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Guidelines and challenges for estimating the economic costs and benefits of adolescent substance abuse treatments

Silvana K. Zavala, (M.P.H.)[a], Michael T. French, (Ph.D.)[a,*], Craig E. Henderson, (Ph.D.)[b], Linda Alberga, (M.A.)[c], Cindy Rowe, (Ph.D.)[c], Howard A. Liddle, (Ed.D.)[c]

[a]*Health Economics Research Group, Department of Sociology, University of Miami, Coral Gables, FL 33124, USA*
[b]*Department of Psychology, Sam Houston State University, Huntsville, TX, USA*
[c]*Center for Treatment Research on Adolescent Drug Abuse, Department of Epidemiology and Public Health, University of Miami, Miami, FL, USA*

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Abstract

Many economic evaluations have been conducted for adult substance abuse treatments, but only a few have been conducted for adolescent-specific treatments. This is the first article to present rigorous methodological guidelines for estimating the economic costs and benefits of adolescent substance abuse treatments while also addressing the potential challenges associated with such research activities. A representative case study of two adolescent substance abuse treatment programs (one residential and one outpatient) is presented to show some of the initial steps of a comprehensive economic evaluation (e.g., cost analyses, selection of treatment outcome measures, and valuation of outcome measures via monetary conversion factors). Cost data were collected and analyzed using the Drug Abuse Treatment Cost Analysis Program. Monetary conversion factors were obtained and presented for a variety of treatment outcomes. The methodological guidelines, discussion of analytic challenges, and recommendations set forth in this article provide a foundation for future economic studies on adolescent substance abuse treatments.

Keywords: Economic costs and benefits; Adolescent substance abuse treatment; Economic evaluation

1. Introduction

Although significant advances have been made in the field of adolescent substance abuse treatment over the last two decades (Liddle, 2004; Williams & Chang, 2000), economic analyses of adolescent substance abuse treatment have started to emerge just recently. Indeed, not much is known about the economic costs or benefits of adolescent substance abuse treatments, despite the publication of numerous recent studies on adult programs (e.g., Barnett, Zaric, & Brandeau, 2001; French, Dunlap, Galinis, Rachal, & Zarkin, 1996; French, McCollister, Cacciola, Durell, & Stephens, 2002; French, McCollister, Sacks, McKendrick, & DeLeon, 2002; French & McGeary, 1997; French, Salomé, & Carney, 2002; French, Salomé, Sindelar, & McLellan, 2002; Zarkin, Lindrooth, Demiralp, & Wechsberg, 2001). Against a backdrop of pressure to transport science-based treatments and within an era of fiscal constraints and declining resources, policymakers, researchers, and providers are being asked to determine the economic needs and impact of adolescent treatments. However, the economic evaluations (cost analysis, cost–effectiveness analysis, benefit–cost analysis) that have recently been completed for adult programs are not always transferable to adolescent programs.

Adolescent-focused drug abuse treatment has emerged as a unique specialty in the past two decades (Liddle, 2004). Several interacting factors account for the development of specialized adolescent drug treatments. Data from large-scale evaluation studies revealed that standard community-based substance abuse programs developed for adults are not effective with, nor are they meeting, the needs of most adolescents with substance abuse and related problems

* Corresponding author. Tel.: +1 305 284 6039; fax: +1 305 284 5310.
E-mail address: mfrench@miami.edu (M.T. French).

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(Dennis, Dawud-Noursi, Muck, & McDermeit, 2003; Etheridge, Smith, Rounds-Bryant, & Hubbard, 2001). For instance, the Services Research Outcomes Study (Office of Applied Studies, 2000) found that whereas adult patients improved significantly in drug abuse programs, adolescents actually increased their alcohol and drug use in the years following treatment. Basic and applied research more clearly delineated the unique developmental and treatment needs of adolescents (e.g., Winters, Latimer, & Stinchfield, 1999) and the complexity of adolescent substance abuse and its corresponding impairments (Bukstein, Glancy, & Kaminer, 1992). Developmental psychologists began to argue that conceptual frameworks for substance abuse traditionally applied to adults, such as the disease model, fail to account for the unique developmental progression of problems among adolescents (e.g., Zucker, Fitzgerald, & Moses, 1995). It became increasingly clear that treatment models borrowed from adult addiction programs are inappropriate for adolescent addiction programs (Deas, Riggs, Langenbucher, Goldman, & Brown, 2000). As the need for effective, developmentally tailored adolescent substance abuse treatments continued to grow (Kaminer, 2001), interventions with less focus on drug use as the primary target and more emphasis on the multiple risk and protective factors that maintain problem behavior over the long term were developed (see Muck et al., 2001). Accordingly, contemporary adolescent substance abuse treatments target the constellation of problems commonly seen among adolescent drug abusers, including delinquent behavior, peer drug use, school failure, social functioning and life skills, and family dysfunction (Rowe & Liddle, 2003).

Given the multifaceted nature of the adolescent clinical problem, adult-style economic evaluations of adolescent substance abuse treatments would not be appropriate. Economic evaluations of adolescent treatments may be more complex and difficult (e.g., multisystemic assessments and interventions) as compared with those of adult treatments. In addition, the economic evaluation methods developed for adult programs may not always be appropriate for adolescent programs. It is therefore necessary to modify and/or enhance methods typically directed at adult programs for use in current studies on adolescent substance abuse treatments. These economic development efforts, in some ways, will parallel the needed and recently accomplished clinical development efforts to adapt adult-based treatments to the unique needs of teenagers (Liddle & Rowe, in press). Efforts in this direction can be noted in the few studies that have examined the economic costs and/or benefits of adolescent substance abuse treatments (French, Roebuck, et al., 2002; French et al., 2003; Schoenwald, Ward, Henggeler, Pickrel, & Patel, 1996). However, no study has either provided practical guidelines for conducting economic evaluations of adolescent substance abuse treatments or addressed the potential conceptual and methodological challenges associated with these research activities.

To initiate dialogue and progress in this area, we introduce methodological guidelines and challenges for estimating the economic costs and benefits of adolescent substance abuse treatments. A representative case study of two adolescent substance abuse treatment programs (one residential and one outpatient) is presented as an aid to understanding the steps toward a comprehensive economic evaluation. These two clinical settings served as prototypes upon which the initial economic evaluation procedures were implemented and refined. In addition, some of the challenges (technical, data related, and programmatic) that analysts may confront when performing these evaluations are explained. Finally, recommendations are presented to enhance the methods and findings of economic evaluation studies.

2. Overview of economic evaluation methods

Most economic evaluation methods can be classified into three categories: cost, cost–effectiveness, and benefit–cost. Cost studies in the substance abuse literature are concerned with the valuation of the resources used to deliver a substance abuse intervention. These studies estimate the economic costs of treatment. Importantly, economic costs are not necessarily equivalent to accounting costs (e.g., direct expenditures, including depreciation expense) paid by programs (Drummond, O'Brien, Stoddart, & Torrance, 1997; French et al., 1997). Economic or opportunity costs include the full value of all resources used by a program, regardless of who paid for them. Although accounting costs may be of interest to providers for fiscal planning, economic costs are preferred for economic evaluation because society shares in the benefits of substance abuse treatment.

Because the impact of drug abuse is felt broadly, the economic evaluation of drug abuse interventions is generally conducted from a comprehensive societal perspective than from a private perspective (e.g., treatment provider, insurance company; Drummond et al., 1997; French, 2000; Gold, Siegel, Russell, & Weinstein, 1996). A societal perspective implies that opportunity costs are included for all participants or stakeholders in a program (without double counting), such as organizations, individuals, taxpayers, and insurance companies (Sindelar & Manning, 1997). The societal perspective is neutral across stakeholders and more comparable across programs (Gold et al., 1996). Because cost evaluations are a prerequisite for cost–effectiveness and benefit–cost analyses, it is important that cost estimates are conceptually accurate and empirically precise. Cost–effectiveness analysis and benefit–cost analysis are full economic evaluations in which both the costs and the outcomes/consequences of health programs or treatments are examined.

A cost–effectiveness analysis compares the opportunity cost of a project, such as a substance abuse treatment episode, with a standard, nonmonetary health outcome, such

as quality-adjusted life-years saved and cases of disease avoided (Barnett et al., 2001; Drummond et al., 1997; Gold et al., 1996; McCollister, French, Inciardi, et al., 2003; McCollister, French, Prendergast, et al., 2003; Zarkin et al., 2001). The costs of the project are then compared with one or more of these health outcomes. The results of such comparisons may be stated in terms of cost per unit of effect or effect per unit of cost. One can then compare the ratios of cost and outcome for two or more alternative programs.

Because many programs or interventions are already operating, the key research question is not on implementation but rather on estimated costs and outcomes if the service were extended or enhanced. In analyzing program enhancements, proper measures are the changes in costs and outcomes in moving from standard to enhanced services. Such an approach is called *incremental cost–effectiveness analysis*. For example, the incremental cost of an enhanced services intervention is the cost of adding this component to standard or baseline services, not the combined cost of standard and enhanced services.

Although one could compare the simple ratios of cost with outcome for two alternative programs, the correct comparison is that between incremental cost and incremental outcome because it tells us how much we are paying (e.g., for each avoided case of illness or diseases) to add the enhanced program/intervention (Drummond et al., 1997). This technique is usually not intended for evaluating a single program or multiple outcomes—a limitation that is problematic in the case of substance abuse treatment, in which multiple outcomes (e.g., employment, crime, drug use, health) are routinely expected (Institute of Medicine, 1990; Lamb, Greenlick, & McCarty, 1998; McLellan et al., 1996). A cost–effectiveness analysis typically examines one target outcome, such as the incremental cost per avoided drug-using day, thus potentially overlooking important information on other outcomes such as avoided emergency department visits (Sindelar, Jofre-Bonet, French, & McLellan, 2004).

A benefit–cost analysis compares the total opportunity cost of a program with its total economic benefit. It converts all outcomes into monetary equivalents, thereby enabling widespread comparison across programs and discussion of more efficient resource allocations. For this reason, benefit–cost analysis is a powerful tool to evaluate health care programs such as substance abuse treatment (Cartwright, 1998, 2000; French, 1995, 2000; Kenkel, 1997). Results are usually expressed as a benefit–cost ratio, and an intervention is considered cost–beneficial if the benefit–cost ratio exceeds 1.0. However, even if the benefit–cost test implies that intervention benefits exceed intervention costs, one cannot immediately conclude that scarce resources are being used efficiently. Thus, benefit–cost studies require supplemental studies on alternative uses of the same resources.

A detailed description of economic evaluation techniques is beyond the scope of this article. However, several useful work on economic evaluation methods in the health care field are available for further consultation (e.g., Cartwright, 1998, 2000; Drummond et al., 1997; French, 1995, 2000; French, McGeary, Chitwood, & McCoy, 2000; French, Salomé, Sindelar, et al., 2002; Gold et al., 1996; Johannesson, 1996; Lave & Satish, 1996; Tolley, Kenkel, & Fabian, 1994; Yin & Forman, 1995; Zarkin, French, Anderson, & Bradley, 1994).

3. Economic evaluation guidelines for adolescent substance abuse treatments

The guidelines that follow are proposed for a benefit–cost analysis of a representative adolescent substance abuse treatment. Naturally, some of these guidelines and techniques may require some modifications to fit the specific aspects of a specific intervention or a particular outcome.

3.1. Economic cost estimation

Resource use and cost information at participating substance abuse treatment programs can be obtained by administering a cost data collection instrument such as the Drug Abuse Treatment Cost Analysis Program (DATCAP; French, 2003a, 2003b; www.DATCAP.com). The DATCAP is a data collection instrument and interview guide designed to measure both the accounting costs and the opportunity costs of a substance abuse treatment program based on standard economic principles. It is appropriate for economic cost evaluations of most treatment modalities in most social service settings. It is intended to collect and organize detailed information on resources used in service delivery and their associated costs. Resource categories include personnel, supplies and materials, contracted services, buildings and facilities, equipment, and miscellaneous items. In addition, the DATCAP gathers data on program revenues and client case flows.

A detailed explanation of the DATCAP as well as a summary of empirical findings from 85 programs can be found in the work of Roebuck, French, and McLellan (2003) and at www.DATCAP.com. However, despite the growing list of DATCAP studies, a few outpatient marijuana treatment programs from the Cannabis Youth Treatment project (French et al., 2003) and the two case study adolescent programs (one residential and one outpatient) described in this article are the only applications of the DATCAP to adolescent substance abuse treatments thus far. The DATCAP was successfully administered in all of these adolescent treatment programs, which is encouraging for future applications.

The cost data collection method for the pilot study presented in this article was the DATCAP. However, several other cost estimation methods have been developed over recent years. For example, Zarkin, Dunlap, and Homsi (2004) developed a treatment services cost estimation method (Substance Abuse Services Cost Analysis Program)

that is based on the DATCAP. The Capital Consulting Corporation (2000) developed an accounting approach to cost estimation entitled Uniform System of Accounting and Cost Reporting for Substance Abuse Treatment Providers. The ADDS Cost Study (Department of Health and Human Services, 2003) provided yet another data collection strategy for estimating the cost of substance abuse treatment. The strengths and limitations of some of these cost estimation methods are discussed by Zarkin et al. (2004).

3.2. Economic benefits estimation

Economic (dollar) benefits can usually be derived from self-reported patient information collected at treatment entry and follow-up using any standardized assessment instrument.[1] Some of the valid assessment instruments used for adolescent research include (a) the Global Appraisal of Individual Needs (Dennis, Titu, White, Unsicker, & Hodgkis, 2002); (b) the Comprehensive Addiction Severity Index for Adolescents (Meyers, McLellan, Jaeger, & Pettinati, 1995); (c) the Adolescent Diagnostic Interview (Winters & Henly, 1993); (d) the Customary Drinking and Drug Use Record (Brown et al., 1998); (e) the Adolescent Drug Abuse Diagnosis (Friedman & Utada, 1989); and (e) the Teen Addiction Severity Index (Kaminer, Bukstein, & Tarter, 1991).

The first step in the estimation process is to select important outcome measures from assessment instruments that can be converted to economic benefits of substance abuse treatments. To show this process, we present a set of possible outcome measures selected from assessment instruments that were used for the case study presented in this article in Table 2. The selected outcomes are then valued in dollar terms using appropriate monetary conversion factors. For example, Table 2 shows a set of possible monetary conversion factors that correspond to outcome measures selected earlier. The acquisition and/or calculation of monetary conversion factors is discussed in Treatment Outcome Measures and Monetary Conversion Factors.

One way to express the economic benefits of treatment is to calculate the change in monetized outcomes from baseline to follow-up. For each of the outcome measures, the difference in values between admission and follow-up can be multiplied by a monetary conversion factor to obtain the estimated posttreatment benefit for each client. For example, consider the dollar benefit of avoiding a medical doctor's office visit (the first outcome listed in Table 2): Suppose the mean change in this outcome from baseline to the 6-month follow-up was two visits, using the monetary conversion factor in Table 2 ($77.62), the average economic benefit associated with this outcome would be $155.24 ($77.62 × 2 = $155.24). The economic benefit associated with other treatment outcomes can be calculated in a similar fashion. After the economic benefit from treatment is calculated for each outcome measure within each outcome domain, the total economic benefit of treatment equals the sum of benefits across all domains.

Although this benefit estimation approach may appear straightforward, considerable effort must be invested in selecting appropriate outcome measures and obtaining or deriving monetary conversion factors. Whenever possible, the choice of specific outcomes should be guided by the objectives of the benefit estimation exercise and findings from related evaluation studies. If related studies are lacking for an outcome, then analysts may need to invest time in developing new estimation procedures and methods. Emphasis should be placed on key outcomes that are indicators of success in adolescent substance abuse treatments and can be measured in or converted to monetary terms. Important outcome measures that cannot be translated to economic benefits (e.g., family conflict) should be noted and perhaps included in a qualitative discussion of patient improvement. The following is a presentation of important and practical points to consider in the process of valuing adolescent treatment outcomes.

3.2.1. Key points for outcome valuation

In the process of estimating accurate and reliable economic benefits of adolescent treatments, several important points should be considered. First, when selecting a source from which to obtain monetary conversion factors, it is preferable to obtain recent unit cost estimates from reliable data sources that are consistently being updated. For example, if patients participating in a program under evaluation received substance abuse services between August 2000 and May 2001, then monetary conversion factors should be derived from data sources pertaining to fiscal year 2001, which typically ran from July 2000 to June 2001.

Furthermore, it is best, when possible, to obtain monetary conversion factors that apply specifically to the location(s) of the intervention under evaluation. If the intervention was conducted in Miami, Florida, use of state-level (i.e., Florida) monetary conversion factors may provide a reasonably accurate estimate of outcome values. If available from a reliable source, local-level unit cost data (i.e., Miami) are probably better. It is best to avoid using national-level monetary conversion factors because they may not be generalizable to a local sample of adolescent substance abuse treatment clients.

Because costs vary widely across institutions and locations, monetary conversion factors (unit cost estimates) should reflect the actual setting of each specific sample being evaluated. For example, when deriving the cost of a doctor's office visit or an outpatient hospital visit, it is best to value the services provided based on the type of clinic or

[1] It is sometimes necessary to supplement self-reported information with abstracted data (see French et al., 2003).

hospital that a typical adolescent in the sample would attend. If most adolescent clients would attend a community hospital, then it is not appropriate to include the cost of a private hospital visit. Furthermore, because the clients are adolescents, it is best to obtain monetary conversion factors that apply to adolescent-specific services and not those targeted and designed for adults.

One feature of treatment evaluation studies that leads to comparability problems is differential follow-up periods. Although the literature suggests that 1-year follow-up assessments should be the standard, some outcome studies have only a 6-month follow-up and others have 2 or more years of follow-up. When calculating economic benefits, it is important to obtain values that extend through but not beyond the length of the follow-up period. It may be tempting to forecast benefits for some outcomes (e.g., educational improvements) beyond the follow-up period, but these forecasts are often unreliable without actual data and the analysis will become uneven if future benefits are predicted for some outcomes and not others. Confining the benefits analysis to the length of the follow-up period also simplifies interpretation of the findings and comparability across studies.

Finally, it is useful to acquire more than one monetary conversion factor for each outcome variable, as several good valuation approaches are often available to monetize various outcomes. This enables one to test the sensitivity of the economic benefit estimates by using lower-bound and upper-bound monetary conversion factors. Sensitivity analysis is discussed in greater detail subsequently.

3.3. Benefit–cost analysis

A representative benefit–cost analysis for adolescents will compare the cost of resources allocated to treatment, as estimated through a valid and reliable instrument such as the DATCAP (French, 2003a, 2003b), with the benefits yielded through treatment, as estimated by monetizing selected treatment outcome variables. The magnitude and statistical significance of the total benefit estimate should be emphasized because the total benefit estimate is more compelling and policy relevant than the benefit estimate for individual outcomes (French, Salomé, Sindelar, et al., 2002). Benefit–cost analysis results may be presented as either a benefit–cost ratio (total benefit divided by total cost) or a net benefit estimate (total benefit minus total cost). If the net benefit is positive (or the benefit–cost ratio is >1), then total benefit exceeds total cost. In addition, the magnitude of these values can be used to guide comparisons and choices among different programs.

3.4. Sensitivity analysis

Performing a sensitivity analysis is a critical component of an economic evaluation when the assumptions and parameter estimates applied in the analysis have uncertain precision. For example, the cost of a single act of robbery will depend on factors such as the seriousness of the crime, the presence of property damage and/or victim injuries, the probability of arrest, and the criminal justice systems costs if arrested. All of these factors require assumptions or "starting values" that should be modified around a range of plausible values to determine a quasi confidence interval for the monetary conversion factor. A sensitivity analysis can be conducted and reported in a variety of ways (Drummond et al., 1997; Gold et al., 1996). One approach is to calculate lower-bound and upper-bound estimates, whenever relevant, for each of the outcome variables used in the benefit calculations. Similarly, lower-bound and upper-bound practical (as opposed to statistical) estimates can be calculated for total benefit. The lower-bound and upper-bound estimates can form confidence intervals for the midrange (i.e., suggested) values. Furthermore, the three total benefit estimates (lower, mid, upper) can be used in sensitivity calculations of benefit–cost statistics. Empirical application of these techniques can be found in the work of French, McCollister, Cacciola, et al. (2002); French, Salomé, et al. (2000); and French, Salomé, Sindelar, et al. (2002).

Another form of sensitivity analysis involves constructing statistical confidence intervals around the cost, benefit, and benefit–cost estimates. For these exercises, a common approach is to obtain 95% confidence intervals by using bootstrapped variance estimates with the normal approximation method (StataCorp, 2001). Examples of statistical confidence intervals in economic evaluations of addiction treatment can be found in the work of French, Salomé, Sindelar, et al. (2002); McCollister, French, Inciardi, et al. (2003); McCollister, French, Prendergast, et al. (2003); and Simon et al. (2001).

4. Case study design

To demonstrate some of the proposed guidelines empirically, we selected an ongoing randomized clinical trial comparing an intensive family-based outpatient substance abuse treatment with a residential treatment for adolescents between the ages of 13 and 17 years (hereafter referred to as the Alternative to Residential Treatment [ART] study). Economic evaluation of the ART study is one of our primary research aims, but the final economic evaluation results will not be completed until the last follow-up interview is conducted. Nevertheless, the cost analyses of the outpatient and inpatient programs have been completed, the outcome measures from the assessment instruments have been selected, and the best sources for monetary conversion factors have been identified. Thus, this ongoing project provides an appropriate case study for demonstrating most of the proposed economic evaluation guidelines outlined earlier in this article.

The ART study was funded by the National Institute on Drug Abuse to investigate the effectiveness of a research-

Table 1
Economic costs of two adolescent substance abuse treatment programs (2001 dollars)

	Residential treatment program ($)	Percentage of total (%)	Intensive outpatient treatment program ($)	Percentage of total (%)
Resource category[a]				
Labor	804,612	61.6	181,679	86.8
Supplies	83,911	6.4	1,875	0.90
Contracted services	130,930	10.0	4,250	2.0
Buildings and facilities	104,136	8.0	13,803	6.6
Equipment	9,285	0.71	0	0.0
Miscellaneous	94,190	7.2	7,668	3.7
Client information				
Average daily census	22.03		10.44	
Average length of stay (weeks)	8.21		29.65	
Total annual economic cost	1,227,064		209,275	
Average (per client) annual economic cost[b]	55,700		20,045	
Average (per client) weekly economic cost[c]	1,068		384	
Average episode economic cost[d]	8,775		11,422	

Note. All data were collected and analyzed with the DATCAP (French, 2003a, 2003b; www.DATCAP.com).
[a] Values within resource categories are annual costs.
[b] Average (per client) Annual Economic Cost = Total Annual Economic Cost/Average Daily Census.
[c] Average (per client) Weekly Economic Cost = Total Annual Economic Cost/Average Daily Census/52.14 weeks.
[d] Average Episode Economic Cost = Average (per client) Weekly Economic Cost × Average Length of Stay (weeks).

supported, family-based outpatient treatment for adolescent drug abuse—Multidimensional Family Therapy (MDFT; Liddle, 2002a)—as an alternative to residential treatment. This randomized, controlled trial compares the therapeutic and economic impact of MDFT with that of a community-based, residential treatment program for seriously impaired adolescent drug abusers. In addition to examining immediate and long-term clinical outcomes and mechanisms of change in both interventions, the study also incorporates an economic evaluation of the two treatments. The ART study represents the first controlled trial comparing a residential drug treatment with an empirically supported outpatient treatment for adolescent substance abusers. For descriptions of both programs, the interested reader can consult the work of Liddle and Dakof (2002) and Rowe, Liddle, McClintic, and Quille (2002).

5. Case study results

5.1. Cost estimation results

Table 1 shows findings from the economic cost analyses of the residential and outpatient programs participating in the ART study. Case flow statistics are reported for each program, and all cost estimates are in 2001 dollars. Taking into account all services provided during the analysis year, estimated total annual economic costs were $1,227,064 for the residential program and $209,275 for the intensive outpatient program. Using the average daily census of 22 clients in residential treatment and 10 clients in outpatient treatment, the economic costs of providing continuous treatment to one individual for the entire year were $55,700 (or $1,068 per week) for residential treatment and $20,045 (or $384 per week) for outpatient treatment. Based on the average length of stay of 8 weeks in residential treatment and 30 weeks in outpatient treatment, the average economic costs of a treatment episode were $8,775 for an individual episode of residential treatment and $11,422 for an individual episode of outpatient treatment.

It is interesting to note that outpatient treatment was more costly than residential treatment on an episode basis ($11,422 vs. $8,775) although residential treatment was considerably more costly on a unit (weekly) basis ($1,068 vs. $384). The reason for this reversal in weekly and episode costs is the wide gap in average length of stay (30 weeks for outpatient vs. 8 weeks for residential). The difference between the length of stay for the two treatments is presumably caused by greater treatment completion and retention rates in the outpatient program (Dakof, Rowe, Liddle, & Henderson, 2003), as both treatments were intended to be delivered over a 6- to 9-month period. Given the abundance of studies showing that treatment retention and completion are significantly linked to better outcomes, one would expect to see larger economic benefits for outpatient treatment relative to residential treatment (Condelli & Hubbard, 1994; Hubbard et al., 1989; Latimer, Newcomb, Winters, & Stinchfield, 2000). Of course, this issue will be explored from many different angles during the upcoming benefit–cost analysis.

5.2. Treatment outcome measures and monetary conversion factors

As noted earlier, economic (dollar) benefits of residential and intensive outpatient substance abuse treatments will be derived from self-reported and abstracted patient information collected at treatment entry and at various points over

Table 2
Selected outcome measures and monetary conversion factors (2001 dollars)

Outcome measure	Data source	Monetary conversion factor
Medical services		
Medical doctor's office visit[1]	Self-report[a]	77.62
Dental office visit[2]	Self-report[a]	16.00
Emergency department visit[3]	Self-report[a]	1,060
Inpatient hospital day[4]	Self-report[a]	1,161
Outpatient hospital visit[5]	Self-report[a]	139.5
Mental health/Substance abuse services		
Psychiatrist's office visit[6]	Self-report[a]/records[†]	159.0
Psychologist's office visit[7]	Self-report[a]/records[†]	91.01
Counselor's office visit[8]	Self-report[a]/records[†]	85.91
Outpatient psychiatric hospital visit[9]	Self-report[a]/records[†]	110.3
Inpatient psychiatric hospital day[10]	Self-report[a]/records[†]	456.0
Education and employment		
Full day's absence from school (excused or unexcused)[11]	Records[††]	14.78
A day's suspension from school[11]	Self-report[b]/records[††]	14.78
A day's expulsion from school (without alternative school)[11]	Self-report[b]/records[††]	14.78
A day's expulsion from school (with alternative school)[12]	Self-report[b]/records[††]	67.39
A day's absence from school or work by family member[13]	Self-report[a]	95.83
Criminal activity		
Assault[14]	Self-report[a,b,d]	11,562
Robbery[14]	Self-report[a,b,d]	9,840
Theft[14]	Self-report[a,b,d]	455.1
Murder[14]	Self-report[a,b,d]	3,616,200
Motor vehicle theft[14]	Self-report[a,b,d]	4,674
Rape/Sexual assault[14]	Self-report[a,b,d]	107,010
Drunk driving[14]	Self-report[a,b,d]	22,140
Burglary[14]	Self-report[a,b,d]	1,722
Arson[14]	Self-report[a,b,d]	46,125
Vandalism	Self-report[a,b,d]	NA
Drug selling[15]	Self-report[a,b,d]	26.46
Probation violation	Self-report[a,b,d]	NA
Juvenile justice services		
Arrest[16]	Self-report[a,b]/records[†††]	4,197
A day's incarceration in prison/jail (male)[17]	Self-report[a]/records[†††]	57.99
A day's incarceration in prison/jail (female)[17]	Self-report[a]/records[†††]	70.49
A day's incarceration in juvenile detention[18]	Self-report[a,b]/records[†††]	118.0
A day under house arrest (with monitor)[19]	Self-report[b]	4.95
A day in a long-term juvenile correctional facility[20]	Self-report[a,c]	44.65
A day under probation[21]	Self-report[b]/records[†††]	30.56
Court hearing (per case)[22]	Self-report[b]/records[†††]	786

Note. NA indicates not applicable. Detailed information corresponding to superscripts are presented in Appendix A.

the 18-month follow-up period. As a first step in this process, outcome measures that can be converted to economic benefits of substance abuse treatment were selected from various assessment instruments and patient records. For the ART study, the following instruments and data sources were used to obtain client-level outcome data: (a) the Service Utilization Interview (Beecham & Knapp, 1995); (b) the National Youth Survey Self-Report Delinquency Scale (Elliott, Ageton, Huizinga, Knowles, & Cantor, 1983); (c) the Adolescent Interview (Center for Treatment Research on Adolescent Drug Abuse [CTRADA], 1998); (d) the Parent Interview (CTRADA, 1998); (e) Miami-Dade County (MDC) Juvenile Justice records (e.g., Criminal Justice Information System Database); (f) MDC public school records; and (g) Florida Department of Children and Family (DCF) records. The measures selected from these instruments and data sources included items within broad outcome categories such as health services use, substance abuse treatment use, education and employment, and criminal activity (see Table 2). Detailed information corresponding to superscripts in Table 2 are presented in Appendix A.

Self-reported information from assessment instruments and abstracted data from client records were equally relied upon when choosing and constructing the outcome variables presented in Table 2. Relying on both of these data sources allowed us to minimize possible misreporting of these activities (see middle column in Table 2).

After selecting appropriate outcome measures, these items can then be valued in dollar terms via monetary conversion factors. Table 2 presents a set of possible monetary conversion factors that correspond to outcome measures chosen for the benefit estimation of the ART study (adjusted to 2001 dollars, the benchmark year for the study). Thirty-five distinct economically important outcomes are reported in nonpecuniary units and therefore require monetary conversion factors. These variables are considered economically important treatment outcomes for the ART study based on criteria specified earlier. Taken together, these variables and corresponding monetary conversion factors can later be used to estimate the total benefit of residential and outpatient treatments. Note that the outcomes listed in Table 2 are intended to be suggestive rather than comprehensive. We have presented only those outcomes that are clinically relevant and important for the ART study and could be valued in monetary terms. Examples of other potentially important outcomes for adolescents include teen pregnancy and rates of high school graduation. However, we did not include these measures in Table 2 because of unavailable information and/or the need for a longer follow-up period. The analysis presented here is a short-term benefit–cost analysis (i.e., 18 months postintake). Longer-term outcomes can be explored in our future benefit–cost analysis for the ART study, which will be based on outcome data collected at 24, 36, and 48 months postintake.

Monetary conversion factors were either obtained from the existing literature or estimated with available data and simulation models. Specific details regarding the monetary conversion factors and the outcome valuation process are discussed subsequently. Although the monetary conversion factors cited below are specific to the ART study in South Florida, the methods proposed here could be transferred to other locations or interventions.

5.2.1. Medical services

The costs of one medical doctor's office visit ($77.62), emergency department visit ($1,060), inpatient hospital day ($1,161), and outpatient hospital visit ($139.5) were based on Miami, Florida-specific fees for these services as compiled and reported by the American Medical Association (2001) and American Hospital Association (2002). The cost of one dental office visit ($16.00) is equal to the fee for a comprehensive oral evaluation as determined by Florida Medicaid (2001). Because the ART sample consists of adolescents, future efforts in outcome valuation will attempt to obtain unit costs for medical services from a medical database that contains health services use and cost information for adolescents treated in a community hospital, such as the Jackson Memorial Hospital in Miami, Florida.

5.2.2. Mental health/substance abuse services

The costs of one psychiatrist's office visit ($159.0), psychologist's office visit ($91.01), counselor's office visit ($85.91), outpatient psychiatric hospital visit ($110.3), and inpatient psychiatric hospital day ($456.0) were based on fees reported by the Florida Department of Health and Rehabilitative Services (2002). These costs are applicable to children's substance abuse/mental health programs in the state of Florida. Furthermore, the DCF, the largest provider of publicly funded adolescent substance abuse treatment in South Florida, uses these rates when providing/contracting substance abuse/mental health services for children in South Florida. Administrators and licensed social workers at the DCF advised that the rates reported earlier are reliable and used by the districts to set rates with each of their providers.

5.2.3. Education and employment

Outcomes pertaining to educational and employment improvements (or decrements) are particularly important for adolescent treatment evaluations. The first outcome measure in this category is a full day's absence from school. Based on the human capital theory in the economics literature (Mincer, 1974), it is assumed that more education will lead to higher future employment earnings, all else equal. Furthermore, the psychology literature consistently shows that education is related to positive mental health, early adult adjustment outcomes, and psychosocial functioning (Kaplan et al., 2001; Noam & Hermann, 2002; Nystom, 1994; Power & Hertzman, 1999; Vagero & Leon, 1994). Predicting the future decrement in earnings for each additional day of schooling missed, however, is not an easy matter. As a starting point for this calculation, the model presented by French et al. (2003) was adopted. Specifically, the cost of a full day's absence from school ($14.78) was calculated using the estimated coefficient of Light (2001) for the wage premium of an additional year of schooling (0.1325) times the average hourly wage rate in the sample ($6.20), inflated from 1986 to 2001 dollars, annualized, and then divided by 180 (the number of days in a school year). Although this estimate is not conceptually ideal for the ART sample because Light's sample of adolescents (well educated, middle class parents) is not congruent with the cohorts from the ART study (urban, less educated, lower middle class or poor, primarily Hispanic), it is nonetheless the best available estimate at the present time. Future research will attempt to improve the generalizability and reliability of this value.

A day's suspension from school and a day's expulsion from school (without alternative school) were also valued at $14.78. Because an adolescent does not attend school the day he or she is suspended from school, he or she also incurs a full day's absence from school. A full day's absence is also implied for an individual who is expelled from school and is not transferred to an alternative school. At times, alternative schools are available for misbehaving students who are expelled from a regular school. Alternative schools are similar to regular schools in many ways (i.e., food and transportation services offered, security, personnel); however, they have a smaller student/teacher ratio (15:1) than do regular schools (35:1).

The cost of a day's expulsion from school (with alternative school) was valued at $67. This value represents the incremental daily cost of attending an alternative school relative to a regular school. Alternative schools are more costly than regular schools are mainly because alternative schools serve fewer students than do regular schools. Consequently, there are fewer students to absorb the fixed alternative school costs.

Parental outcome measures are also particularly important for adolescent treatment evaluations because parents/guardians incur significant costs associated with adolescent substance abuse and often play key roles in the treatment process. The cost of a day's absence from work or school by a family member was set equal to the average daily wage rate in 2001 for the ART sample (parents; $95.83).

5.2.4. Criminal activity

Unit cost estimates of various criminal acts were obtained from Miller, Cohen, and Wiersema (1996) and Rajkumar and French (1997). Unit cost estimates are available for the following crimes: assault ($11,562), robbery ($9,840), theft ($455), murder ($3,616,200), motor vehicle theft ($4,674), rape/sexual assault ($107,010), drunk driving ($22,140), burglary ($1,722), arson ($46,125), and

drug selling ($26.46). These unit cost estimates include criminal justice system costs, crime career costs, and costs to crime victim(s) (tangible and intangible) for each type of act, adjusted for inflation to 2001 dollars. Although these estimates of the costs of crime are not based on an adolescent sample, the cost estimates should only vary slightly by the age of the offenders. It is the quantity and types of crimes that may show greater variation by age. Because the available cost estimates for criminal activity are based on an adult sample, cost estimates for criminal acts more commonly associated with adolescents (e.g., vandalism, probation violations) are not yet available to be presented in this document. Efforts to obtain unit cost estimates for these adolescent-related criminal acts will be initiated shortly by conducting a comprehensive search of juvenile justice data sources and then developing estimation algorithms similar to the ones used in earlier crime cost studies (Miller et al., 1996; Rajkumar, & French, 1997).

5.2.5. Juvenile justice services

The costs for a single arrest ($4,197), a day's incarceration in juvenile detention ($118), a day under house arrest ($5), and a day in a long-term juvenile correctional facility ($45) were based on the Florida-specific costs of these services as estimated and reported by the Florida Department of Juvenile Justice (2000, 2001, 2002), updated to 2001 dollars where necessary. The single arrest cost includes both law enforcement costs and Juvenile Assessment Center (JAC) costs. The MDC JAC is a centralized processing, referral, and evaluation center for all juveniles arrested in MDC and thus constitutes an important component of the total arrest cost per case. The cost of a day in a long-term juvenile correctional facility was obtained by calculating the average annual program cost from a total of nine long-term, residential, juvenile correctional facility programs throughout the state of Florida that the ART participants attend and then dividing by 365 days to obtain a daily cost.

The costs of a day's incarceration in prison/jail—$57.99 for males and $70.49 for females—and a day under probation ($30.56) were based on the Florida-specific costs of these events as estimated and reported by the Florida Department of Corrections (2001). The total per-day cost of these events included operations, health services, and education services (and the indirect administrative costs of these three components).

The monetary conversion factors cited earlier for arrest, incarceration, detention, house arrest, and probation pertain to juveniles within the Florida juvenile justice system and are based on statewide (Florida) published data. Given that our sample of substance abuse treatment clients came from MDC, we will undertake efforts to obtain monetary conversion factors that are specific to this area. As a starting point, for example, the cost of a court hearing ($786) was estimated by soliciting juvenile court cost data from key informants at the Administrative Office of the Courts (Eleventh Judicial Circuit of Florida, Miami-Dade Juvenile Division). This cost estimate includes the sum of juvenile operational court costs associated with delinquency for fiscal year 2001 divided by the number of delinquency petitions filed for that year (Supreme Court of Florida, 2001).

As noted earlier, future applications of these methods should obtain monetary conversion factors that apply directly to the specific sample(s) being evaluated and the location(s) of the intervention.

6. Challenges and limitations associated with proposed guidelines

Before explaining some of the potential challenges associated with the economic analysis of adolescent treatment, we will highlight the progress that has been made in estimating the costs and benefits of treatment delivery. For example, the recent development of the DATCAP family of instruments (www.DATCAP.com) constitutes an important contribution to cost and benefit–cost research (e.g., Bradley, French, & Rachal, 1994; French, Bradley, Calingaert, Dennis, & Karuntzos, 1994; French, Dunlap, Zarkin, McGeary, & McLellan, 1997; McCollister & French, 2002; Salomé & French, 2001). However, the DATCAP has, thus far, primarily been applied to adult substance abuse programs. Recently, however, the DATCAP was successfully administered in several outpatient adolescent programs (French, Roebuck, et al., 2002). Future studies are planned to further test the DATCAP for administration in adolescent programs and to develop and test a caretaker DATCAP to address the costs incurred by parents, guardians, and other directly affected individuals when an adolescent participates in addiction treatment.

Despite the progress made in cost estimation, benefits estimation procedures, such as the dollar valuation of adolescent substance abuse treatment outcomes, remain largely unexplored. Significant progress has recently been made in benefits estimation with regard to adult treatment programs (French, Mauskopf, Teague, & Roland, 1996; French, Salomé, & Carney, 2002; McCollister, French, Prendergast, et al., 2003; McGeary, French, Metsch, & McCoy, 1997), but the process of selecting outcome measures from adolescent-specific assessment instruments and converting them into economic benefits of adolescent treatments has only recently been attempted with a few outpatient marijuana treatment programs for adolescents (i.e., the guidelines and recommendations offered here add to the growing foundation of economic evaluations of adolescent programs; many more applications are necessary to test and improve these methods).

Several studies have addressed the valuation of criminal activity outcomes. For instance, Miller et al. (1996) estimated victim costs (tangible and intangible) for a variety of individual criminal acts. Rajkumar et al. (1997) also

provided crime cost estimates. These unit cost estimates, however, pertain solely to adult criminal activity. Although the unit costs for criminal activity outcomes may show minimal variation by the age of an offender, the quantity and types of crimes show greater variation by age. For example, adult-related criminal activities include more acts of assault, robbery, theft, murder, and rape/sexual assault whereas adolescent-related criminal activities include more acts of vandalism, minor theft, and gang-related violence. For this reason, monetary conversion factors for criminal acts more commonly associated with adolescents (e.g., vandalism and probation violation) are pending future analyses.

As a substitute for estimating crime-related economic benefits of adolescent substance abuse interventions, investigators can obtain dollar estimates (monetary conversion factors) of juvenile justice services (e.g., arrest, detention, probation, court hearing). For the economic analysis of the ART study, both domains (criminal activity and juvenile justice services) are valuable for our planned analyses but should not be included simultaneously in the calculations owing to the potential for double counting (or overestimating) crime-related benefits. Both domains are valuable, however, because each allows us to analyze the economic impact of adolescent treatment from a different perspective (e.g., societal perspective, criminal justice perspective).

Most economic evaluations conducted with adults offer few suggestions on how to value educational outcomes for adolescent programs (e.g., school absenteeism, school expulsion) because such outcomes are usually not pertinent for adult programs. Improvements in these outcomes, however, represent an important economic benefit of adolescent treatment.

Many economic studies in the adult substance abuse literature value employment outcomes based on income or wage improvements. For the ART study, prevention of a day's absence from school for a student or from work for a family member was valued in this fashion. However, the calculations for reduced school absenteeism require numerous assumptions because adolescent students are typically not working and earning a salary. Thus, predicting future earnings improvements or declines is the intent of these exercises. Ideally, the estimated future decrement in earnings for each additional day of schooling missed would be observed directly from educational data and labor market outcomes (measured at later follow-up periods) collected from the ART sample. Unfortunately, many of the participants in the intervention are not part of the conventional labor market and/or may not enter the labor market soon after graduating from high school. Another issue is that very few research projects follow adolescent subjects into their young adult years, when labor market outcomes could be measured. In the future, it may be possible to address this question empirically with data from an ongoing study of the long-term outcomes of the ART sample, which follows these adolescents for 4 years past their entry into treatment.

In the absence of longitudinal data from long-term follow-up studies, the public health service recommends the use of mathematical models and secondary data sources to estimate employment and earnings profiles (Torrance, Siegel, & Luce, 1996). For example, mathematical models can be used to predict the labor market benefits (i.e., increased future earnings) of substance abuse interventions on the basis of observed adolescent information such as demographics, substance use, and educational attainment. Although the model adopted by the ART study does not fully represent all of the adolescent participants, it is nonetheless the best available estimate at the present time. This estimate was derived from a study with several notable strengths (Light, 2001), including the collection of multiple years of data from the same cohort and good measures of schooling, in-school work experience, and wages. The impact of reduced school absenteeism on overall economic benefit may take years to manifest and may even turn out to be relatively small. Nevertheless, educational outcomes could represent an important indirect benefit of treatment, as school attendance and involvement in prosocial activities are two of the strongest predictors of substance abuse activity (Hawkins, Catalano, & Miller, 1992). School-related variables are a core target of the MDFT (Liddle, 2002a, 2002b), and this approach is one of the few adolescent treatments that have reported success not only in reducing drug outcomes but also in increasing teenagers' functioning in school (Liddle et al., 2001; Liddle, Henderson, Dakof, & Rowe, 2005).

Regarding assessment instruments used for adolescent research, it is sometimes necessary to augment these clinical instruments with other measures to capture the range of economic effects of substance abuse treatments. As part of the proposed guidelines in this article, we have identified important and quantifiable outcome variables for adolescent substance abuse interventions, as contained in standardized instruments, and have documented the process for translating those variables into dollar equivalents. Research efforts will be initiated in the future to improve adolescent instruments and thereby collect additional measures that are necessary to complete a full economic evaluation.

This list of challenges and limitations is certainly not exhaustive. Furthermore, additional issues are likely to emerge as more empirical economic evaluation studies are initiated. Indeed, the investigative team intends to address and possibly even resolve some of these challenges and limitations in a future economic analysis of the ART study. Hopefully, the methodological guidelines, discussion of economic analysis challenges/issues, and recommendations set forth in this article will aid policymakers, adolescent treatment researchers, directors, and evaluators by providing a foundation for future economic studies on adolescent substance abuse treatments. Although the focus of this article is on substance abuse treatment, the guidelines given can also be applied to other types of interventions (e.g., prevention, school-based initiatives, drug courts).

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Appendix A. Descriptive information corresponding to superscripts in Table 2

Symbol	Description
a	Service Utilization Interview – Adolescent and Parent (Beecham & Knapp, 1995)
b	Adolescent Interview (CTRADA, 1998)
c	Parent Interview (CTRADA, 1998)
d	National Youth Survey – Report Delinquency Scale – Adolescent (Elliott et al., 1983)
†	State of Florida Department of Children and Family records
††	MDC public school records
†††	Criminal Justice Information System database
1	Miami, Florida-specific fee for an office consultation with a new or established patient, which requires a detailed history, a detailed examination, and medical decision making of low complexity (American Medical Association, 2001)
2	Florida-specific fee for a comprehensive oral evaluation (Florida Medicaid, 2001)
3	Miami, Florida-specific physician fee for 3 hours of critical care, evaluation, and management of unstable critically ill or unstable critically injured patients, requiring the constant attendance of a physician and including the following medical services: interpretation of cardiac output measurements, chest X-rays, gastric intubation treatment, temporary transcutaneous pacing, ventilator management, and vascular access procedures (American Medical Association, 2001)
4	Represents the average cost for 1 inpatient day in a community hospital in the state of Florida (American Hospital Association, 2002)
5	Miami, Florida-specific fee for a visit to a hospital for the evaluation and management of a patient, including admission and discharge on the same date, which requires a detailed history, a detailed examination, and medical decision making of low complexity (American Hospital Association, 2002)
6	Florida-specific cost of 1/2 hour of primary medical care, therapy, and medication administration to improve the functioning or prevent further deterioration of persons with mental health or substance abuse problems. Included is psychiatric mental status assessment. Applicable to children's substance abuse/mental health programs (Florida Department of Health and Rehabilitative Services, 2002)
7	Florida-specific cost for 1 hour of contact in a therapeutic environment that is designed to improve the functioning or prevent further deterioration of persons with mental health and/or substance abuse problems. Applicable to children's substance abuse/mental health programs (Florida Department of Health and Rehabilitative Services, 2002)
8	Florida-specific cost for 1 hour of assessment, evaluation, and assistance to individuals and families to determine level of care, motivation, and the need for services and support to assist individuals and families identify their strengths. Applicable to children's substance abuse/mental health programs (Florida Department of Health and Rehabilitative Services, 2002)
9	Miami, Florida-specific fee for individual psychotherapy—insight oriented, behavior modifying, and/or supportive, with medical evaluation and management services—in an inpatient hospital, partial hospital, or residential hospital (American Medical Association, 2001)
10	Florida-specific cost for 1 day of inpatient services provided in a hospital (general hospitals or psychiatric specialty hospitals). Services include intensive treatment to persons exhibiting violent behaviors, suicidal behavior, and other severe disturbances owing to substance abuse or mental illness. Applicable to children's substance abuse/mental health programs (Florida Department of Health and Rehabilitative Services, 2002)
11	Represents the cost of a day's absence from school. Calculated using the estimated coefficient for the wage premium of an additional year of schooling (0.1325) times the average hourly rate in the sample ($6.20), inflated from 1986 to 2001 dollars, annualized, and then divided by a 180-day school year (Light, 2001)

12 Florida-specific daily cost of attending an alternative school. This value represents the incremental daily cost of attending an alternative school relative to a regular school. The cost to attend an alternative school was obtained by calculating an average annual cost per FTE from a total of seven alternative schools throughout the state of Florida that the ART participants typically attend ($17,657) and then dividing by a 180-day school year to obtain a daily cost ($98). The cost to attend a regular school was obtained by calculating the average annual cost per FTE from two randomly selected regular schools throughout the state of Florida that the ART participants typically attend ($5,527) and then dividing by a 180-day school year to obtain a daily cost ($31)

13 Represents the average daily wage rate in 2001 for the ART sample (parents)

14 Victim costs (tangible and intangible) by type of crime, inflated from 1993 to 2001 dollars (Miller et al., 1996)

15 Actual cost for a drug law violation, inflated from 1992 to 2001 dollars (Rajkumar & French, 1997)

16 Florida-specific law enforcement costs (includes arrest costs and processing activities performed at the JAC) per arrest, inflated from 1998 to 2001 dollars. Estimated law enforcement expenditures for traffic operations and crime prevention activities were subtracted (Florida Department of Juvenile Justice, 2000)

17 Florida-specific inmate cost per day for a female and male youthful offender, including operations cost, health and education services costs, and indirect administrative costs (Florida Department of Corrections, 2001)

18 Florida-specific cost of a day's incarceration in juvenile detention (Florida Department of Juvenile Justice, 2002)

19 Florida-specific cost of a day under house arrest (with a monitor; Florida Department of Juvenile Justice, 2002)

20 Florida-specific cost of 1 day in a long-term juvenile correctional facility. The cost was obtained by calculating an average annual program cost from a total of nine long-term, residential, juvenile correctional facility programs throughout the state of Florida that the ART participants attend and then dividing by 365 days to obtain a daily cost, inflated from 2000 to 2001 dollars. Program costs consist of Department of Juvenile Justice total annual expenditures for each particular program divided by the number of youth completing the program during the year (Florida Department of Juvenile Justice, 2001)

21 Florida-specific inmate cost per day at a probation and restitution center (Florida Department of Juvenile Justice, 2001)

22 Miami, Florida-specific total juvenile circuit court cost per case filed. The court cost is based on the sum of juvenile operational court costs associated with delinquency for the fiscal year 2001 divided by the number of delinquency petitions filed for that year (Supreme Court of Florida, 2001)

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