of a national EBP dissemination and implementation initiative (S. H. Godley, Garner, Smith, Meyers, & Godley, 2011). Our adaptation, the TCAT-Lite, shortened the instrument to reduce respondent burden. It also included consistency checks to improve data accuracy and forecasting to help stakeholders predict the effects of future changes in staffing, client flow and program design. We endeavored to improve the accuracy of the instrument by first gathering and listing each staff member's name and role and then eliciting time allocation information for each of three key staff functions (i.e., supervision, clinical, and administration). Each site's TCAT-Lite was prefilled as much as possible with external data (e.g., organization's name and address, respondent's contact information, and volume of services). Although the TCAT had been used previously to estimate economic cost of 70 substance abuse treatment organizations in the US (Flynn et al., 2009), it has not been validated. The primary aim of this paper was to examine the reliability and validity of the TCAT-Lite as a management and research tool and to show how it can describe and analyze the costs of a specific EBP both retrospectively and prospectively.

Methods

Study context

Data used in this study were collected as part of a larger study called the Reinforcing Therapist Performance (RTP) experiment. As described by Garner et al. (Garner, Godley, Dennis, Godley, & Shepard, 2010), the RTP experiment is a cluster randomized experiment testing the effectiveness and cost-effectiveness of using pay-for-performance methods to improve substance abuse treatment implementation and effectiveness. Important to note, the RTP experiment (which was funded by the National Institute on Alcohol Abuse and Alcoholism) builds upon a large adolescent EBP implementation initiative funded by the Substance Abuse and Mental Health Services Administration's Center for Substance Abuse Treatment (SAMHSA/CSAT). Marijuana and alcohol were the adolescents' primary substances of abuse. This SAMHSA/CSAT-funded initiative provided 32 community-based treatment organizations with approximately \$900,000 each over a three year period to learn and implement A-CRA/ACC (S. H. Godley et al., 2011). Two additional organizations participating in the Treatment Capacity Expansion initiative each received \$1,500,000 over this period. Therapists at participating organizations also submitted client data to the web-based evidence-based treatment system (EBTx), which kept track of actual numbers of clients treated by month. The economic analysis was approved by the Institutional Review Committees at Chestnut Health Systems and Brandeis University.

Brief description of A-CRA/ACC

Based upon the Community Reinforcement Approach (CRA) originally developed for treating substance abuse with adults (Azrin, Sisson, Meyers, & Godley, 1982; Higgins et al., 1991; Hunt & Azrin, 1973; Meyers, Dominguez, & Smith, 1996; Meyers & Smith, 1997; Smith, Meyers, & Delaney, 1998), A-CRA/ACC are adolescent adaptations of CRA that some studies have reported to be both effective and cost-effective (Dennis et al., 2004; S. H. Godley et al., 2010), while other studies have examined effectiveness alone (Garner, Godley, Funk, Dennis, & Godley, 2007; M. D. Godley, Godley, Dennis, Funk, & Passetti, 2002, 2007; Slesnick, Prestopnik, Meyers, & Glassman, 2007). In contrast to session-based EBPs, which deliver treatment procedures to all clients in the same prescribed order, A-CRA/ACC are procedure-based interventions that require therapists to be able to not only deliver the treatment procedures, but also determine which procedure(s) are most appropriate, based on what the adolescent says during each treatment session. The ACRA/ACC intervention is a defined episode of treatment of 26–28 weeks of planned duration.

Sample

The sample for this study included the 29 community-based treatment organizations participating in both the SAMHSA/CSAT-funded initiative and the RTP experiment. Of these, 26 (90%) organizations provided complete study information and thus were included in the current analyses. They were located in 13 diverse states across the United States (AR, AZ, CA, CO, FL, MA, MO, NV, OH, TN, TX, VA, and WV) and treated an average of 48 unduplicated clients per year with a range of 27 to 81 clients.

Description of the TCAT-Lite

Employing a general costing framework (Drummond, Sculpher, Torrance, O'Brien, & Stoddart, 2005; Gold, Siegel, Russell, & Weinstein, 1996), the TCAT-Lite identifies key activities involved in outpatient treatment. The TCAT-Lite requires data entry of three types of information: (1) general information about the substance abuse treatment parent organization and delivery sites (e.g. addresses and contact information), (2) inputs of personnel and non-personnel resources, and (3) outputs of services. The inputs include the

amount of time worked per week and detailed time allocation (e.g. for clinical activities and non-clinical activities) that each staff person spent on the treatment program under evaluation. To derive the personnel cost, a financial or program staff member fills in information on the salary and the fringe rate of each staff member.

Applying the concept of economic cost, the TCAT-Lite estimates the economic cost of volunteers, if any, based on their qualifications and time spent on the program. Non-personnel costs include the market value for capital and operating resources used (e.g. buildings, computer systems, administrative items, laboratory services, and client and staff transportation) and overhead (indirect cost) rates. The service outputs include counts of clients, client visits, and length of the visits and preparation time (hours) for counseling. Thus, the TCAT-Lite Excel workbook generates several cost measures, including the total economic cost and clinical cost, which are the costs analyzed in this study. In this study, the term “economic cost” includes costs of research and evaluation (R & E), while “clinical cost” includes costs directly related to treatment activities, but excludes costs for activities not directly serving current clients, such as R & E.

The key features of the TCAT-Lite are its ability to conduct consistency checking and automatic calculations through Excel formulas. For example, all shares of a staff person’s working time must sum to 100 percent. Through the tool’s built-in formulas, it estimates a series of average costs (cost per episode and cost per therapist hour). It also asks the respondent to estimate the time required for each component of a client visit (e.g. scheduling, preparing, traveling, and documenting). Combining this with the number of average number of documented visits provides an estimate of the minimum time required for a treatment episode. By comparing different time periods with each other and budget and actual data, the findings generate summaries, diagnostics and feedback.

TCAT-Lite collection periods

Two rounds of the TCAT-Lite were collected. The first round was to assess A-CRA/ACC inputs and outputs of each organization during the 12 months prior to the RTP experiment (hereafter called “period 1”), while the second round was to assess the implementation of A-CRA/ACC during the 6-months after the organizations were thought to be running at full capacity and the RTP experiment was initiated (hereafter called “period 2”). We also created a combined 1.5-year reference period by summing the inputs and outputs for periods 1 and 2. To make the data relevant for sites and improve accuracy, we generated a preliminary report and data questions for each site, sent them to the site, and asked staff to check the data for accuracy and update it as needed.

Budgeted and implemented indicators

To supplement cost and client counts from the TCAT-Lite, which used a 1.5-year reference period, we also obtained budget and activity information over the 3-year grant period. SAMHSA/CSAT allowed A-CRA/ACC grant recipients to allocate up to 20% over their funding, over the period of their award, for research and evaluation. Based on the results from T-CAT-Lite for the 1.5 year reference period, they committed an average of 20.6% for this purpose during this period. Thus for budgeted spending, we assumed that A-CRA/ACC grant recipients allocated 20% of funding for research and evaluation over the entire 3-year grant period, leaving 80% for provision of clinical services. We also obtained the projected number of clients treated (i.e., episodes) from each organization’s application to the SAMHSA/CSAT-initiative and the corresponding actual number from EBTx.

Analysis plan

We used a two-pronged approach to evaluate the extent of the TCAT-Lite measurements' reliability and validity. First, we conducted tests of statistical significance to determine whether mean differences and correlations between measures of interest were statistically significant at the $p < .05$ level. Second, applying established standards, small, medium and large correlations were defined 0.1, 0.3, and 0.5, respectively (Cohen, 1988). In our study, results had to demonstrate at least a medium correlation to be considered reliable or valid.

Comparability of means between time periods

The main input indicators include the count of full-time equivalent (FTE) staff and therapists. The key output indicators include the count of clients, number of visits, and the duration of counseling and preparation (hours). The resultant calculations include the total economic cost of the treatment, the total clinical cost that excluded the cost associated with non-clinical activities (e.g., research and evaluation, as well as training), economic cost per episode, clinical cost per episode, as well as number of treated episodes per \$100,000. For comparability between the periods, we annualized all reported indicators. As our first test of the reliability and validity of the TCAT-Lite, we compared the input values of personnel and non-personnel resources and output values of services between the two time periods. If these values differed, then either the resources themselves changed over the course of the CSAT funding, or the reliability of the data collection instrument was low. Excluding the unlikely possibility that changes in resources exactly offset differences due to low reliability, the similarity of results (i.e., the absence of statistically significant differences between time periods) would indicate program stability and good reliability of the TCAT-Lite in collecting the key costing information.

Correlation of indicators between the two periods

As organizations were delivering the same EBP in the same setting in both time periods, we hypothesized that unit costs would remain substantially the same. We tested this hypothesis by examining correlations of selected indicators between the first and second periods. Statistically significant correlation coefficients between the two periods would suggest good reliability of TCAT-Lite.

Correlations among indicators and seemingly unrelated regressions

Within each time period, related indicators ought to be highly correlated. For example, an organization's total economic cost should be correlated to its number of staff (FTE), as personnel cost represents the largest share of treatment cost in most substance abuse treatment programs. We also hypothesized, based on economic theory, that the unit cost (e.g. cost per episode) had a quadratic (U-shaped) relationship to the number of clients, as all organizations were incorporating the EBP on a short term basis (maximum of three years). If the TCAT-Lite has high reliability, the correlation (coefficients of correlation or slopes) among them should reveal no statistical significance between the first and the second period. We constructed seemingly unrelated regressions using the data from the two periods and compared the coefficients from the regressions.

Comparison of unit costs from alternative sources

To show how the TCAT-Lite can be used to assess validity and program efficiency, we compared unit costs derived from budgeted and reported data measured over two different time periods. These comparisons are similar to variance analysis in managerial accounting, which compares budgeted and actual costs (Finkler, Ward, & Barker, 2007). We compared the economic cost per episode over 1.5 years from the TCAT-Lite (TCAT-Lite reported cost per episode) to the cost per actual episode over 3 years (implemented cost per episode) and

cost per projected episode over 3 years (budgeted cost per episode). We also compared the corresponding inverse estimates--the number of episodes per \$100,000 among the three data sources. Whereas the distribution among sites of cost per episode tended to be skewed, this inverse estimate was more normally distributed. Specifically, we examined the correlation between the cost per episode and the actual number of episodes per \$100,000 from the TCAT-Lite (over 1.5 years) and those projected or actually treated over 3 years.

To interpret the patterns, we defined the “recruitment efficiency” as the ratio of the implemented cost per episode to the budgeted cost per episode. As the organizations’ costs were the same in both instances, the only difference arose from the discrepancy between estimated and actual number of clients receiving substance abuse outpatient treatment. We defined the “midterm efficiency” to compare the TCAT-Lite cost per episode over the 1.5 years and implemented cost per episode over the three years. Finally, we used the “combined efficiency” to indicate how well the TCAT-Lite cost per episode matched the budgeted cost per episode.

Identification of efficient scale of the service

We used the TCAT-Lite to identify the most efficient scale of services as an example to show the application of TCAT-lite for decision-making and planning. We fitted a quadratic relationship between the annualized cost/client and the number of clients receiving outpatient services, using the combined results for 1.5 years from the TCAT-Lite. We then estimated the scale of services with the lowest average cost, its associated cost, and the relationship to the current average cost.

Results

Descriptive findings

Table 1 describes the 26 substance abuse treatment programs for the first and second periods. After annualizing the indicators in the second period, eight of the ten indicators selected for the evaluation showed no statistical difference between the two periods, including staff (FTE) and therapists, counseling hours, annual economic cost of the treatment and annual clinical cost, cost per episode, cost per counseling hour, and episodes per \$100,000. However, it appeared that on average these organizations received more clients and more client visits in the second period—evidence of maturing programs. The differences of these two indicators were statistically significant ($t = -3.69$ and $t = -3.77$ respectively) between the two time periods.

Overall, the average volume of clients per program receiving and therapists providing A-CRA/ACC was relatively small. In period 1, 69 clients received A-CRA/ACC, and 84 in period 2, on average. Numbers of FTE total staff and therapists changed little between the two periods. One FTE staff served 16.4 clients and 19.0 clients in the first and second periods, respectively. The annual cost per episode was \$4,771 in the first period and \$4,964 in the second period. Because all organizations received a similar amount of funding over the three years to provide the outpatient treatment services, the annual economic cost of the treatment was similar (\$287,785 vs. \$292,942).

The data in Table 1 also demonstrate the high staffing intensity entailed in initiating A-CRA/ACC through this grant mechanism. Dividing the number of paid counselor hours by the number of treatment episodes, we found that an average program had 74.4 paid counselor hours per treatment episode in period 1 and 66.2 in period 2. Other questions in the TCAT-Lite showed that the time required for delivering an episode averaged 19.5 hours across the two time periods. Thus, the paid hours were 3.82 and 3.39 times the required hours in these periods, respectively.

Reliability

The first data column of Table 2 shows the correlation of the eight indicators between the two periods. All the indicators exhibited positive correlations, with statistical significance for all the coefficients of correlation except for “cost per episode”. Furthermore, most indicators showed at least a moderate association between the two periods. Seven out of eight coefficients of correlation were greater than 0.5. The number of clients and number of FTE staff demonstrated the highest correlations between the two periods. The significant correlation between the two periods indicates the reliability of the tool in collection of the relevant data.

Since personnel cost constitutes the major share of cost for substance abuse outpatient treatment, a strong positive association is expected between the total economic treatment cost and the number of FTE staff. Figure 1 shows the relationship of the two indicators in the two periods. As expected, the total economic cost was positively associated with the number of personnel. The coefficients of correlation were 0.79 in period 1 and 0.55 in period 2. Both coefficients are statistically significant ($p < 0.05$). We fitted a similar linear regression within in each period and found that the slopes of the two fitted lines showed no statistical difference ($t = 0.52$, $p = 0.47$) after testing with the seemingly unrelated regression. Figure 1 also shows that the deviations away from the fitted line are especially prominent among programs with 3–5 FTE staff.

Validity

Validity was assessed by comparing the budgeted, implemented and TCAT-Lite reported costs and the number of clients. Table 3 reports means and standard deviations of program indicators from these three data sources. Compared to the projected estimates from the budget, the annual economic cost of the program reported in the TCAT-Lite (annual cost in the middle period of the program) was greater than that from the budget, about \$36,000 more. It also appeared that organizations had overestimated the number of clients who would seek treatment. The actual number of annual clients who received outpatient services was 34% lower than originally estimated. Over the three years, the clients who received treatment were concentrated in the middle period as shown by the much higher annual number of clients in the middle period (estimates collected from the TCAT-Lite). The cost per episode in the middle period of the program was similar to the budgeted cost per episode.

The last three columns in Table 2 show correlations among these indicators related to validity. All of the 12 correlations related to validity are positive, and half are 0.50 or above and statistically significant, indicating broad consistency among the measures. Most important, the correlation coefficient between reported and implemented settings of the cost per episode was 0.62 ($p < 0.001$), and the correlation coefficient of the number of episodes per \$100,000 was 0.57 ($p < 0.01$).

Applicability

The TCAT-Lite is a costing tool that could be applied in many setting to help decision-making. Here we provided an example to show the application of TCAT to identify the most efficient scale of clients for the treatment organizations included in the study. According to economic theory on average cost, we expected a quadratic relationship between cost per episode and the volume of clients receiving services, and between cost per hour and number of counseling hours, because the average cost will fall as the fixed cost is shared by an increasing magnitude of clients, and may rise again when providing a larger volume of services. Figure 2 shows the relationship between the cost per episode and the number of episodes annually in both periods. In period 1, the most efficient program was estimated to

treat 100 clients, each with one episode, with an average cost of \$3,406 per episode, while the most efficient programs in period 2 treated 122 clients, again each with one episode, with an average cost of \$2,435 per episode. Despite the apparent differences between these calculated lowest costs, the coefficients of both terms (number of episodes and the squared number of episodes) in the functions for average cost were not statistically significant between the two periods ($t = 1.70$ and $p = 0.19$ for number of clients, $t = 0.29$ and $p = 0.59$ for the squared number of episodes). Similar quadratic cost functions on cost per counseling hour found that the lowest hourly costs were obtained at 8,012 hours per year with cost/hour of \$42 in period 1 and at 7,060 hours with cost/hour of \$39 in period 2. The cost function combining the two time periods found that the program serving 124 episodes per year resulted in the lowest cost per episode (\$2,690).

The actual average cost per episode, shown in Table 3, was \$4,430. This comparison with results from the cost function suggests that by operating at the optimal scale (lowest average cost), the unit cost could be reduced by 42%. The aggregate annual clinical spending (excluding research and evaluation) for the 26 sites in the midterm period was \$8.24 million and treated 1,859 episodes. Up to a point, increasing the number of episodes treated improves efficiency. Had all sites been able to operate at the lowest cost per episode (124 episodes at \$2,696 per episode), i.e., the most efficient pattern, they would have treated 64% more episodes than actually served at the same cost per site (\$334,000).

Table 4 shows the three efficiencies derived from the comparisons among data from each site's TCAT-Lite, budget, and client or episodes count. We found that the number of clients receiving treatment was often lower than the estimated number from the facility's grant application, with recruitment efficiency less than 1. The midterm efficiency of 1.45 indicates that the cost per episode was about 45% more efficient in the midterm than in the entire duration of the program. The combined efficiency was 1.06, which meant that the actual cost of each client was close to that proposed in the budget. The midterm unit cost seems a good proxy of the unit cost for projecting future costs, as it is based on costs during the period of full operation.

Discussion

This paper examined the reliability, validity, and applicability of the TCAT-Lite, which is a customized version of the TCAT (Flynn et al., 2009). Based upon the current results and correlation size criteria (see Cohen, 1988) (Cohen, 1988) the TCAT-Lite appears to have good reliability and validity. Moreover, we demonstrated the instrument's applicability to estimating the costs and improving the efficiency of delivering an EBP. To our knowledge, this paper is the first demonstration of the reliability of a costing instrument, which was possible because of repeated applications of the same instrument to each facility at nearby time periods. Similarly, we believe it is the first validation of a costing instrument, which was enabled by the availability of external financial and service information (i.e., budgets from the sponsor and EBTx data). Finally, we believe that this is the first time that a costing instrument has been applied to a large sample of facilities delivering the same EBP, permitting multiple analyses of costs and efficiency.

Reliability

In terms of reliability, we found strong, highly significant positive associations of key indicators between the two periods, and no statistically significant difference in the corresponding indicators between the periods, as well as strong correlations between related variables within each period. The high correlations between periods in total and clinical costs and number of clients reflect the care in accounting for the time allocation and salaries

of each staff member and non-personnel costs, and an objective source for volumes of clients (the electronic EBTx data base for entering each client's data).

In assessing the reliability of cost measures, the results depended on how the variables were expressed. The original correlation between cost per episode in period 1 versus period 2 was not statistically significant with the sample of 26 responding facilities. The number of episodes during the second period proved to be especially variable compared to period 1. However, when we expressed costs in a transformed way as episodes per \$100,000 (a less skewed measure), the correlation was positive, large according to Cohen's (1988)(Cohen, 1988) criteria, and highly significant as hypothesized. The low correlation in cost per episode may be due to the short length of data collection in the second period, which results in less stable data on both cost and outputs.

Validity

One strength of this analysis was our ability to compare the pre-determined funding for this SAMHSA/CSAT-funded initiative (approximately \$900,000 per organization over three years) to self-reports of actual spending. These comparisons allowed us to assess the accuracy of self-reported cost estimates. The correlation between the number of episodes per \$100,000 from two independent data sources suggests a high level of validity. The validity was limited by the fact that respondents to the TCAT-Lite had to rely on recall, rather than objective time measurements, in allocating staff time, and the fact that costs may have varied as the programs progressed through the three-year project period. The low correlations of budgeted versus reported indicators were expected. These measures combine two relatively independent sources of variability. First, implemented versus reported costs differed due to differences between 18 and 36 months and distinctions in approaches for allocation of time. Second, implemented versus budgeted costs differed due to uncertainties and overly optimistic projections in this budgeting context. The average correlation was close to the product of averages for each component.

Applicability to costs of an EBP

While the number of adolescents with substance abuse disorders is increasing (Aarons, Brown, Hough, Garland, & Wood, 2001), limited research has conducted economic analyses of treating this population (Dennis et al., 2004; French, Popovici, & Tapsell, 2008; French et al., 2002; French, Zavala et al., 2008; S. H. Godley et al., 2010). Thus, this application of the TCAT-Lite helps fill a gap in understanding the costs of an EBP for a growing population.

The TCAT-Lite proved easy to use and adaptable and could be potentially applied in several areas. For example, at the policy level, it is important to understand how much resources are needed to plan a service, which requires representative cost analysis to help make decisions about resource allocation. With basic information on cost per episode and potential quantity of clients in the site's service area, funders could use the TCAT-Lite to evaluate the budget requested by health facilities, allowing the money to be used more efficiently. State agencies also could use the TCAT-Lite to determine the cost band for reimbursement limits on EBPs. In this respect, this study adds to previous work to determine the cost band of different substance abuse treatments (French, Popovici et al., 2008). The second application is for use at the facility level to help managers reduce the unit costs of their services. Furthermore, the summaries reported by the TCAT-Lite would allow program directors and financial officers to allocate, analyze and estimate outpatient treatment costs to improve efficiency.

EBPs have been advocated in the treatment of substance abuse to provide effective and efficient services (Garner, 2009). Unlike many costing studies that assess programs having multiple heterogeneous components, this is one of the first applications of a costing tool to a

substantial number of sites delivering the same EBP. Thus, the results provide a more stable estimate of the cost of the practice under study. Although within the \$1,000 – \$5,000 cost band outlined in the request for applications (RFA; TI-06-007) the TCAT-Lite showed that the average cost per episode in the initial implementation phase of an EBP was higher than those in a previous application of the TCAT of \$882, \$1,310 and \$1,381 for three types of outpatient substance abuse treatment (Flynn et al., 2009).

The costs per client are probably relatively high for several reasons: First, the RFA allowed for average outpatient (non-methadone) costs up to \$5,000. Second, the grant amount for each program was fixed at the outset and was not adjusted to actual output, so the grant provided no financial incentive to therapists and program staff to treat more patients. Third, the grant applications submitted by programs in requesting funding for this EBP proved overly optimistic on average. Our budget analysis shows that during the budgeting period, the unit cost of treatment seemed reasonably gauged, but treatment facilities tended to project more clients than actually were treated, indicating that most of the grantees were optimistic that supplementary resources would permit them to recruit additional therapists and ultimately increase the level of clients. However, the number of clients did not grow, probably due to the limited time frame of 3 years. Fourth, a demonstration program may require high start-up costs to permit both providers and clients to become familiar with the treatment procedures, particularly during the inception phase necessary for proper planning. Conversely, if A-CRA/ACC were routinely offered and not supported by start-up grants, the program would have a lower unit and total cost. Fifth, administrative costs were high. We found out the administrative cost represents more than 20% of total economic cost, even after excluding the overhead for their parental program. These findings suggest that the reimbursement of services on a per client basis might promote greater efficiency than the lump sum payments provided through some grant mechanisms.

The cost per episode is much higher over three years than during the 1.5-year combined reference period for the two TCAT-Lite rounds, probably due to the high start-up cost in the programs' first year. The indicator of number of episodes per \$100,000 also showed greater efficiency during the TCAT-Lite reference period.

Improving efficiency

In addition to evaluating the cost of programs, the TCAT-Lite provides an understanding of the efficiency of substance abuse treatment in the specialty sector. Several costing tools have been developed over the last decades and are aimed at providing the unit cost of various substance abuse programs to answer a specific policy question (Cartwright, 2008; French et al., 2002; French, Zavala et al., 2008; Roebuck, French, & McLellan, 2003; Zarkin et al., 2004). But the majority of these previous studies applied costing tools to a variety of substance abuse programs. The homogeneity of A-CRA/ACC in the 26 facilities makes the attempt to examine the efficiency of that program plausible. This sample allows for obtaining the unit cost per episode of A-CRA/ACC in each facility and to compare the budget and recruitment efficiency across facilities. Likewise, this specific TCAT application permits researchers to depict and analyze the best performing facilities, and to determine the minimum average cost of A-CRA/ACC and the combination of outputs leading to this efficiency point. Thus, the TCAT-Lite can serve as a tool for evaluating the efficiency of a facility providing substance abuse treatment.

As discussed under Table 1, paid counseling hours were several times the required hours. In other words, required hours represented only 26% in period 1 and 29% in period 2 of paid hours. These low percentages illustrate the challenges to efficiency in promoting the rapid expansion of EBPs. While prospective sites created projections of the expected annual treatment episodes they would deliver, neither the sites nor the funder knew whether these

projections would be realized. In funding the new service through a grant mechanism, rather than fee-for-service reimbursement, SAMHSA bore the risk that unit costs could be relatively high if utilization proved low. As EBPs become established, policy makers and funders may wish to improve efficiency by incentivizing sites to find and treat more patients needing the service, and/or reduce staffing and funding commensurate with the volume and quality of services being provided.

Though the TCAT-Lite was not designed for routine management, periodic assessment of inputs and outputs using this tool would be helpful to guide management practices. At the facility level, the TCAT-Lite could answer various what-if scenarios. For example, suppose the facility added one more FTE therapist and increased the annual number of treatment episodes by 20 percent. How would the new and old average cost per episode compare? How would the incremental cost per additional client compare with the projected reimbursement for a new service? For example, if a potential managed care contract offered \$2000 per client episode, the incremental unit cost would indicate whether such a contract is financially viable in terms of incremental cost. Finally, the tool could help policy makers at a system level, such as a state substance abuse agency, state Medicaid program, or network manager for a managed care organization to compare present costs against projected costs under alternative configurations, perhaps entailing consolidation of certain programs.

Limitations

Several limitations must be acknowledged. First, our measures of reliability and validity implicitly assume that the program operation is similar over the three-year duration. Changes in program operation result in lower estimates of reliability and validity. Second, our data provided little ability to capture unit cost per treatment visit, as the available data on services did not capture less formal services (e.g., taking adolescents to pro-social activity). Third, in interpreting the cost results, one should remember that the start-up process and pre-determined funding may have increased the cost per episode compared to what would be expected in a mature, self-funded program. Fourth, the current analyses, being done from the perspective of a treatment site, do not reflect the full economic cost of this EBP, as they exclude the costs of therapist training and associated travel that were supported by SAMHSA/CSAT at no charge to the sites.

Lessons learned

The study confirmed the importance of structuring the cost instrument (e.g., through personnel lists and validity checks) in order to maximize its accuracy. The high TCAT completion rate in this study (90% of the 29 eligible facilities) was a result of persistent and tactful follow-up via telephone and email to obtain complete data and resolve any inconsistencies. It would be useful to examine the TCAT in other contexts and to perform similar validation analyses of other costing instruments for comparison.

The 26 sites tended to be overly optimistic in their recruitment projections; the sites actual low recruitment rates led to high unit costs. The counseling hours required for the clients actually served were only 26% to 29% of the paid hours in the two time periods studied. We suggest that future funding of substance abuse treatment initiatives, such as this one, should be tied to strong recruitment incentives in order to improve efficiency. For example, future grants could include modest support for the first few months as therapists are recruited, trained and practice a new EBP. Thereafter, fee for service payments at a higher rate than those for established services could encourage efficiency and support the extra time for supervision and documentation of a well implemented EBP. Also, funders of demonstration projects for EBPs could require applicant sites to match grant or demonstration funding with

service revenues from families and/or insurers. Such incentives might not only improve efficiency, but also may accelerate the adoption and sustainability of EBPs.

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Figure 1.
Relationship between number of FTE staff and the economic cost of treatment in the two periods

Figure 2.
Relationship between cost per episode and the number of episodes in the two periods

Table 1

Characteristics and annualized costs per program in two periods (n=26)

Variable	Period 1			Period 2			t value (period 2–period 1)
	Mean	SD	CV	Mean	SD	CV	
Episodes	69	30	44%	84	36	43%	3.69**
Documented visits	551	281	51%	758	381	50%	3.77***
Paid counseling hours	5,132	1,889	37%	5,559	1,869	34%	1.12
Staff (FTE)	4.2	1.4	34%	4.4	1.0	24%	0.84
Therapists (FTE)	3.7	1.5	41%	3.8	1.2	32%	0.66
Total economic cost (\$)	287,785	69,975	24%	292,942	56,621	19%	0.41
Total clinical cost (\$)	232,035	64,771	28%	223,811	63,487	28%	−0.73
Cost per episode (\$)	4,771	1,815	38%	4,964	3,573	72%	0.28
Episodes per \$100,000	23.5	1.6	7%	26.3	2.1	8%	1.57
Cost per hour (\$)	63	26	41%	63	43	69%	−0.08

Notes: SD denotes standard deviation; CV denotes coefficient of variation (SD/mean); FTE denotes full time equivalent. All the numbers are annualized in period 2.

* $p < 0.05$,

** < 0.01 ,

*** < 0.001

Table 2

Correlation of indicators among time periods

Indicator	Reliability Indicator		Validity indicators	
	First vs. second	Implemented vs. reported	Budgeted vs. implemented	Budgeted vs. reported
Episodes	0.82 ***	0.62 ***	0.50 *	0.17
Total economic cost	0.54 **	0.38	1.00 ***	0.38
Cost per episode	0.37	0.62 ***	0.33	0.19
Episodes per \$100,000	0.58 **	0.57 **	0.54 **	0.24
AVERAGE (4 items)	0.58	0.55	0.54	0.25
Staff (FTE)	0.75 ***	n.a.	n.a.	n.a.
Therapists (FTE)	0.62 ***	n.a.	n.a.	n.a.
Total clinical cost	0.62 ***	n.a.	n.a.	n.a.
Cost per hour	0.63 ***	n.a.	n.a.	n.a.
AVERAGE (all items)	0.61 ***^a	n.a.	n.a.	n.a.

*
 $p < 0.05$.**
 < 0.01 ,***
 < 0.001 ;^a
standard error 0.041; FTE denotes full time equivalent.

Table 3

Comparisons among budgeted, implemented, and TCAT-reported indicators

Indicators	<u>Budgeted</u>		<u>Implemented</u>		<u>TCAT-Lite reported</u>	
	Mean	SD	Mean	SD	Mean	SD
Total treatment cost (\$1000s)	252.8	44.3	252.8	44.3	289.5	59.1
Number of episodes	67.1	30.7	44.7	11.7	74.3	30.8
Cost per episode (\$1000s)	4.31	1.62	6.03	1.88	4.43	1.74
Episodes per \$100,000	27.0	12.9	17.8	4.4	25.6	9.0

Note: Aggregate items (total cost and number of clients) are annualized. Budgeted and implemented indicators were obtained over 3 years. TCAT-Lite data were obtained for 1.5 years. SD denotes standard deviation. As all sites received and, to our knowledge used, their full budgets, implemented total costs equal budgeted total costs.

Table 4

Efficiencies compared to budget

Efficiency component	Mean	SD
Recruitment efficiency	0.73	0.24
Midterm efficiency	1.45	0.38
Combined efficiency	1.06	0.46

Notation: SD denotes standard deviation