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Economic Evaluation of Adolescent Addiction Programs: Methodological Challenges and Recommendations

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Abstract

This paper identifies and describes several methodological challenges encountered in economic evaluations of substance abuse interventions for adolescents. Topics include study design, the choice of perspective, the estimation of costs and outcomes, and the generalizability of results.

Recommendations are offered for confronting these challenges using examples from adolescent addiction research.

Keywords

adolescent addiction; substance abuse programs; economic evaluation; costs; benefits

Introduction

In contrast to the extensive literature evaluating the clinical effectiveness of adolescent substance abuse treatment (SAT) [1–10], only a small number of studies have evaluated these programs from an economic perspective. The limited economic evaluation research in this area is surprising, given the important role economic evidence can serve. The presence of limited funding mechanisms has been identified as one of the main challenges in the delivery of adolescent SAT [11], and only 8.7 percent of the 2.1 million adolescents aged 12 to 17 in the United States who needed illicit drug or alcohol treatment received it in 2006 [12]. In conjunction with clinical outcomes, economic evaluation can provide essential information about whether health care resources invested in a particular intervention are being employed efficiently [13]. Results can help determine the most appropriate funding levels to maximize benefits for the greatest number of recipients.

One possible reason for the small number of economic evaluations of adolescent SAT is that adapting economic evaluation techniques designed for traditional health care programs, which frequently involve pharmacological interventions and adult populations, introduces several methodological challenges. In 2005, the National Institute on Drug Abuse (NIDA) provided funding to develop standardized methods to estimate the economic costs and benefits of adolescent SAT and to add an economic evaluation component to several ongoing projects in

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six states. Another grant objective was to enable clinical and economic investigators to collaborate in developing economic evaluation modules to collect data and measures needed for economic analyses. Although the sites included disparate programs, the investigative team encountered a number of common methodological challenges when retrofitting existing studies.

With this backdrop and motivation, the present paper has several objectives. First, it provides an overview of economic evaluation, addressing its application in health care generally and the various types of economic evaluations that can be applied to health care interventions. A comprehensive literature review was conducted, identifying several economic evaluations of adolescent SAT (Tables 1 and 2). After reviewing the limited literature, we distinguish between economic evaluations of adolescent SAT and traditional health care programs, focusing on several methodological challenges encountered in any economic evaluation of adolescent SAT. For each of these challenges, we offer recommendations based on examples from the literature review and the experience with the multi-site grant noted earlier. Finally, we review the implications for clinical and adolescent researchers and provide a list of key research guidelines (Table 3).

Overview of Economic Evaluation Methods

Economic evaluation is broadly defined as “the comparative analysis of alternative courses of action in terms of both their costs and consequences” [13]. In adolescent SAT, an enhanced therapy might be compared to usual services or an older therapy. As the comparison of treatments in an economic evaluation requires data on efficacy or effectiveness, data obtained from clinical trials or quasi-experimental designs are supplemented with economic data. *Trial-based* studies are economic evaluations conducted alongside, or concurrently with, a given clinical trial. In other instances, economic evaluations are undertaken based on a synthesis of data from a range of sources. These *modeling studies* employ decision-analytic or epidemiological models.

The economic costs for various treatments include the value of all resources invested in a program, which is much broader than accounting costs or direct expenditures. The perspective adopted by an economic evaluation will determine which costs and economic benefits are considered. While some economic evaluations consider a narrow perspective (e.g., health care system), others adopt a broader societal perspective, accounting for costs and benefits that affect patients, family members, government agencies, educational and criminal justice systems, insurance companies, and the broader economy. This is especially relevant for adolescent SAT, due to the widespread consequences and costs of substance use on various sectors of the economy (e.g., criminal justice system, schools).

In some cases, a *partial economic evaluation* is conducted that only focuses on costs or outcomes or that does not compare two alternative treatments [13]. This section will briefly discuss the main types of *full economic evaluations* accounting for costs as well as consequences [13]. Drummond et al. (2005) provide a more detailed source for the economic evaluation of health care programs.

A *cost-effectiveness analysis* (CEA) compares costs to a primary outcome and estimates the “cost per unit of effect” or the “effects per unit of cost.” The choice of units of measurement depends on the clinical question being studied [13]. Interpreting results from a CEA can be challenging, particularly because a therapy may be superior for certain outcomes, requiring decisions about the relative value of each outcome. To avoid this dilemma, analysts sometimes resort to *cost-consequences analyses*, whereby a range of different consequences are presented to the decision-makers, who then make an overall assessment based on the outcomes they value most highly.

Another possibility is to combine the various consequences into a single generic measure of health improvement. In a *cost-utility analysis (CUA)*, health states are valued relative to one another through the use of health state preference values or health *utilities*. As such, the superiority of one therapy over another can be expressed in terms of the quality-adjusted life-years (or QALYs) gained. QALYs incorporate changes in mortality and morbidity, and may be compared across studies [13].

The aim of a *benefit-cost analysis (BCA)*, the broadest form of economic evaluation, is to determine whether an intervention is justified by comparing total benefit with total cost. In this type of evaluation, a societal perspective is often adopted, a range of consequences and outcomes are included, and all values are expressed in monetary units.

Use of Economic Evaluation Methods in Adolescent SAT

An extensive literature review was conducted using the Web of Science, Econ Literature Index, and Google Scholar (keywords “adolescent,” “substance abuse treatment” or “addiction treatment”, and “cost” or “economic evaluation”) to identify economic evaluations of adolescent SAT. Sheidow and colleagues [14] and the Fort Bragg Demonstration Project [15, 16] included adolescents with and without substance use disorders. Tables 1 and 2 present the full list of 12 studies from this review.

Several types of economic evaluations have been used with adolescent SAT. The most common form is partial evaluation [15–22], followed by CEA [7,14,23,24]. Outcomes in the CEAs included day of abstinence, client in recovery, percentage point decrease in days of marijuana use, and one-unit decrease in a delinquency score [7,23]. French et al. [25] and Schoenwald et al. [26] performed the only published BCAs of adolescent SAT. The literature review did not identify any CUAs of adolescent SAT programs.

Methodological Challenges Posed by Adolescent SAT

The small number of economic evaluations of adolescent SAT conducted may reflect the methodological challenges inherent to this type of research. These complexities primarily stem from the characteristics of adolescent clients and the far-reaching consequences of SAT.

Adolescence is a period of dramatic emotional, physical, familial, and economic change [27]. Substance misuse may represent one of many developmental adolescent problems, which complicates the delivery of appropriate and effective services. Adolescents may have low internal motivation to attend SAT, particularly if they do not view their behavior as a problem, and many are required to attend treatment by the courts or their parents.

Unlike most health care interventions that primarily target a single person, with benefits accruing to the patient alone, the outcomes of adolescent SAT extend to numerous sectors of society beyond the patient, family, and health care system. Aarons and colleagues [28] estimated the prevalence of substance use disorders among adolescents in five sectors of care. Rates of substance use disorders were high in the following service sectors: alcohol and drug (82.6%), juvenile justice (62.1%), mental health (40.8%), school based services for youths with serious emotional disturbance (23.6%), and child welfare (19.2%). Based on this study, an adolescent participating in SAT funded by their insurance company would likely produce benefits for the health care system as well as the criminal justice system, school system, and child welfare programs. In economics jargon, the improvements in the criminal justice, school, and child welfare sectors would be considered *positive externalities*, because the benefits are experienced by parties other than the consumer (adolescent in SAT) or producer (insurance company) of a good or service (SAT) [29]. Ignoring the positive externalities in an economic evaluation may underestimate the program’s benefits, while overlooking any negative

externalities may underestimate the program's costs. One challenge associated with evaluating adolescent SAT is capturing all the relevant externalities.

Although some methodological issues are specific to the type of evaluation (e.g., CEA, BCA) being conducted, several underscore all economic evaluations of adolescent SAT. The next sections will discuss key methodological challenges related to study design, the choice of perspective, the estimation of costs and outcomes, and the generalizability of study results.

Selecting a Study Design and Follow-up Period

As noted earlier, economic evaluations are sometimes conducted alongside an existing clinical trial or quasi-experimental study. In the case of the multi-site grant, the investigative team worked with existing clinical studies of adolescent SAT programs to add an economic evaluation module. Since choices regarding the study design and the length of follow-up period were already decided by the core research team who initially designed the study, economic evaluation plans had to adapt to these conditions.

Double-blinded randomized controlled trials (RCTs) have traditionally been regarded as the strongest design for estimating relative treatment effects in epidemiology, health services research, and medicine [30–32]. In Table 1, over half of the economic evaluations were based on clinical studies that randomized adolescents to at least two different treatment conditions. Although adolescent SAT studies have used randomization to compare a new or enhanced treatment to the standard of care or usual services, other elements of the double-blinded RCTs are not entirely appropriate for adolescent SAT. RCTs in adolescent SAT have not used a no-treatment control group, since withholding care is ethically inappropriate and can result in serious consequences [1,7,33–35]. In addition, RCTs require significant funding and oversight, and it may not be possible to ensure all treatment options are available in a given location. Finally, masking patients, health care providers, or assessors may be more difficult when a non-pharmacological intervention is being assigned, and inadequate blinding can lead to biased estimates [36].

Many adolescent SAT studies have relatively short follow-up periods due to the high cost of collecting long-term data, the increased rates of non-response by subjects, and the desire of stakeholders for quick answers. A few clinical studies in the literature have had follow-up periods for up to four years [1,37], but economic evaluations have not been conducted beyond 18 months and most have had a follow-up period of 12 months or less (Table 1). Selecting an appropriate follow-up time for adolescents is critical because of the developmental changes during this period [27]. For example, marriage often coincides with decreases in substance use, while college enrollment may increase the risk of relapse. If the follow-up period is too short, estimation results may not capture the various trajectories adolescents can follow after treatment [37–39], failing to assess whether the immediate effects of treatment (e.g., decreased substance use) necessarily lead to other desirable longer-term outcomes (e.g., high school graduation). These benefits may increase over time and would be missed in an evaluation with a follow-up period of only one year. French and colleagues [23] did not identify many statistically significant differences in substance use and delinquency outcomes across four adolescent treatment interventions, perhaps because of the short follow-up period of seven months.

On the other hand, studies with follow-up periods of several years may make it difficult to determine whether positive outcomes are the result of the original intervention, subsequent treatment episodes, or unrelated developmental changes. Most with substance abuse receive three to four treatment episodes over many years before achieving sustained abstinence [40]. If so, an adolescent may be exposed to multiple interventions over subsequent years. In the 30 months following one intervention, 20 percent of the adolescent sample spent significant time

in a controlled environment, such as juvenile detention or residential treatment [38]. Although adolescents in these settings may be abstinent, it is possible that their substance use behavior reflects their current environment, rather than the effect of treatment per se.

Small changes to the design of an adolescent addiction intervention can address certain concerns and preserve the strengths of a RCT. Although it might seem unrealistic to blind therapists or clients in RCTs of behavioral interventions, individuals performing the assessments can be blinded to reduce bias. For example, Liddle and colleagues [34] used clinician raters who were blind to treatment condition and phase of assessment (whether they were at follow-up or intake) to rate drug use severity. Additionally, instead of randomizing individual subjects to treatment conditions, cluster randomization, where treatment centers are randomized, can be used [41]. If possible, the treatment group can be compared to a natural control group, such as patients on a wait list for an intervention [42], rather than a no-treatment control group.

Alternative study designs become necessary when randomization is not practical, ethical, or economically feasible. As seen in Table 1, several economic analyses were based on studies with an observational or quasi-experimental design [15–17,20–22]. Evaluators of the Fort Bragg Demonstration project used a quasi-experimental design to compare mental health expenditures for patients aged 5–17 at the Demonstration (continuum of care) with those at two comparison sites (where services were reimbursed by the Civilian Health and Medical Program of the Uniformed Services). In observational studies such as the Fort Bragg project, unobservable variables (e.g., health status) could jointly influence the decision to receive treatment and the outcome(s) of interest [43,44]. Econometric methods such as propensity score matching, fixed-effects models, and instrumental variable techniques can be used to try to reduce this type of bias. In their partial evaluation, Balsa and colleagues [20] used instrumental variables to analyze whether treatment initiation was associated with several behavioral and clinical outcomes, since simple multivariate models failed to account for selection into treatment based on differences in severity, motivation, or other unobserved factors. Results indicated that selection bias is an important concern when evaluating observational studies.

Sophisticated modeling can also be used to address concerns associated with the length of the follow-up period. If a follow-up period is shorter than desired, researchers can use modeling to extrapolate information beyond the clinical trial to later endpoints [45]. This approach has not been used in adolescent SAT, but epidemiological data from long-term observational studies in other health care areas have been used to model survival or other outcomes beyond the follow-up period [46]. In order to apply this approach to adolescent SAT, research funds should be invested in collecting long-term observational data with standardized measures that will be useful in modeling the long-term impacts of adolescent SAT. Furthermore, modeling can address some of the concerns associated with very long follow-up periods by taking into account developmental transitions, time in controlled environments, and exposure to other treatment interventions. Besides standard outcome data, researchers should ensure that follow-up interviews collect information on all types of service delivery and living arrangements that could affect substance use.

Choosing the Perspective for an Economic Evaluation of Adolescent SAT

As mentioned earlier, the analysis perspective can profoundly impact the costs and outcomes that are included in an economic evaluation. A narrow perspective might only consider the direct impact of a program on the funding agency. This approach would perhaps be appropriate to evaluate a therapy to treat Type I diabetes among adolescents, whereby an economic evaluation focused on the health care sector would capture the vast majority of program costs and benefits. When a primary outcome related to the patient's health status is easy to identify, the program's success can be assessed based on this outcome. This is not necessarily the case

for adolescent SAT programs, however. Reductions in substance use can generate significant, long-term positive externalities for the adolescent's family and other sectors of society (e.g., employers and school, criminal justice, and health care system). With a narrow perspective, an economic evaluation of adolescent SAT may overlook important outcomes with significant economic benefits, especially if adolescents improve in certain areas but not others.

Two studies from Table 2 discussed broadening their perspective beyond the health care system. The original evaluation of the Fort Bragg Demonstration project was conducted in 1995 and based on the perspective of its sponsor, the U.S. Department of Defense. Results indicated that expenditures on mental health services for young children and adolescents at the Demonstration were substantially higher than at the comparison sites. Critics believed these results reflected the narrow perspective of the original analysis. Foster and Bickman [16] re-analyzed the data and included utilization of mental health services outside the main catchment areas, utilization of medical services by children and adolescents, and expenditures on mental health services by other family members. Although the differences in expenditures between those at the Demonstration and comparison sites were narrower after including this information, total family expenditures were still higher at the Demonstration site. Schoenwald and colleagues had a similar experience in their economic evaluation comparing multi-systemic therapy (MST) to usual services [26]. The difference in the total costs per youth between MST and usual services was \$1,695 (costs for MST were higher). After accounting for the decrease in incarceration days, the total cost per youth for MST was still higher than for usual services, but the difference narrowed to \$877.

In some instances, the sponsor of the economic evaluation may only be interested in a narrow perspective, but the analysis' perspective should be made clear when reporting results. In evaluating adolescent SAT, a wider perspective is preferable because of the nature of adolescent SAT and the important externalities. The choice of perspective defines which costs and outcomes will be included in an economic analysis. The estimation of these costs and outcomes will be discussed next.

Estimating Costs Incurred by Multiple Parties

The direct resources invested in adolescent SAT services include those pertaining to the client, caretaker and families, and program. Estimating the opportunity costs incurred by the client, caretaker, and family are especially difficult in evaluations of adolescent SAT. Many adolescents are mandated by the court, school, or their parents to attend treatment, and may not believe they have an addiction problem. The family is often key to the participation in, and success of, many contemporary adolescent addiction interventions, such as Multidimensional Family Therapy (MDFT). Because adolescent clients usually live at home and are dependent on parents/guardians financially, costs to the family may be significant. Assessing only the time and money spent by an adolescent to attend treatment may overlook important costs, such as parental absence from work to assist with and participate in treatment. Although studies from adult SAT offer some guidance for estimating costs, methods need to be adapted to address features specific to adolescents.

The Drug Abuse Treatment Cost Analysis Program (DATCAP) is a standardized and theory-driven instrument that can be used to collect data for personnel costs, supplies, buildings, equipment, contracted services, and other items from SAT programs. DATCAP results from 13 adolescent outpatient programs and 1 residential program indicated that adolescent interventions were more costly than adult programs [18]. On average, adolescents attended treatment for 13 weeks at a cost of \$194 per week and \$2,678 per treatment episode. Other studies have estimated total annual economic costs, average economic cost of a treatment episode, and average weekly cost per client for adolescent SAT [19,22,23,47] (Table 2).

Studies of adult SAT have estimated client costs incurred by those in treatment, such as the opportunity cost of time in treatment (e.g., forgone employment) and travel time [48,49]. For adolescent SAT, costs to the family of adolescents in SAT may be more relevant than client (i.e., adolescent) costs. Evaluators should design data collection forms or utilize existing instruments to collect these data. For example, French and colleagues [25] measured the days a parent missed work or school in addition to the time missed by adolescents in the CYT study. Another possibility would be to design an instrument for parents/guardians of adolescents in treatment similar to the Significant Other Survey, measuring the health, financial, legal, relationship, and emotional problems experienced by partners of adults with substance abuse problems [50]. In this regard, the Caregiver DATCAP is part of several on-going adolescent addiction studies (www.DATCAP.com).

Researchers in the adolescent addiction field could set the standard for other health care researchers in conducting a comprehensive assessment of treatment-related costs. The intervention studies currently being conducted could generate a rich data source concerning costs outside the health care sector, specifically those affecting the family, which plays a crucial role in the delivery and effectiveness of adolescent interventions.

Estimating Benefits for Multiple Parties

Although clinical evaluations of adolescent addiction interventions generally focus on measures of abstinence or reduced substance use as the primary outcome [4], more have begun to evaluate the effects of adolescent SAT on schooling, family problems, health care utilization, and psychological adjustment [1,2,6,51]. With adolescent SAT, certain sectors (e.g., health care) may bear the majority of costs, although most of the benefits accrue to other sectors (e.g., criminal justice), as seen in the study by Balsa and colleagues [20]. Results of this study suggest that initiating treatment affects schooling and employment, domains beyond the sphere of the managed care organization that provided the treatment. Even if reductions in substance use are not sustained, there may be improvement in other areas [52]. Likewise, reduced substance use may not by itself generate a positive economic result if other outcomes do not improve. Cohen estimated that the typical heavy drug user generates \$370,000–\$970,000 in external costs to society [53]. Consequently, preventing high risk youth from lifetime drug use can result in substantial economic benefits. Because of the widespread consequences of adolescent substance abuse, economists must decide which treatment outcomes to measure and how to value them.

When applied to adolescent SAT, the economic evaluation methods discussed earlier each have strengths and weaknesses. CEAs are best suited for interventions that have one clear goal or several secondary outcomes that are strongly related to the primary outcome [13,54]. Although several studies in Table 2 conducted a CEA, adolescent SAT is fundamentally a multi-outcome intervention. Thus, the economic merits of a program will depend on the outcome selected for the CEA [54]. Balsa and colleagues examined the effects of treatment initiation on substance use, schooling, criminal activity, and employment [20]. No significant effects on criminal activity were found, but treatment initiation was associated with positive effects on the other outcomes. Had a CEA been conducted with criminal activity as the primary outcome, the authors would have concluded the intervention was not cost-effective. For this reason, several cost-effectiveness ratios should be estimated to assess multiple outcomes [23]. The decision-maker can then rank the importance or value of each outcome and apply these rankings to the cost-effectiveness ratios. If the perspective of the evaluation leads to only one outcome, a CEA may be more appropriate and efficient. French et al. discuss other methodological challenges in conducting a CEA of adolescent SAT interventions [23].

The use of QALYs in a CUA of adolescent SAT overcomes some of the limitations of a CEA because QALYs are a generic measure of health gain [13]. To our knowledge, a CUA of

adolescent SAT has yet to be conducted. Economists have begun to use QALYs to evaluate other adolescent programs, such as treatments for depression, but these studies have relied on utility weights for adults [55,56]. Some question whether this approach can be applied to addiction interventions for adolescents. The formal consideration of preferences of adolescents with substance abuse and the subsequent calculation of QALY gains may be qualitatively different from valuing the QALY gains from other interventions. QALYs do not typically capture the benefits in other domains or the effects on individuals other than the client in treatment, although, in principle, the QALYs experienced by others (e.g., family members) could also be measured.

A BCA is best suited to measure the externalities associated with adolescent SAT because it includes a wider range of outcomes. Outcomes are first selected from an assessment instrument designed for SAT programs, such as the Global Appraisal of Individual Needs (GAIN) [19, 25]. One challenge with an instrument like the GAIN is that measures may be more applicable for clinical evaluations, making it difficult to convert them to economic benefits. In their BCA of the CYT study, French et al. included the following SAT outcomes: health services utilization, subsequent SAT utilization, education and employment, and criminal activity [25]. For criminal activity, the GAIN only recorded the number of arrests, rather than the number of times adolescents committed individual crimes. Although revisions were made to the GAIN in this area, it is likely that the authors underestimated the true number of crimes and the benefits of treatment.

After selecting and measuring appropriate outcomes for SAT interventions, these outcomes must be converted to dollars or other currency using monetary conversion factors, which are not always readily available for adolescents. McCollister et al. estimated the cost of criminal activity before and after treatment in a juvenile drug court [24]. The study relied on crime cost estimates based on adult criminal activity that incorporated victim costs, crime career costs, criminal justice system costs, and intangible costs related to the victim's pain and suffering. The authors explain that the juvenile justice system and crime career costs are probably different for adults and adolescents. Zavala and colleagues [19] more extensively discuss how to value outcomes.

The solution to these valuation challenges is far from clear. In the short term, a reasonable approach would be to conduct a cost-consequences analysis. Rather than synthesize consequences and costs into one measure, various outcomes can be presented, making it easier for decision-makers to select the outcomes that are most important from their perspective [57].

Allowing for the Context-specific Nature of Adolescent Substance Abuse Interventions

The goal of an economic evaluation is to guide decision-making about the appropriate allocation of scarce resources. If a state drug court program for adolescents produces cost-savings in one state, other states might be interested in adopting a similar program. The wide range of organizations (e.g., school systems, local foundations, criminal justice system, religious organizations) involved in treating adolescents with substance abuse disorders makes it difficult to generalize results from an economic evaluation conducted in a specific setting. Differences in organizational structure, management, clinical practice patterns, and relative prices may lead to variations in costs and benefits across settings, and hence differences in cost-effectiveness and net benefit.

An example of this scenario and its impact on results from an economic evaluation can be seen in the CYT study, which evaluated five outpatient interventions delivered at four sites: Farmington, CT; St. Petersburg, FL; Madison County, IL; and Philadelphia, PA. Treatment costs varied significantly across sites because of cost of living differences, education and

licensure of personnel, and management decisions [7,25,47]. For instance, the site in Philadelphia primarily hired therapists with PhDs and spent more on staff salaries than the other sites, which hired therapists with Master's degrees. Certain sites also used more full time employees to provide therapy, while others employed part-time workers to better manage the workflow.

When estimating costs and benefits, economists should consider the actual setting and use monetary conversion factors specific to the geographic area [25]. The CYT study described above also reveals some potential solutions that can help address this challenge. CYT evaluators collected site-specific monetary conversion factors for health services utilization (e.g., emergency room visit), substance abuse treatment utilization (e.g., intensive outpatient program visit), education and employment (e.g., day missed of school or training), and criminal activity (e.g., day in prison). The value of an emergency room visit ranged from \$189.24 in St. Petersburg, FL, to \$210.39 in Farmington, CT.

Whenever feasible, data should be collected so that covariate adjustments pertaining to the site can be included in the analysis. A rigorous sensitivity analysis can account for uncertainty in the underlying assumptions and factors associated with location [58,59]. These considerations may be more numerous and complex in evaluations of adolescent SAT, compared to other interventions, to account for regional variation related to organizations that interact with adolescents at a local level.

Summary

This paper has highlighted the various economic evaluation techniques that can be used to study adolescent addiction interventions. Although the numbers are small, we organized all of the existing economic analyses of adolescent SAT into summary tables that can be used as a reference guide. Further, we defined and discussed some common methodological challenges that are encountered in any economic evaluation of adolescent SAT, along with corresponding recommendations. A summary of our recommendations can be found in Table 3. The list of methodological challenges outlined above is not exhaustive and other issues (e.g., small sample sizes, highly skewed distributions, missing data) are not specific to economic evaluations, but are often encountered in any study of adolescent addiction programs [19,20,23,24].

Innovative study designs, rigorous data analysis techniques, and careful data collection efforts can help address many of the challenges discussed here. We encourage clinical researchers to begin collecting data that are pertinent for an economic evaluation to ensure adequate cost and outcome measures are available. Moreover, collaborations with health economists should be forged early in the study design process to guarantee that these issues are not accidentally overlooked.

The far-reaching consequences of adolescent substance abuse and the diverse needs of adolescents in treatment contribute to making the economic evaluation of adolescent SAT unique, timely, and policy relevant. Rather than viewing the accompanying challenges as insurmountable obstacles, adolescent addiction researchers should see them as opportunities to set the standard for others in the health care field. Health economists, in collaboration with adolescent addiction researchers and clinicians, could be leaders in the estimation of costs and benefits of multi-outcome interventions affecting many sectors of society. We expect that the coming years will be marked a dramatic surge in both the number and rigor of economic evaluations of adolescent SAT.

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Table 1
Economic Analyses of Adolescent Substance Abuse Treatment (SAT) Programs

Study	Comparison	Design	Type of Study	Follow-Up	Sample
<i>Studies from the Multi-Site Grant</i>					
Alternative to Residential Treatment Study [19]	MDFI vs. residential treatment	Randomized to treatment	Partial evaluation	N/A	N/A
Balsa et al. [20]	N/A	Observational	Partial evaluation	12 months	419 aged 12–18
Cannabis Youth Treatment [7,25,47]	Two multi-site trials: ◆ Trial 1: MET/CBT 5 sessions vs. MET/CBT 12 sessions vs. FSN ◆ Trial 2: MET/CBT 5 sessions vs. ACRA vs. MDFI	Randomized to treatment within site	Cost analysis, CEA, and BCA	12 months	600 aged 12–18
French et al. [23]	CBT vs. FFT vs. integrative treatment combining individual and family therapy (joint) vs. skills-focused psychoeducational group	Randomized to treatment	CEA	4 and 7 months	114 aged 13–17
McCollister et al. [24]	FC with community services vs. DC with community services vs. DC/MST vs. DC/MST/CM	Randomized to treatment	CEA	12 months	161 aged 12–17
<i>Other Studies from the Literature</i>					
Fort Bragg Demonstration Project [15,16]	Fort Bragg Demonstration project (continuum of care) vs. two FFS mental health services	Observational	Partial evaluation	6–18 months	984 aged 5–17; 428 aged 12–17 [15]
Freeborn et al. [21]	N/A	Observational	Partial evaluation	12 months	469 aged 10–19
National Treatment Improvement Evaluation Study [22]	N/A	Observational	Partial evaluation	1 year prior & 1 year post treatment	677 < 21 years old
Parthasarathy et al. [17]	Adolescents entering CD treatment vs. matched sample of health plan members	Retrospective case control	Partial evaluation	1 year prior & 1 year post treatment	419 aged 12–18
Roebuck et al. [18]	Summary of DATCAP results of 13 adolescent outpatient & 1 residential program		Partial evaluation		
Schoenwald et al. [26]	MST vs. usual services	Randomized to treatment	BCA	6 months	118 aged 12–17
Sheidow et al. [14]	MST vs. usual inpatient services & aftercare	Randomized to treatment	CEA	12 months	115 aged 10–17 with psychiatric emergencies

Notes: DATCAP= Drug Abuse Treatment Cost Analysis Program; **Type of Economic Evaluation:** BCA=benefit-cost analysis; CEA=cost effectiveness analysis; **Therapies:** ACRA=Adolescent Community Reinforcement Approach; CD= chemical dependency; CBT=Cognitive Behavioral Therapy; DC=drug court; DC/MST = Drug court with multisystemic therapy; DC/MST/CM= Drug court

with multisystemic therapy enhanced with contingency management; FSN=Family Support Network; FC=family court; FFS= fee-for-service; FFT= Functional Family Therapy; MDFT=Multidimensional Family Therapy; MET/CBT= Motivational Enhancement Treatment/Cognitive Behavioral Therapy; MST= Multisystemic therapy

Table 2
Outcomes and Results from Economic Analyses of Adolescent SAT Programs

Study	Outcomes	Clinical Results	Economic Results
<i>Studies from the Multi-Site Grant</i>			
Alternative to Residential Treatment Study [19]	Economic outcomes: Total annual economic costs; Average economic costs of a treatment episode; Average (per client) annual economic cost; Average (per client) weekly economic cost	N/A	Total annual economic costs and costs per patient: residential > MDFT. Average economic costs per episode: MDFT > residential
Balsa et al. [20]	Outcomes: substance use problem severity, abstinence, school attendance, employment, and involvement in criminal activity	Adolescents who initiated treatment were more likely to attend school and be abstinent and less likely to be employed than those who did not initiate treatment.	
Cannabis Youth Treatment [7,25, 47]	Clinical outcomes: Days of abstinence; whether the adolescent was in recovery Economic outcomes: Total accounting & economic costs; average weekly cost per client; average cost per treatment episode Economic outcomes in CEA: Cost per day of abstinence & per person in recovery Economic outcomes in BCA: Average quarterly cost to society in terms of health care & SAT utilization, education, employment, criminal activity	Significant improvement pre-post treatment in all 5 interventions in days of abstinence and percent of adolescents in recovery. Little variation across sites in clinical outcomes.	Cost analysis: Average cost of all 5 interventions ranged from \$837–\$3,334 per episode. Cost-effectiveness: Trial 1: MET/CBT5 > MET/CBT12 > FSN. Trial 2: ACRA > MET/CBT5 > MDFT BCA: Net economic benefits to society were positive for MET/CBT 5, MET/CBT 12, and FSN.
French et al. [23]	Clinical outcomes: Percentage of days of marijuana use & any drug use; score on a juvenile delinquency subscale Economic outcomes in CEA: Average cost of achieving a one-percentage point reduction in the days of marijuana use & a one-unit reduction in the delinquency score	4 months: FFT had greater decrease in marijuana use than group. 7 months: Similar in marijuana use and delinquency outcomes across interventions	Range of average episode cost: \$885 (group)–\$2,546 (joint). CEA: Group > CBT, FFT, and joint
McCollister et al. [24]	Clinical outcomes: Substance use, antisocial behavior, and out-of-home placements Outcome: Self-reported criminal activity using the Self-Report Delinquency Scale Economic outcomes: Value of criminal activity events based on crime cost estimates from existing literature; net benefits of reduced crime; average intervention costs	DC was more effective in reducing substance use and criminal activity compared to FC.	The DC groups were committing fewer and less costly crimes over the 12-month period compared to the FC group, but few significant differences in criminal activity costs across groups. Average intervention costs: FC<DC<DC/MST< DC/MST/CM
<i>Other Studies from the Literature</i>			
Fort Bragg Demonstration Project [15,16]	Clinical outcomes: Mental health outcomes Economic outcomes: Expenditures on mental health services; average treatment costs for adolescents with & without comorbid substance use disorders	Overall, mental health outcomes were equivalent. Demonstration project had better outcomes for certain subgroups. .	Expenditures on mental health services: Demonstration > FFS Average treatment costs were highest for clients with comorbid substance use disorder.
Freeborn et al. [21]	Economic outcomes: Program expenses for adolescent CD treatment in an HMO; additional monthly premium cost per member for comprehensive adolescent treatment	N/A	The additional monthly premium cost per member for adolescent chemical dependency treatment was \$0.28.
National Treatment Improvement Evaluation Study [22]	Economic outcomes: Average cost of treatment for clients under 21; change in total health care costs, average earnings, & average crime-related costs to society after treatment	N/A	Average cost of treatment: \$3,584; 28.2% decrease in total health care costs, 80.6% increase in average earnings, & 72.6% decrease in average crime-related costs to society after treatment.

Study	Outcomes	Clinical Results	Economic Results
Parthasarathy et al. [17]	Economic outcomes: Costs for health care services	N/A	Costs for health care services: adolescents entering CD treatment > matched controls.
Roebuck et al. [18]	Economic outcomes: Average cost per week & per treatment episode	N/A	Average cost per week and average cost per episode: residential program > outpatient programs
Schoenwald et al. [26]	Clinical outcomes: Days of incarceration; days of out-of-home placements; utilization of mental health & SA services Economic outcomes: Program costs; cost of mental health & SA services; incremental cost of MST	Alcohol, marijuana, & other drug use declined in MST posttreatment & total days in out-of-home placement declined at 6-months. [60]	Total costs (after taking into account cost of incarceration days): MST > usual services
Sheidow et al. [14]	Clinical outcomes: Externalizing & internalizing behaviours scales; global severity index Economic outcomes in CEA: Medicaid costs were assessed for all inpatient, outpatient, pharmacy, & other services.; average cost per 1/10 of a standard deviation change in the clinical scale	MST was more effective in reducing symptoms and out of home placements, but MST and usual services had similar clinical outcomes by 12–16 months.	CEA: MST was more cost-effective in the short-term, but the two treatments were similar during 12-month follow-up.

Notes: DATCAP= Drug Abuse Treatment Cost Analysis Program; **Type of Economic Evaluation:** BCA=benefit-cost analysis; CEA=cost effectiveness analysis; **Therapies:** ACRA=Adolescent Community Reinforcement Approach; CD= chemical dependency; CBT=Cognitive Behavioral Therapy; DC=drug court; DC/MST = Drug court with multisystemic therapy; DC/MST/CM= Drug court with multisystemic therapy enhanced with contingency management; FSN=Family Support Network; FC=family court; FFS= fee-for-service; FFT= Functional Family Therapy; MDFT=Multidimensional Family Therapy; MET/CBT= Motivational Enhancement Treatment/Cognitive Behavioral Therapy; MST= Multisystemic therapy

Table 3
Summary of Recommendations for Future Economic Evaluation Research of Adolescent SAT

Research Recommendation

- 1 Foster collaborations between clinical researchers and health economists early in the study to design instruments and collect appropriate cost and outcomes measures.

Selecting a Study Design and Follow-Up Period

- 2 When double-blinded randomized controlled trials are not practical or ethical, consider cluster randomization or a natural control group. Certain individuals in the study can also be blinded to reduce bias.
- 3 For quasi-experimental or observational designs, consider statistical methods such as propensity score matching, fixed-effects models, or instrumental variables techniques to reduce possible selection bias.
- 4 Invest research funds to collect long-term observational data with standardized measures that can be used in modeling the long-term impacts of adolescent SAT.
- 5 Ensure that follow-up interviews collect information on all types of treatment utilization, life transitions, and living arrangements that could affect substance use and other outcomes.

Choosing the Perspective for an Economic Evaluation of Adolescent SAT

- 6 A wider (i.e., societal) perspective is preferable when evaluating adolescent SAT. In some instances, the sponsor of the economic evaluation may only be interested in a narrow perspective. Whatever the analyst chooses, however, the analysis perspective should be made clear when reporting results.

Estimating Costs Incurred by Multiple Parties

- 7 Collect data on costs incurred by caregivers (e.g., parents, guardians) of adolescents in SAT such as missed work and transportation expenses.
- 8 Design and administer an instrument to measure the health, financial, legal, relationship, and emotional impact on parents of adolescents in treatment.

Estimating Benefits for Multiple Parties

- 9 Identify economic outcomes of interest and select the appropriate form of economic analysis (cost analysis, CEA, CUA, BCA, or cost-consequences).
- 10 When conducting a CEA, estimate several cost-effectiveness ratios to account for multiple outcomes.
- 11 Consider using a cost-consequences analysis to present various outcomes to decision-makers, who can then decide which outcomes are most important from their perspective.

Allowing for the Context-specific Nature of Adolescent Substance Abuse Interventions

- 12 When estimating economic costs and benefits, use monetary conversion factors that are geographic specific and collect data that can be used for each setting.
 - 13 Conduct a rigorous sensitivity analysis to account for uncertainty in the underlying assumptions of the economic evaluation and for factors associated with location or other characteristics unique to each specific study site.
-