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Abstract

Juvenile drug court (JDC) programs have expanded rapidly over the past twenty years and are an increasingly popular option for rehabilitating juvenile offenders with substance use problems. Given the high cost of crime to society, an important economic question is whether and to what extent JDC programs reduce criminal activity among juvenile offenders. To address this question, the present study added an economic cost analysis to an ongoing randomized trial of JDC conducted in Charleston, South Carolina. Four treatment conditions were included in the parent study: Family Court with usual community-based treatment (FC, the comparison group), Drug Court with usual community-based treatment (DC), DC with Multisystemic Therapy (DC/MST), and DC/MST enhanced with Contingency Management (DC/MST/CM). The economic study estimated the cost of criminal activity for nine specific crimes at baseline (pretreatment) and 4 and 12 months thereafter. A number of methodological challenges were encountered, suggesting that it may be more difficult to economically quantify frequency and type of criminal activity for adolescents than for adults. The present paper addresses methodological approaches and challenges, and proposes guidelines for future economic evaluations of adolescent substance abuse and crime prevention programs.
Introduction

The co-occurrence of substance use and delinquent behavior among adolescents poses a major public health challenge. Nearly 80% of arrested juveniles report problems with addictive substances, test positive for drugs at the time of arrest, are arrested for drug law violations, or are under the influence of drugs and/or alcohol at the time they commit the offense(s).¹ These data clearly reveal the need to address substance use within the juvenile offender population and suggest that the juvenile justice system can provide a viable opportunity to intervene with adolescents engaging in substance use and crime. In this regard, juvenile drug courts (JDCs) have emerged as promising programs for juvenile offenders with substance use problems.²⁻⁴ JDCs combine intensive judicial leverage with substance abuse treatment in an attempt to reduce participant substance use and criminal activity.

Although emerging JDC results are promising,⁵ these programs have yet to be fully evaluated in economic terms. For example, rates and types of offending have not been translated into their associated costs to society. Because JDC programs aim to reduce substance use and criminal behavior, they provide a valuable opportunity to evaluate the economic impact of reduced criminal activity among a substance-involved population. Working within the context of a randomized clinical trial of JDC,⁶ the present study estimated the differential cost of criminal activity across four interventions for nine specific crimes over a one-year assessment period. The specific research goals were (1) to estimate the full cost of criminal activity among all study participants and compare costs for JDC participants to those for family court participants; (2) to identify and, when possible, address the methodological challenges associated with this exercise; and (3) to offer some practical recommendations for improving future
economic studies of addiction treatment and other crime prevention programs specifically geared toward adolescents.

**Background**

The first drug court programs were established in the late 1980s for adult offenders in response to the dramatic increase in drug-related offenses during that time and an increasingly overburdened criminal justice system.² Drug courts provide an alternative to incarceration for nonviolent offenders and take a collaborative approach to rehabilitation by combining efforts between probation officers, courts, substance abuse treatment programs, and other community based services. Drug court programs were quickly embraced by the correctional community, as evidenced by the rapid proliferation of these programs over the past twenty years. There are currently more than 1,600 drug court programs nationwide, and approximately 73,000 adult and 4,000 juvenile drug court participants have graduated to date.⁷

In a comprehensive review of the extant research, the Government Accountability Office (GAO) has endorsed the effectiveness of adult drug courts.⁸ The GAO concluded that drug court participants generally demonstrate lower rates of criminal behavior during and after drug court participation than participants in equivalent comparison groups. Moreover, these reductions in criminal activity tend to translate into positive economic benefits. Some evidence of the potential net benefits of adult drug court programs is provided in a report from the state of Washington that estimated the cost per drug court participant to be about $2,000 more than standard court processing.⁹ The economic benefits of drug courts were estimated in terms of savings to the Washington state criminal justice system from reduced offenses, reduced crime victim costs, and improved quality of life. From the perspective of the Washington taxpayer, the net benefit from reduced justice system costs in 1998 dollars was $2,923 per drug-court
participant (a benefit-cost ratio of $2.46). Additional benefits associated with savings to crime victims and improved quality of life were valued at $6,368 for each participant.

Complementary economic evidence is supplied by a recent benefit-cost analysis of three adult drug court programs in Kentucky. The economic benefits of drug court were estimated from reduced incarceration, mental health services, and legal costs as well as increased earnings and child support payments. Results indicated that graduates of the drug court programs generated the greatest net benefit ($14,526 per graduate or $3.83 for every dollar invested in drug court). Program terminators (dropouts) generated a significantly lower net benefit ($231 per graduate or $1.13 for every dollar invested in drug court). Adult drug courts thus seem to have favorable effects on both criminal activity and criminal justice system costs.

In response to the demonstrated success of adult drug courts, JDCs were initiated in the early 1990s, and 357 JDCs were in operation by the end of 2004. In general, findings from the relatively modest existing research on JDCs parallel those from the much more extensive adult drug court literature. Program evaluations as well as a recent randomized clinical trial have supported the potential of JDCs to reduce participant substance use and criminal behavior. As yet, however, economic evaluations have not been conducted for JDC programs. This study takes a first step in examining the economic impact of JDC by leveraging criminal activity data collected in the aforementioned randomized trial of juvenile drug court and incorporating external crime cost estimates to derive the costs of criminal behavior among JDC and Family Court participants before and after entering the program. The objective here is not to provide a full economic evaluation of JDC by valuing a range of costs and benefits associated with these interventions but rather to focus specifically on types of offenses and costs of criminal activity
among the substance-involved juvenile offender population. Results are highlighted within the context of methodological limitations confronted in the analyses.

Methods

Design

The present study is based on a randomized trial of JDC that evaluated youth drug use, crime, and other outcomes over a 12-month assessment period. The study examined (a) the effectiveness of JDC itself, (b) the effects of integrating evidence-based treatment (i.e., multisystemic therapy [MST]) as the community intervention component of the drug court process, and (c) whether the integration of contingency management (CM) techniques into the MST treatment protocol would improve substance use outcomes for MST.

The trial, including research and treatment procedures, is described in detail in Henggeler and colleagues (2006), but a brief description is provided here. To address the study hypotheses, all juvenile offenders reporting to the Department of Juvenile Justice and residing in Charleston County (South Carolina) were assessed for possible drug use. Those meeting diagnostic criteria for substance abuse or dependence were recruited for the study (98% recruitment rate) and were randomly assigned at the time of recruitment to one of four treatment conditions:

- **Family Court with Community Services (FC) (n = 42):** Youths appeared before a family court judge once or twice a year and received outpatient alcohol and drug abuse services from the local center of the state’s substance abuse commission;
- **Drug Court with Community Services (DC) (n = 38):** Youths appeared before the drug court judge once a week for monitoring of drug use (urine screens) and received outpatient alcohol and drug abuse services from the local center of the state’s substance abuse commission;
• **Drug Court with MST (DC/MST) (n = 38):** Youths received an evidence-based treatment (MST) rather than community services in conjunction with drug court. MST is a well validated\textsuperscript{13} family- and community-based treatment for youths presenting serious antisocial behavior and at high risk of out-of-home placement;

• **Drug Court with MST enhanced with Contingency Management (DC/MST/CM) (n = 43):** Youths received MST enhanced with key components of contingency management (CM; e.g., frequent in-home screens to detect drug use, voucher system contingent on clean screens, drug refusal training) in conjunction with drug court. CM is one of the best-validated evidence-based treatments for adult and adolescent substance abuse and is clinically and theoretically compatible with the MST model.\textsuperscript{14-15}

**Procedures**

Assessments were conducted at baseline (pretreatment), 4 months post-recruitment, and 12 months post-recruitment. Outcome measures included self-report and biological indices of substance use, self-report and archival indices of criminal activity, youth mental health symptoms based on youth and caregiver reports, and days in out-of-home placement. In the present study, the key outcome of interest pertains to youth reports of criminal activity from the Self-Report Delinquency Scale (SRD),\textsuperscript{16} in which respondents report the number of specific criminal offenses committed during the previous 90 days. Outcomes from this measure showed that in general, youths in the drug court conditions (i.e., DC, DC/MST, and DC/MST/CM) engaged in significantly fewer status offenses and crimes against persons (but not general theft) than did their FC counterparts during the 12-month assessment period. For example, from pre-treatment to 12-month post-recruitment, effect sizes for status offenses (comparing the three drug court conditions with FC), ranged from 1.88 to 2.11. Similarly, pre-treatment to 12-months post-
recruitment effect sizes for crimes against persons ranged from 0.43 to 0.62. Thus, with regard to self-reported offending, results suggest that drug court was more effective than family court but that the integration of evidence-based treatments did not enhance the effectiveness of drug court.6

Sample

Table 1 presents sample characteristics at baseline by study condition (FC, DC, DC/MST, DC/MST/CM). In light of the aforementioned finding that criminal activity outcomes were significantly more effective for the three drug court conditions than for FC but that outcomes did not differ among the three drug court conditions, data are also reported for a combined drug court group (DC-Combined N=119; containing all subjects from DC, DC/MST, and DC/MST/CM). Participants were between 12 and 17 years old, but 75% of the sample was in the older cohort (ages 15-17 years). The majority of participants were male (more than 80%) and African American (more than 65%). Most of the youths lived in a single parent/caregiver household, and the average parent/caregiver had a high-school education. The median annual household income was $15,000 to $20,000, considerably lower than the national average of $46,326.17

In terms of criminal activity and substance use, 89% of the youths reported some history of criminal activity at baseline and had an average of 3.6 previous arrests. As noted previously, one of the inclusion criteria for the study was that the youth had to meet diagnostic criteria for substance abuse or dependence. By far, the most abused substance in this sample was cannabis. In addition, most of these adolescents began experimentation with drugs and/or alcohol by the age of 12 years, 57% met diagnostic criteria for at least one co-occurring psychiatric disorder, and almost half had received previous mental health and or substance abuse treatment. Together,
these demographic and clinical data suggest that the profile of the average participant is that of an economically disadvantaged minority youth with multiple and serious psychosocial difficulties. Between-group comparisons using the Kruskal-Wallis equality of populations rank test revealed no statistically significant differences in demographics, family/household characteristics, criminal history, or addiction treatment history.

**Measures**

The key outcome for this study was self-reported criminal activity at the 4- and 12-month follow-up assessments, and this construct was obtained through the 47-item SRD. The SRD is regarded as one of the most validated measures of criminal behavior by adolescents for assessing the frequency of behaviors during the previous 90 days. The SRD assesses an array of behaviors, including status offenses, public disorder offenses, theft, and crimes against persons; but cost estimates were not available for all behaviors reported on the SRD. Based on consensus among the investigators, 17 items from the SRD could be classified into one of nine offenses for which cost estimates are available to estimate criminal activity costs. The nine offenses can be further collapsed into three categories, including public disorder, general theft, and crimes against persons. Examples of excluded items from the SRD include cheating in school, hitchhiking, and making obscene phone calls, which would not be expected to contribute substantially to crime costs for a community.

Criminal activity events were valued in dollars using available unit crime cost estimates from the literature. These estimates reflect the total cost of individual criminal acts for a broad range of offenses and are comprised of four cost categories: victim costs, crime career costs, criminal justice system costs, and intangible costs associated with a victim’s pain and suffering. These crime cost estimates represent national values for adult criminal activity and are
the most current and comprehensive available. Unfortunately, there are no unit cost estimates for
the same crimes committed by juvenile offenders. The current analysis therefore assumes that
the unit cost of a crime committed by a juvenile is similar to that of an adult offender. Although
it is expected that victim costs and intangible costs are similar regardless of the age of the
perpetrator, the costs to the juvenile justice system and crime career losses are probably different
for adolescent offenders. Nevertheless, these are the best estimates available for calculating the
cost of crime for this sample of JDC participants.

Analyses

The total cost of all criminal activity for each subject was calculated by multiplying the
number of self-reported offenses at each assessment point by their respective unit cost estimates
and then summing across all crime categories. Bivariate and multivariate analyses were
conducted to examine treatment effects and other predictors of continuous and dichotomous
measures of criminal activity cost at 4 and 12 months after recruitment. A number of statistical
techniques were employed to address the highly skewed cost data, the zero or very low values
for some clients, and the presence of missing data for some measures of criminal activity.
Results of the analyses are discussed below.

Results

Descriptive Statistics

The types, counts, and costs of criminal offenses were evaluated for the 90 days
preceding and the 12 months following entry into the court system, for both JDC and FC
participants. Table 2 presents summary statistics for criminal activity and associated costs at the
baseline, 4-month, and 12-month assessments for all study conditions and for a combined DC
group. Criminal activity measures are grouped by offense category and represent the number of
public disorder offenses, general theft offenses, and crimes against persons committed during the prior three months. Table 2 also presents the total cost of criminal activity at the three assessment points by study condition.

Public disorder offenses include acts of disorderly conduct, vandalism, truancy, running away from home, and selling drugs. General theft offenses include motor vehicle theft, household burglary, stolen property, and larceny/theft. Crimes against persons include aggravated assault, minor assault, and robbery. For some crimes such as vandalism and larceny/theft, multiple items from the SRD were combined to better characterize these specific offenses. For example, there are four SRD items that pertain to acts of vandalism. Respondents were asked how many times they had “purposely damaged or destroyed property belonging to [their] parents or other family members,” “purposely damaged or destroyed property belonging to a school,” “purposely damaged or destroyed other property that did not belong to [them] (not counting family or school property),” and/or “thrown objects (such as rocks, snowballs or bottles) at cars or people.” Each of these items clearly reflects an act of vandalism, so the sum of these four items represents the total number of vandalism offenses. Similar calculations were performed for other criminal activity categories.

For the full sample, participation in criminal activity significantly declined over the 12-month follow-up. Compared to 100% participation at baseline, 75% of respondents reported committing any type of crime at the 4-month assessment (p<0.01) whereas only 56% reported any criminal activity at the 12-month assessment (p<0.01). Consistent with national statistics, more crimes of public disorder and general theft were reported than crimes against persons. For most criminal activity measures, the DC conditions showed reductions in the number of offenses from baseline to the 4-month assessment and from the 4-month to the 12-month assessment. The
FC condition showed crime reductions from baseline to the 4-month assessment but subsequently showed significant increases in all three offense categories from the 4-month to 12-month assessment. Despite the broad within-group differences over time, there were no statistically significant differences between groups for any crime category at any assessment point, with the exception of DC/MST/CM having a marginally significant lower number of general theft offenses than FC at baseline ($p<0.10$).

As noted earlier, unit cost estimates were available for most but not all delinquent behaviors assessed in the SRD. The cost analysis therefore focused on a subset of crimes within the three main offense categories. The total cost of criminal activity was comprised of the following acts, with unit cost estimates in parentheses: vandalism ($616$), selling drugs ($28.44$), aggravated assault ($111,431$), minor assault ($2,630$), robbery ($48,095$), motor vehicle theft ($8,913$), household burglary ($4,044$), stolen property ($668$), and larceny/theft ($1,583$).

Extensive details of the methodology for estimating the societal cost of crime are available from the original sources. As an example of how these estimates are calculated, consider the crime of robbery, which had a reported 501,820 offenses in 2004. The tangible costs of a robbery are estimated from victim losses, criminal justice system costs, and the lost productivity of the perpetrator. Victim costs include property loss/damage, short-term medical expenses, and the victim’s lost earnings/productivity loss (together labeled “direct victim costs”) as well as risk-of-homicide costs and mental health care costs. Data from the U.S. Department of Justice, Cohen and Miller (1998), and Miller, Cohen, and Rossman (1993) provide estimates of victim losses for each of these categories. Total victim costs were estimated to be $3,491 per robbery.
Criminal justice system costs include police protection, legal/adjudication, and correction costs for the three jurisdiction levels (federal, state, and local). Information from the U.S. Department of Justice on national police protection expenditures, legal/adjudication expenditures, costs of local, state, and federal corrections costs as well as the productivity losses caused by the criminal due to being incarcerated provides the estimate for criminal justice system and crime career costs ($19,736 per robbery).\textsuperscript{24,27,28} Summing the three cost components (crime victim, criminal justice system, and crime career costs) produced an overall tangible cost of $23,227 per robbery offense.

In estimating the intangible losses to the victim of a robbery, the jury compensation method was used\textsuperscript{29} to incorporate values for pain and suffering associated with certain injuries that are likely to occur during crimes like aggravated assault and robbery\textsuperscript{23}. The overall per-robbery pain and suffering cost was estimated to be $4,292. This was combined with an adjusted risk-of-homicide cost for robbery, which was based on the mean value of a statistical life ($6.7 million), as calculated by Viscusi and Aldy (2003)\textsuperscript{30}. This value was multiplied by the probability that a robbery results in a homicide (0.30\%)\textsuperscript{31}, yielding a corrected risk-of-homicide cost of $22,656 per robbery. The total intangible cost per robbery is $26,947. Based on these calculations, the total per-offense cost of a robbery is $48,095.

Translating counts of criminal offenses into costs exacerbated the highly skewed distributions of the self-reported crime data, especially when considering crimes against persons. As noted above, most participants reported committing public disorder and general theft offenses, which are relatively less expensive than crimes against persons. Any adolescent who committed even a small number of aggravated assaults (at a cost of more than $100,000 per act), however, would be an extreme outlier in the distribution and dominate the total cost of criminal
activity for that treatment condition. Individuals in the FC group reported more crimes against persons at baseline and the 12-month assessment and therefore had much higher mean criminal activity costs at these assessment points ($228,874 at baseline versus $86,477 for DC-Combined and $231,867 at the 12-month assessment versus $54,099 for DC-Combined).

Despite the large difference in mean values of criminal activity cost across study groups, these values were not statistically different due to a few large outliers. For example, the standard deviations were often two or three times larger than the mean values (e.g., more than $600,000 for the FC group and more than $200,000 for DC-Combined at the 12-month assessment), highlighting the extreme variability in these measures and clearly revealing the distributional issues that must be considered in the multivariate analyses.

**Multivariate analyses**

The intended purpose of the multivariate analysis was to evaluate the effects of JDC and other measures on the total cost of criminal activity at each follow-up assessment. Given the stark (yet not statistically significant) group differences in criminal activity costs at baseline, various specifications were estimated, including classic linear regression on total criminal activity cost at follow-up, robust regression analysis to downweight outlier observations, and probit models for dichotomous measures of any criminal activity at follow-up. Regardless of the specification, various statistical problems were encountered with the estimation.

For demonstration purposes, Table 3 presents the linear regression results for criminal activity costs at the 12-month assessment. Two models are presented: Model 1 shows coefficients for the three DC conditions relative to the omitted FC condition, and Model 2 presents the DC conditions combined relative to FC. Both models include a list of standard covariates, such as baseline characteristics, as well as the number of days incarcerated from
baseline to the 12-month assessment and a binary missing data indicator. As suggested by the mean values for crime costs in Table 2, results show that each of the DC conditions had lower criminal activity cost at the 12-month assessment (e.g., $157,853 less criminal activity cost for DC/MST/CM than FC, p<0.10; $144,373 less for the combined DC group, p<0.10). Although this result seems to support the expectation that JDC is associated with reduced criminal activity over follow-up relative to FC, these results were only marginally significant and highly sensitive to the exclusion of a few severe outliers. In the following sections, the results are explored further within the context of the methodological limitations confronted in the analysis. The discussion highlights the unexpected obstacles encountered in carrying out this economic study and offers guidelines for future analyses of the costs of criminal activity among juvenile offenders.

**Discussion**

To summarize the main results presented above, Tables 2 and 3 suggest that the DC groups were committing fewer crimes and less costly crimes over the 12-month follow-up period relative to the FC group. From an empirical perspective, however, the difference in criminal activity costs between groups was marginally or not statistically significant. These findings highlight many of the methodological and data challenges confronted in this economic study. These challenges coincide with other recent studies of adolescent substance use and suggest that economic evaluations of adolescent interventions can be more complicated than those of adult treatment. The four main limitations in the present study were sample size, missing data, collecting reliable criminal activity data from adolescents, and the distribution of the criminal activity cost measure.
Although relatively small samples (i.e., n<50 subjects per condition) are fairly common in clinical studies, small sample sizes can compromise economic studies by limiting the ability to detect significant cost differences when costly behaviors have a low base rate. Economic measures tend to be more lumpy and skewed, and require larger samples to conduct reliable empirical analyses. In the present study, criminal activity data at follow-up were available on only 129 individuals (less than 40 per study group), which lowered statistical power for the multivariate analyses. In addition, although the empirical models included many of the important control variables, such as selected risk variables that are robust predictors of delinquent behavior, the list of potential explanatory variables was fairly limited and the models may be subject to omitted variables bias. Data imputation and bootstrapping techniques were employed to preserve observations and improve statistical power, but these techniques did not necessarily improve the precision of the results.

A second limitation was the high proportion of missing data on some measures of criminal activity. Because the original sample size was relatively small, missing data were even more of a concern than with larger samples. There were no observations with missing data at baseline, but 8 were missing certain values at the 4-month assessment, and 32 were missing values at the 12-month assessment. In these cases, missing data resulted from an inability to locate certain subjects and, in some cases, subjects’ refusal to participate. In this regard, it is questionable to assume that these data are missing at random (MAR) because subjects who are difficult to locate may have different criminal activity profiles than those who respond. Despite this potential problem, missing observations at the 12-month assessment did not seem to be group specific. The non-response rates were similar across study conditions and ranged from 20-24%.
Assuming that these observations are MAR, there are some standard approaches for handling missing data.\textsuperscript{34} Perhaps the most common approach is listwise deletion — that is, simply dropping the missing observations as was done with the regression models presented in Table 3. This results in a decreased sample size (more than 20% loss from baseline), a noteworthy drawback in smaller studies. More advanced imputation methods are based on maximum likelihood estimation (MLE) and multiple imputation (MI), which apply an iterative method that predicts missing values from all other available data (see Schafer and Graham [2002] or Little and Rubin [2002] for formal methodological discussion).\textsuperscript{35-36} MI methods were used in the present study to impute missing criminal activity data using the \textit{uvis/mvis} program in Stata.\textsuperscript{37} This procedure includes a bootstrap option, which relaxes the assumption that the distribution of regression coefficients is multivariate normal (essentially increasing robustness). Despite these efforts, analysis of the imputed data set did not substantially change the results of regression models of criminal activity costs.

Another limitation of the data pertains to the nature and possible perception of criminal activity among adolescents. When measuring counts of conventional criminal acts (e.g., assault, robbery, vandalism), additional explanation and probing might be necessary. For example, it is possible that some adolescents overstated the number of predatory acts they had committed by incorrectly including minor scuffles with classmates or relatives in these categories. If so, then this could at least partially explain why some adolescents reported an atypical number of predatory acts relative to the median values. One simple and inexpensive method of improving precision in this area is to request further descriptions from adolescents whenever counts exceed a certain threshold in each category (see Thornberry & Krohn [2000] for a full discussion).\textsuperscript{20}
The nature and perception of criminal activity among adolescents highlights another important limitation: namely, that there are currently no estimates of criminal activity costs specific to juvenile offenders. While victim costs most likely will be the same across adolescent and adult offenders, factors such as the cost of crime to the juvenile justice system are potentially more complex. For example, in many states juvenile offenders are first brought to a juvenile assessment center where a number of services and/or evaluations are provided including drug testing and counseling. Such costs are not accounted for in existing crime cost studies. In addition, the opportunity cost of an adolescent’s time lost from school and work, as well as the opportunity cost for the time lost from work for the caregiver(s) of the adolescent, are not accounted for in the current analysis. Other long-term costs associated with educational attainment and career development that may be impacted by adolescent criminal activity are also not measured. Assessing the total cost of criminal activity for the juvenile offender population is clearly an area that could benefit from future research.

The final major challenge relates to the underlying etiology of criminal activity. These data tend to be highly skewed and clustered at zero. When converting the counts of acts to the cost of criminal activity by incorporating large unit cost factors in some cases, the result is a very poorly distributed measure with extreme variance. Not surprisingly, significant cost outliers were present in the data, particularly for the FC group. These extreme outliers were generated by a handful of individuals who reported a large number of crimes against persons.

When faced with a continuous dependent variable that is not normally distributed, the conventional approach is to transform this variable using the natural logarithm or other functions (e.g., square root) and then to run OLS regression on the transformed data. Log transformations of criminal activity cost (with the value of 1 first added to those observations with zero cost)
were substituted in the regression models from Table 3, but the skewness and kurtosis were so substantial that no transformation could correct for the non-normality of the criminal activity data. Additional multivariate analyses were conducted using different specifications (e.g., robust regression, winsorize, censored regression), but there were no significant findings in these alternative specifications of criminal activity costs either.

An alternative approach to evaluating the full cost of criminal activity is to dichotomize criminal behavior and use limited dependent variable (LDV) models (i.e., probit or logit) to examine predictors of any criminal activity or certain types of crime such as high-cost or low-cost crimes. Complementary analyses specified probit models of zero criminal activity cost at follow-up, having cost of crime at baseline greater than cost of crime at follow-up, engaging in low-cost crime at follow-up, and engaging in high-cost crime at follow-up. High- and low-cost thresholds were determined by the median values of criminal activity cost across study groups. In most cases, there was no significant DC effect in predicting different levels of crime cost, although the findings suggested that adolescents in the DC/MST condition were significantly less likely than those in other groups to commit high-cost crimes (p<0.05). Although these models are informative for determining whether criminal activity occurred, they do not address the main research and policy question of this study pertaining to the differential cost of all criminal activity across groups.

**Incorporating Intervention Costs**

Though not a main focus of this study, additional analyses compared average intervention costs for each group to changes in criminal activity costs. Individual-level cost data were not available for all study conditions, so a simple measure of treatment cost was created by assigning every individual in a group the average cost for that condition. Average intervention costs were
estimated at $3,718 for FC, $9,178 for DC, $12,499 for DC/MST, and $12,994 for DC/MST/CM. The costs for the FC group included sessions with the family court judge about once or twice a year and standard outpatient alcohol and drug abuse services from the local center of the state’s substance abuse commission. DC included weekly visits with the drug court judge, weekly drug testing, and standard outpatient treatment services from the local center of the state’s substance abuse commission. The increase in costs was therefore due to more frequent contact with the judicial system (i.e., court facilities and personnel costs) as well as urine drug testing conducted by the court. DC/MST included costs of drug court plus treatment with MST instead of standard outpatient services. The increased intervention costs for this condition are a result of MST requiring more intensity and lower caseloads, as well as greater training and supervision, than services usually available in the community. Finally, DC/MST/CM included costs of drug court as well as treatment with MST enhanced with contingency management, which added approximately $500 to total intervention costs (i.e., additional training and adherence monitoring for therapists, increased monitoring of drug use through urine screens, and rewards contingent on abstinence). Obviously, both treatment and criminal activity costs are specific to the programs as they were implemented in the community of Charleston, South Carolina, and may not generalize to other communities or settings.

Changes in criminal activity costs were compared to the cost of treatment to estimate the net benefit of reduced crime. Based purely on the mean values of criminal activity costs from Table 2, the DC conditions all generated reductions in crime costs that were greater than the average cost of treatment, but these relationships could not be tested or confirmed empirically for individual subjects. In order to perform a formal benefit-cost analysis of reduced criminal
activity, it would be necessary to conduct a comprehensive cost analysis documenting the cost per intervention episode for all study participants.

**Methodological Recommendations**

Given the research limitations and challenges explained above, the following recommendations are proposed to facilitate future economic evaluations of JDC and other adolescent-focused interventions. First, investigators should invest in acquiring larger samples for studies that intend to include an economic evaluation. Of course, this may not be logistically or financially practical in all cases, but if researchers plan on estimating skewed and zero-inflated economic outcomes such as criminal activity costs or other measures such as health care expenditures, then larger samples are needed. A number of advanced econometric models from recent studies of health care utilization and costs may be particularly useful for evaluating criminal activity costs. Examples include the two-part model (2PM), Cox proportional hazard models, Generalized Linear Models (GLM), and mixed-effects mixed-distribution model.

A second recommendation is that program developers and evaluators should integrate and work closely with economists during the earlier study planning and implementation phases to ensure that the best measures and data are collected for economic evaluation objectives. This is particularly important for collecting program cost data where specific information on intervention resources and client caseflow must be documented for all study conditions. As mentioned previously, the present study did not collect the appropriate data to estimate individual treatment costs for all conditions. Standardized cost instruments have been developed to collect program resource and cost data for treatment programs, which could be included in future studies. For example, the Drug Abuse Treatment Cost Analysis Program (DATCAP;
The DATCAP provides estimates of total program cost, weekly cost per client, and the average cost per treatment episode. Such estimates provide individual-level cost data that can then be compared directly to economic outcomes to estimate the costs and benefits of a program or intervention.

Finally, to facilitate evaluations of corrections-based interventions like JDC, researchers should secure access to juvenile justice data (arrests, incarceration, probation/parole) in order to accurately track these outcomes, which are of particular interest to policy makers and justice officials. A primary motivation for economic evaluation is to provide policy makers with reliable estimates of the economic costs and benefits of programs that are competing for limited resources. Access to juvenile justice data will allow economic studies to consider not only the societal impact of JDC programs but also the specific impact on the juvenile justice system in terms of the costs of reduced arrests and days of incarceration.

**Implications for Behavioral Health**

Adult and juvenile drug courts have contributed to an increased public awareness of addiction treatment and other health care needs among criminal offenders. This awareness is evidenced by the proliferation of various court-based recovery programs, including mental health courts, domestic violence courts, DWI courts, and truancy courts. JDCs are a good example of these multifaceted approaches to balancing punishment with rehabilitation, given that the JDC process relies on a collaborative effort by juvenile courts, treatment providers, community service providers, schools, and family members. Evaluating JDCs and similar interventions is important for understanding the impact of these programs upon public health, through reduced drug use and criminal recidivism, as well as their impact upon school performance and family functioning. The research presented in this paper is one of a few existing attempts to conduct an
economic study of JDC programs while focusing on an outcome of primary importance to society: criminal activity. Studies have shown that reducing criminal activity is the largest contributor to the total economic benefit of addiction programs.\textsuperscript{45}

The research limitations and challenges confronted in the present study suggest that estimating the differential costs of criminal activity is a more complex process for JDCs than for adult programs, given the types and cost of crimes committed by adolescent offenders. Future research of JDC and other adolescent-focused programs should re-estimate the costs of criminal activity along with other economic outcomes such as educational achievement and health services utilization, and compare economic benefits with program costs to more fully assess the net benefit of these programs.

**Acknowledgments**

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References


<table>
<thead>
<tr>
<th>Variables</th>
<th>Family Court (FC; n=42)</th>
<th>Drug Court (DC; n=38)</th>
<th>DC + Multisystemic Therapy (DC/MST; n=38)</th>
<th>DC + MST + Contingency Management (DC/MST/CM; n=43)</th>
<th>DC-Combined (n=119)</th>
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<tbody>
<tr>
<td><strong>Demographics</strong></td>
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<td></td>
<td></td>
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<tr>
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<td>15.14 (1.07)</td>
<td>15.21 (1.16)</td>
<td>15.32 (1.09)</td>
<td>15.33 (0.94)</td>
<td>15.29 (1.06)</td>
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<td>Female</td>
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<td>0.16</td>
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<td>0.32</td>
<td>0.32</td>
<td>0.30</td>
<td>0.31</td>
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<td>0.67</td>
<td>0.66</td>
<td>0.68</td>
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<td>Live with two parents/caregivers</td>
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<td>0.32</td>
<td>0.29</td>
<td>0.40</td>
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<td>Live with single parent/caregiver</td>
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<td>0.53</td>
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<td>0.42</td>
<td>0.51</td>
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<td>Live with other relatives</td>
<td>0.02</td>
<td>0.16††</td>
<td>0.11</td>
<td>0.18††</td>
<td>0.15</td>
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<td>Highest education of parent/caregiver in years</td>
<td>12.57 (1.96)</td>
<td>12.89 (2.65)</td>
<td>12.11 (1.93)</td>
<td>12.74 (2.73)</td>
<td>12.59 (2.48)</td>
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<td><strong>Criminal History</strong></td>
<td></td>
<td></td>
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<tr>
<td>Number of previous arrests</td>
<td>3.60 (2.39)</td>
<td>4.08 (3.06)</td>
<td>3.18 (2.14)</td>
<td>3.49 (2.19)</td>
<td>3.58 (2.49)</td>
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<td>Any criminal activity at baseline</td>
<td>0.95</td>
<td>0.89</td>
<td>0.89</td>
<td>0.95</td>
<td>0.92</td>
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<td><strong>Addiction Treatment History</strong></td>
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<td></td>
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<td>Age of first alcohol or illicit drug use in years</td>
<td>12.83 (1.59)</td>
<td>13.0 (1.32)</td>
<td>12.21 (2.43)</td>
<td>12.86 (1.71)</td>
<td>12.70 (1.88)</td>
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<td>Previous mental health or addiction treatment</td>
<td>0.45</td>
<td>0.42</td>
<td>0.34</td>
<td>0.51</td>
<td>0.43</td>
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</tbody>
</table>
Notes: Standard deviations in parentheses for continuous variables. Statistically significant differences in variable medians between FC, DC, DC/MST, and DC/MST/CM: * p<0.10, ** p<0.05, Kruskal-Wallis equality of populations rank test. Significantly different from FC, † p<0.10, †† p<0.05, Wilcoxon rank-sum (Mann-Whitney) test.
Table 2
Mean Criminal Activity and Costs at Baseline, 4-Month, and 12-Month Assessments, by Treatment Condition

<table>
<thead>
<tr>
<th>Criminal Activity Measures</th>
<th>Family Court (FC; n=42)</th>
<th>Drug Court (DC; n=38)</th>
<th>DC + Multisystemic Therapy (DC/MST; n=38)</th>
<th>DC + MST + Contingency Management (DC/MST/CM; n=43)</th>
<th>DC-Combined (N=119)</th>
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<tr>
<td><strong>Public Disorder&lt;sup&gt;a&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Number of public disorder offenses at baseline</td>
<td>18.14 (19.98)</td>
<td>16.97 (33.59)</td>
<td>19.50 (25.20)</td>
<td>22.47 (32.42)</td>
<td>19.76 (30.79)</td>
</tr>
<tr>
<td>Number public disorder offenses at the 4-month assessment</td>
<td>13.6 (28.83)</td>
<td>14.63 (25.95)</td>
<td>9.74 (19.96)</td>
<td>10.45 (18.75)</td>
<td>11.64 (21.69)</td>
</tr>
<tr>
<td>Number public disorder offenses at the 12-month assessment</td>
<td>18.09 (32.79)</td>
<td>2.66 (4.49)</td>
<td>3.93 (6.89)</td>
<td>12.24 (36.56)</td>
<td>6.75 (23.37)</td>
</tr>
<tr>
<td><strong>General Theft&lt;sup&gt;a&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of general theft offenses at baseline</td>
<td>10.50 (15.70)</td>
<td>8.66 (14.75)</td>
<td>7.79 (14.36)</td>
<td>4.63 (7.12) †</td>
<td>6.92 (12.52)</td>
</tr>
<tr>
<td>Number general theft offenses at the 4-month assessment</td>
<td>3.25 (6.35)</td>
<td>2.29 (5.14)</td>
<td>1.86 (6.41)</td>
<td>2.08 (3.68)</td>
<td>2.08 (5.09)</td>
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<tr>
<td>Number general theft offenses at the 12-month assessment</td>
<td>5.33 (14.06)</td>
<td>1.93 (7.15)</td>
<td>1.9 (6.45)</td>
<td>1.43 (3.11)</td>
<td>1.73 (5.61)</td>
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<tr>
<td><strong>Crimes Against Persons&lt;sup&gt;a&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Number of crimes against persons at baseline</td>
<td>7.88 (13.09)</td>
<td>4.11 (6.65)</td>
<td>4.45 (9.27)</td>
<td>3.09 (5.65)</td>
<td>3.85 (7.31) †</td>
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<td>Number crimes against persons at the 4-month assessment</td>
<td>4.95 (15.21)</td>
<td>4.21 (16.45)</td>
<td>2.6 (3.78)</td>
<td>5.83 (18.80)</td>
<td>4.28 (14.78)</td>
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<tr>
<td>Number crimes against persons at the 12-month assessment</td>
<td>9.48 (25.20)</td>
<td>0.93 (2.03)</td>
<td>2.27 (6.42)</td>
<td>1.59 (3.98)</td>
<td>1.60 (4.48)</td>
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<td><strong>Criminal Activity Costs&lt;sup&gt;b&lt;/sup&gt;</strong></td>
<td></td>
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<tr>
<td>All crimes – baseline</td>
<td>$228,874 (600,032)</td>
<td>$125,471 (231,250)</td>
<td>$100,083 (227,131)</td>
<td>$39,995 (63,105)</td>
<td>$86,477 (188,939)</td>
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<td>All crimes – 4-month assessment</td>
<td>$114,027 (297,754)</td>
<td>$64,739 (183,713)</td>
<td>$59,400 (144,266)</td>
<td>$93,499 (272,467)</td>
<td>$67,444 (196,695)</td>
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<tr>
<td>All crimes – 12-month assessment</td>
<td>$231,867 (613,954)</td>
<td>$32,185 (106,134)</td>
<td>$73,866 (270,706)</td>
<td>$90,275 (378,627)</td>
<td>$54,099 (214,807)</td>
</tr>
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</table>
FC = family court with community services; DC = drug court with community services; DC/MST = drug court with multisystemic therapy; DC/MST/CM = drug court with multisystemic therapy and contingency management.
Baseline = pretreatment assessment (N=161); 4-month follow-up (N=153); 12-month follow-up (N=129)
Standard deviations in parentheses.

a Number of public disorder offenses, crimes against persons and general theft offenses reflect self-reported criminal activity during the previous 3 months. Public disorder offenses include: disorderly conduct, vandalism, truancy, running away, and selling drugs. Crimes against persons include: aggravated assault, minor assault, and robbery. General theft offenses include: motor vehicle theft, household burglary, stolen property, and larceny/theft.

b Cost of crime calculated with estimates originally reported in French, McCollister, and Reznik (2007), Rajkumar and French (1997), and Miller, Cohen, and Rossman (1993). Total criminal activity cost comprised of the following acts: vandalism ($616), selling drugs ($28.44), aggravated assault ($111,431), minor assault ($2,630), robbery ($48,095), motor vehicle theft ($8,913), household burglary ($4,044), stolen property ($668), and larceny/theft ($1,583).

Statistically significant differences in variable medians between FC, DC, DC/MST, and DC/MST/CM: * p<0.10, ** p<0.05, Kruskal-Wallis equality of populations rank test. Significantly different from FC, † p<0.10, †† p<0.05, Wilcoxon rank-sum (Mann-Whitney) test.
<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
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<tr>
<td>DC</td>
<td>-140,572</td>
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<td></td>
<td>(94,647)</td>
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<tr>
<td>DC/MST</td>
<td>-132,696</td>
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<tr>
<td></td>
<td>(92,918)</td>
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<tr>
<td>DC/MST/CM</td>
<td>-157,853*</td>
<td>-144,373*</td>
</tr>
<tr>
<td></td>
<td>(88,975)</td>
<td>(74,332)</td>
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<tr>
<td>DC-Combined</td>
<td>-144,373*</td>
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</tr>
<tr>
<td></td>
<td>(74,332)</td>
<td></td>
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<tr>
<td>Days in DJJ placement baseline to 12-month assessment</td>
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<td>-578</td>
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<td>(452)</td>
<td>(439)</td>
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<td>Cost of criminal activity at baseline</td>
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<td>31.65</td>
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<td>(95.80)</td>
<td>(94.58)</td>
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<td>(34,525)</td>
<td>(34,075)</td>
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<td>Male</td>
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<td>(84,178)</td>
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<td>126,161</td>
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<td>(92,686)</td>
<td>(91,222)</td>
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<td>Education of parent/caregiver</td>
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<td>(259,542)</td>
<td>(255,616)</td>
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<td>Living with two parent/caregivers</td>
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<td>(73,105)</td>
<td>(71,840)</td>
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<td>Median annual household income</td>
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<td>(2,661)</td>
<td>(2,612)</td>
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<td>Number previous arrests</td>
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<td>(15,583)</td>
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<td>Previous mental health or addiction treatment</td>
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<td>(65,917)</td>
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Notes: Estimates are based on OLS regression of total criminal activity cost at the 12-month assessment. Standard errors in parentheses.
*Significance at 10% level; **Significance at 5% level