

Long-Term Prevention of Criminality in Siblings of Serious and Violent Juvenile Offenders: A 25-Year Follow-Up to a Randomized Clinical Trial of Multisystemic Therapy

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Objective: Family-based treatment models that have shown effectiveness with juvenile offenders may also lead to reduced criminality in siblings of those offenders. However, the lasting effects of such treatments on siblings have not been evaluated. In the present study, the authors examined criminal outcomes for siblings of serious and violent juvenile offenders who had participated on average 25.0 years earlier in a clinical trial of multisystemic therapy (MST; Borduin et al., 1995). **Method:** Participants were 129 closest-in-age siblings of individuals who were originally randomized to MST or individual therapy (IT) during adolescence. Arrest and incarceration data were obtained in middle adulthood when siblings were on average 38.4 years old. **Results:** Intent-to-treat analyses showed that arrest rates were significantly lower for siblings in the MST condition than in the IT condition (43.3% vs. 72.0%, respectively). In addition, siblings in the IT condition were about 3 times as likely to be convicted of a felony and more than twice as likely to be sentenced to incarceration and probation. **Conclusion:** The present study represents the longest follow-up to date of sibling participants in an MST clinical trial and demonstrates that the positive impact of an evidence-based treatment for serious and violent juvenile offenders can extend to other family members. Implications of the authors' findings for policymakers and service providers are discussed.

Keywords: sibling, multisystemic therapy, evidence-based treatment, randomized clinical trial, juvenile offender

Reviewers have identified a number of family-based treatment models that have shown effectiveness in reducing long-term criminal activity among serious and violent juvenile offenders (Eyberg, Nelson, & Boggs, 2008; Lochman, 2006). However, the lasting effects of such treatments on criminality in other family members have not been evaluated. This is unfortunate because treatments that involve the entire family are ideally suited to have a positive impact beyond the individual offender and may be especially cost-effective. Indeed, research findings demonstrating the broader clinical benefits of family-based treatments for serious and violent juvenile offenders would be useful for policymakers and service providers to consider in their decisions about mental health interventions.

Siblings of juvenile offenders are at high risk to engage in criminal behavior themselves due to shared genetic and environmental factors (Farrington, 1995; Gregory, Eley, & Plomin, 2004; Rhee & Waldman, 2002; Thapar & McGuffin, 1996). Regarding environmental risks, juvenile offenders and their siblings often have shared experiences with delinquent peers (Bank, Burraston, & Snyder, 2004; Haynie & McHugh, 2003) and with harsh or hostile caregivers (Conger & Conger, 1994; Patterson, Reid, & Dishion, 1992). In addition, juvenile offenders frequently have detrimental influences on their siblings by training them in coercive techniques (Garcia, Shaw, Winslow & Yaggi, 2000; Slomkowski, Cohen, & Brook, 1997) and by modeling violence and other delinquent behaviors (Ardelt & Day, 2002; Low, Shortt, & Snyder, 2012; Stormshak, Comeau, & Shepard, 2004). To the extent that these shared environmental risks are amenable to treatment, they represent a logical target of family-based interventions seeking to prevent criminality in siblings of serious and violent juvenile offenders.

Multisystemic therapy (MST; Henggeler & Borduin, 1990) is an intensive family- and community-based treatment that has demonstrated significant effects on the criminal activity of serious and violent juvenile offenders in more than a dozen clinical trials (Henggeler, Schoenwald, Borduin, Rowland, & Cunningham, 2009). The MST theory of change (see Henggeler et al., 2009) points to two likely pathways by which the benefits of MST and other comprehensive family-based interventions may extend to siblings. First, MST targets a complex interplay of risk factors (e.g., modeling of antisocial behavior, access to delinquent peers, neighborhood violence) in the multiple systems (e.g., family, peer,

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community) shared by juvenile offenders and their siblings. Given the substantial contribution of shared environmental risk factors to sibling criminality (see Rhee & Waldman, 2002), effective MST interventions may reduce environmental risks for future offending in both offenders and their siblings. Second, MST focuses on caregivers as the primary conduits of change and empowers them to engage in parenting practices (e.g., monitoring, conflict management) that improve juvenile offender and sibling functioning across family, peer, school, and community contexts. It seems reasonable to suggest that changes in caregiver effectiveness that result from MST may also benefit siblings who were not directly targeted by treatment. Taken together, it seems likely that a comprehensive family-based treatment model such as MST would produce reductions in criminality for all youths in a family through changes in shared environmental risk factors and parenting practices.

There is some evidence that family-based treatments have positive effects on problem behaviors (e.g., drug use, conduct problems) in siblings of youths referred for treatment. For example, in a follow-up of closest-in-age siblings of substance-abusing juvenile offenders who had been randomly assigned to MST or usual community services, Rowland, Chapman, and Henggeler (2008) found that siblings of MST participants reported a greater reduction in substance use through 18 months postrecruitment. These findings are generally consistent with those of other family-based treatments that have demonstrated short-term (i.e., 12–36 months) reductions in conduct problems and antisocial behavior among siblings of youths involved in delinquent acts (Arnold, Levine, & Patterson, 1975; Klein, Alexander, & Parsons, 1977). However, it is not known whether the positive effects of MST and other family-based treatments on siblings extend across a range of antisocial activities (i.e., both felony and misdemeanor offenses) and persist into adulthood.

In the current study from the Missouri Delinquency Project, we examined a broad range of criminal outcomes for closest-in-age siblings of serious and violent juvenile offenders who participated on average 25.0 years earlier in the largest randomized clinical trial of MST (see Borduin et al., 1995). Specifically, we investigated the long-term effects of MST on closest-in-age siblings' likelihood and number of (a) adult arrests for misdemeanor or felony offenses, (b) years sentenced to incarceration in the adult court system, and (c) years sentenced to adult probation. Although MST clinical trials (e.g., Borduin et al., 1995) have not revealed any significant moderators of treatment outcomes for juvenile offenders, we also examined the effects of potential moderators of outcomes for siblings (i.e., age, gender, race, socioeconomic status) in the absence of prior work evaluating such effects. As such, this study represents the longest and most comprehensive follow-up of siblings from an MST clinical trial to date and, to our knowledge, of any evidence-based psychotherapy for youths.

Method

Design

In the present study, we examined the long-term criminal outcomes of 129 siblings of serious juvenile offenders who received MST or individual therapy (IT) 25.0 years earlier in a randomized clinical trial (Borduin et al., 1995). The original trial used a pretest–posttest control group design, with random assignment to

conditions and a 4-year follow-up for rearrests, to compare the effectiveness of MST versus IT. Because this sample has been described extensively elsewhere (Borduin et al., 1995), a shorter description of the participants is provided here.

Participants

Participants were 129 closest-in-age siblings of juvenile offenders ($N = 176$) whose families participated in the original clinical trial (Borduin et al., 1995). These families had been referred consecutively to the Missouri Delinquency Project between July 1983 and October 1986 and agreed to complete pretreatment and posttreatment assessment measures. Inclusion in the original study required that referred youths (a) have at least two arrests (i.e., convictions), (b) live with at least one parent figure, and (c) have no evidence of psychosis or dementia. Families meeting these criteria were randomly assigned via coin toss to either MST ($n = 92$) or IT ($n = 84$). The referred youths had extensive criminal histories, averaging 3.9 previous felony arrests and 47.8% having at least one arrest for a violent crime (e.g., assault).

The present study included the sibling (if any) who was closest in age to each juvenile offender and was living in the same home at the time of the clinical trial (Borduin et al., 1995). Of the families in the trial, 72.8% (67 of 92) in the MST condition and 73.8% (62 of 84) in the IT condition had at least one sibling in the home. Of the closest-in-age siblings (hereafter referred to as *siblings*), 60.0% were younger siblings (whose mean ages were 11.1 [MST] and 11.9 [IT] years), and 40.0% were older siblings (whose mean ages were 16.3 [MST] and 16.6 [IT] years). The mean ages of the siblings and juvenile offenders were 13.4 ($SD = 3.7$) and 14.5 ($SD = 1.4$) years, respectively. Exactly half (50%) of the siblings and more than half (69.3%) of the juvenile offenders (i.e., those with siblings) were boys. The majority of families in the present study had two parent figures (59.1%), 39.1% were of lower socioeconomic status (Class IV or V; Hollingshead, 1975), and 86.4% were White. The average age of siblings at follow-up was 38.4 years ($SD = 3.7$). *T* tests and chi-square tests revealed that siblings in the two treatment conditions (MST vs. IT) did not significantly differ in terms of demographic characteristics.

Treatment Conditions

Families were randomly assigned to treatment conditions and to therapists within each condition. All analyses in the present study were by intent-to-treat. Details regarding therapists and treatment fidelity are provided in Borduin et al. (1995) and Sawyer and Borduin (2011).

MST. The MST interventions and model of service delivery are described in a clinical volume (Henggeler & Borduin, 1990) and subsequent treatment manual (Henggeler, Schoenwald, et al., 2009). Interventions integrate empirically supported clinical techniques (e.g., from behavioral and cognitive-behavioral therapies and structural/strategic family therapy), which have historically focused on a limited aspect of the youth's social ecology (e.g., individual youth, family), into a broad-based ecological framework. Services are delivered to youths and their family members (e.g., siblings, parents, grandparents) in home, school, and neighborhood settings at times convenient to the family (including evenings and weekends). Therapists match intensity of treatment

to clinical need, spending more time with families in the initial weeks of therapy (e.g., 3–4 times per week if indicated) and tapering off during a relatively brief (i.e., 4 to 6 months) course of treatment.

IT. The therapy in this condition represented the usual community outpatient treatment for juvenile offenders in the local judicial district as well as nationwide (see Loeber & Farrington, 1998). Interventions were an eclectic blend of psychodynamic (e.g., promoting insight and expression of feelings), client-centered (e.g., providing empathy and warmth), and behavioral (e.g., reinforcing school attendance and other positive behaviors) therapies. Although there were some variations in the therapists' strategies (e.g., some therapists provided less empathy or were more directive than other therapists), all focused on intervening with the individual youth rather than with his or her social ecology (e.g., family members).

Research Procedures

Original outcome study. Families referred to the treatment project were initially contacted via phone or home visit and told that a 1.5-hr research assessment would be conducted prior to the start of treatment and again after all treatment sessions were completed. Families were informed that participation in the research was voluntary and that refusing to participate or discontinuing participation would not jeopardize the receipt of treatment services or result in sanctions from the court. Families were also informed that arrest records and other public records would be obtained for individual family members. Family members provided written consent or assent for the research procedures. All procedures were approved by the Institutional Review Board of the University of Missouri. Only those procedures and measures relevant to the current study are described.

Present study. Public records information for adult criminal court records were obtained within the state of Missouri.¹ A broader search of criminal records in other states was not possible because fingerprints would have been required to conduct a national criminal records search, and these were not obtained from siblings or other family members at the time of the original study. Nevertheless, we assumed that arrest rates for those siblings residing outside Missouri did not differ systematically from those siblings remaining in the state. We also assumed that variation between treatment groups in arrest rates would be consistent whether siblings resided within or outside Missouri.

In the present study, Missouri residency was confirmed to determine whether each sibling had resided in the state since the time of treatment using the same procedures as Sawyer and Borduin (2011) and, thus, whether he or she was available to have a court record (i.e., arrests, sentencing) in the state through December of 2010, when our follow-up was completed. Several steps were used to confirm residency. First, state criminal records were searched, and adult arrests that had occurred after release from treatment and that led to convictions were recorded. Next, for those siblings whose names did not appear in state criminal records, a search of state driving records was conducted. An individual was considered to have resided in the state during the follow-up period if he or she held a Missouri driver's license. Finally, property ownership and marital records were searched for siblings for whom there were no arrest or driver's license records.

Overall, 85.3% ($n = 110$) of the siblings were located and determined to have lived in the state since the end of treatment, including 89.6% ($n = 60$) of the MST siblings and 80.6% ($n = 50$) of the IT siblings; attrition rates did not differ significantly between groups. The remaining 14.7% of the sample for whom residency could not be verified were considered lost to follow-up (see Figure 1). There were no demographic differences between siblings located at follow-up versus siblings considered lost to follow-up. The demographic characteristics of siblings who were located at follow-up, as well as *T* tests and chi-square tests that demonstrate no differences in these characteristics between the two conditions (MST vs. IT), are presented in Table 1.

Measures

Adult criminal court records, which are freely available to the public in the state of Missouri, were obtained using an Internet database searched separately by four research assistants, all of whom were blind to each sibling's treatment condition. Siblings' names were used to search court records, including known aliases, alternative first names (e.g., Christy or Tina for Christina), and alternative last names for women whose names may have changed due to marriage (based on state-level court records and county-level marriage records).

Several steps were taken to reduce the possibility of false positives for siblings whose names were present in court records. First, siblings were matched to records by date of birth, middle name or middle initial, and suffixes (e.g., Jr.). Second, when such indicators were absent for a specific case, siblings were matched to records based on similarities to cases that met the first search criterion, including previously recorded addresses, court locations, and names of other individuals listed on the court docket (e.g., spouses). If siblings could not be matched to records by this rule-out process, no information was recorded for a given sibling. Thus, the data for the present study provided a conservative estimate of court involvement in the state of Missouri.

For criminal records, data were coded by crime classification (misdemeanor vs. felony) and date of arrest. In addition, sentencing information was recorded as the number of days sentenced to incarceration and/or probation. For cases in which incarceration sentences were suspended in favor of probation, only days sentenced to probation were recorded, unless the terms of probation were violated and the incarceration sentence was executed. In addition, only criminal arrests that resulted in convictions were included in the present study; those criminal cases that were dismissed or that were not yet disposed at the time of data collection were not recorded. Traffic court records, which included

¹ At the time of the original outcome study, we did not obtain juvenile arrest records for the closest-in-age siblings because none of these siblings were under juvenile office supervision. Nevertheless, it is likely that some of the siblings were arrested as juveniles in the years following the original study. Unfortunately, we could not obtain sibling juvenile arrest records for the present follow-up (i.e., on average 25 years after treatment) because any pertinent juvenile records had been permanently sealed once the siblings reached adulthood (age 17 in Missouri). Although juvenile arrest records for siblings were not available, the siblings' adult arrest records covered the greater part (i.e., 21.6 years, or 84%) of the entire follow-up period.

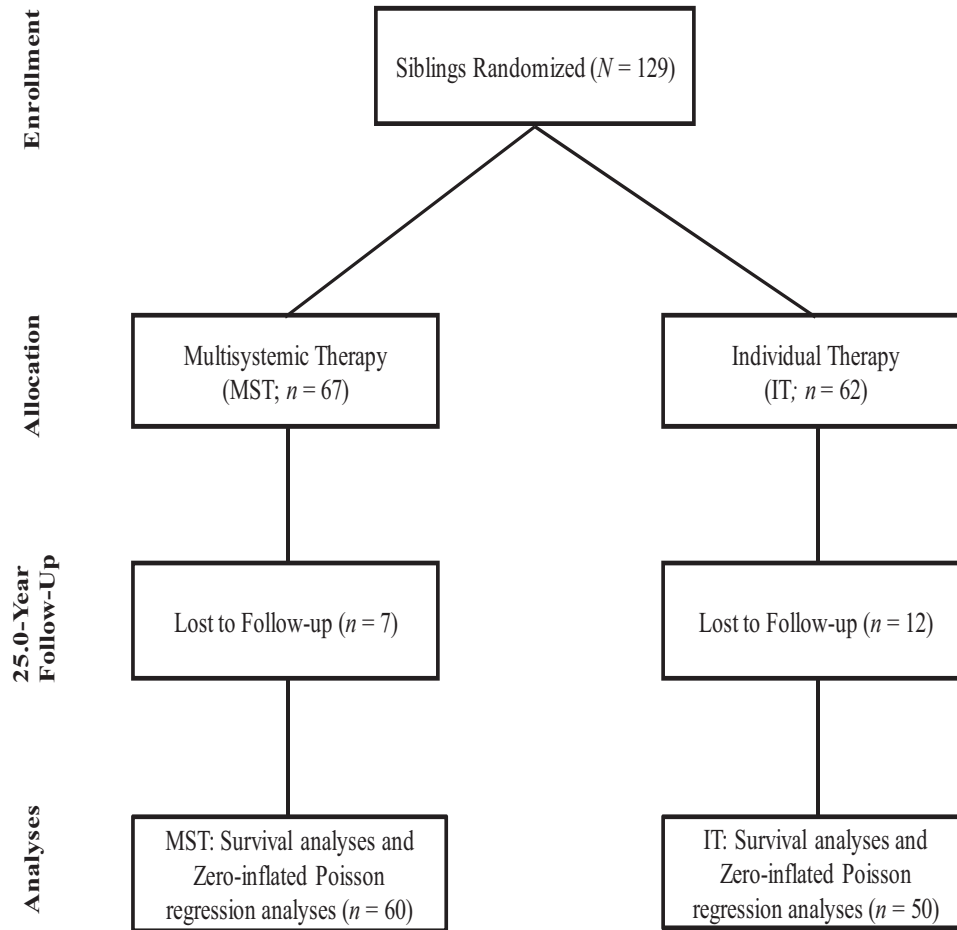


Figure 1. Flow diagram of siblings from family referral to follow-up. MST = multisystemic therapy; IT = individual therapy.

minor traffic violations (e.g., speeding), were not included in the data set.

Results

We conducted three sets of analyses to evaluate the impact of treatment group (MST vs. IT) on criminal court outcomes. First, we used descriptive statistics to examine the frequencies of dichotomous outcomes (i.e., arrested vs. not arrested) for each group. Second, we conducted survival analyses to evaluate between-group differences in length of time to the first occurrence of a given outcome (i.e., arrest). Third, we used zero-inflated Poisson (ZIP) regressions to examine between-groups differences on continuous outcomes (i.e., number of arrests and years sentenced). ZIP regressions were also used to evaluate the effects of potential moderators of treatment.

Relative Odds of Arrests

We calculated the percentages and relative odds of arrests in the IT group versus the MST group. Odds ratios greater than 1.0 indicated higher odds for IT siblings relative to MST siblings. Confidence intervals that did not include 1.0 indicated that results

were unlikely to occur by chance (Cohen, 1994). As described in Table 2, by the end of the follow-up period, 72.0% of the siblings in the IT group had been arrested at least once, compared with 43.3% of the siblings in the MST group. The odds of being arrested for any crime during follow-up were 3.36 times higher for the IT group than for the MST group. Similarly, when crime subtypes were examined, the odds of arrest for felonies and misdemeanors, respectively, were 2.92 and 2.63 times greater for IT siblings than for MST siblings. For all categories of crimes, the confidence interval around the odds ratio did not include 1.0.

Survival Functions for Arrests

Survival analyses (Cox proportional hazards regressions; SPSS, Version 15) were used to obtain cumulative survival functions (or survival curves) for criminal outcomes among siblings in the MST and IT groups. The cumulative survival function represents the proportion of siblings who survived any type of arrest (i.e., were not arrested) in each group by the length of time (in years) from release from treatment. Survival analyses are appropriate here because they model data that are censored, (i.e., when some individuals in the sample do not experience an event, such as arrest; Keiley & Martin, 2005). A log-rank test revealed that the

Table 1
Demographic Characteristics of Siblings Located at Follow-Up

Variable	Group		Analyses	
	MST	IT	<i>T</i>	χ^2
Age (years)				
<i>M</i>	12.95	13.90	-1.34	
<i>SD</i>	3.95	3.41		
Male gender (%)	53.3	46.0		0.59
Younger sibling (%)	65.0	58.0		0.57
Social class ^a (%)				
Class V	25.0	18.0		2.06
Class IV	16.7	18.0		
Class III	26.7	31.8		
Class II	25.0	22.7		
Class I	6.7	6.4		
Race (%)				
African American	8.3	20.0		3.15
White	91.7	80.0		
Two-parent households (%)	63.3	54.0		0.98

Note. For all analyses, only those youths with complete follow-up data were included. Sample sizes for therapy conditions are as follows: MST (*n* = 60); IT (*n* = 50). For age, *df* = 108; for social class, *df* = 4; for gender, younger sibling, race, and two-parent households, *df* = 1. For all *T* and χ^2 values *ps* > .05. MST = multisystemic therapy; IT = individual therapy.

^aBased on Hollingshead's (1975) Four-Factor Index of Social Status.

survival functions for the two groups on any arrest were significantly different, $\chi^2(1, N = 110) = 8.35, p = .004$, with MST siblings at lower risk of arrest (i.e., more likely to survive) during follow-up than were IT siblings. The hazards ratio for treatment condition (MST or IT; *p* = .005) was .491, suggesting a medium effect size for the lower risk of arrest observed for MST siblings.

We also used survival analyses to examine between-groups differences on time to first arrest for various types of crimes (i.e., felonies and misdemeanors). As depicted in Figure 2, a nonsignificant trend indicated that siblings in the MST group were at lower risk of arrest for felonies, $\chi^2(1, N = 110) = 3.22, p = .07$, during follow-up than were siblings in the IT group. In addition, MST siblings were at lower risk of arrest for misdemeanors, $\chi^2(1, N = 110) = 5.71, p = .02$, than were IT siblings (see Figure 3). The hazards ratios for these survival functions suggested medium effects for MST on felonies ($\beta = .495$) and misdemeanors ($\beta = .531$), respectively.

Table 2
Likelihood of Posttreatment Arrests by Therapy Condition

Criminal arrests	%	χ^2	<i>p</i>
Any crime		10.52	.002
IT	72.0		
MST	43.3		
Any felony		6.18	.013
IT	34.0		
MST	15.0		
Any misdemeanor		6.85	.009
IT	62.0		
MST	38.3		

Note. Sample sizes for therapy conditions are as follows: individual therapy (IT; *n* = 50); multisystemic therapy (MST; *n* = 60).

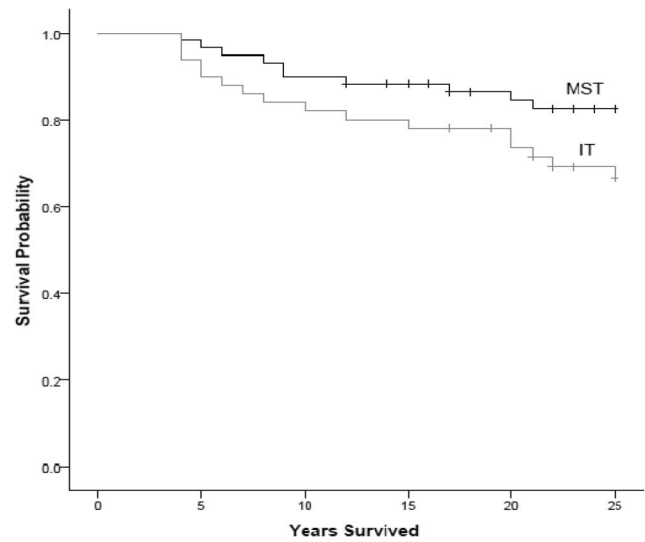


Figure 2. Survival functions for multisystemic therapy (MST) and individual therapy (IT) siblings on time to first felony arrest following treatment.

Number of Arrests and Years Sentenced

ZIP regression analyses evaluated the impact of treatment condition on the number of posttreatment arrests and years sentenced to incarceration or probation. Because the outcome variables in the present study are continuous, nonnormal, and nonnegative (i.e., there are no negative values), they are considered censored-dependent variables (Greene, 1993). These variables contain both qualitative (e.g., arrested vs. not arrested) and quantitative (e.g., number of arrests) components. ZIP regressions account for the qualitative and quantitative components of such variables by producing two separate estimates: (a) an estimate of relative odds

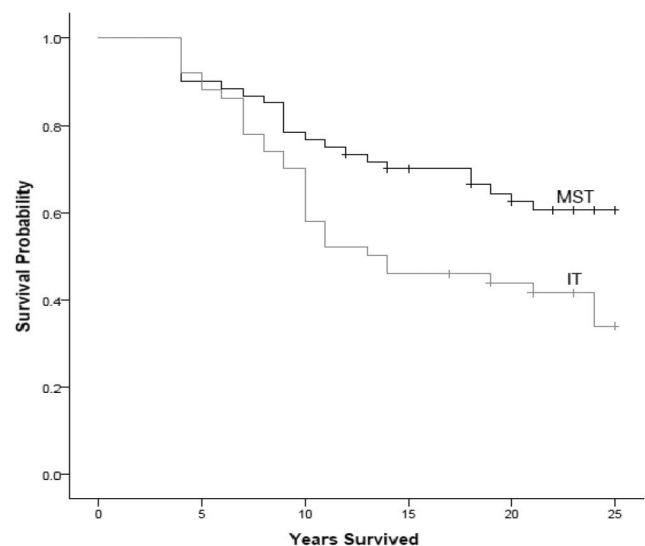


Figure 3. Survival functions for multisystemic therapy (MST) and individual therapy (IT) siblings on time to first misdemeanor arrest following treatment.

(e.g., of being arrested) and (b) an estimate of relative rate (e.g., of number of arrests). Both estimates differ from traditional odds and rate statistics in that they are inferential estimates of effect rather than descriptive statistics. ZIP regressions perform well when sample distributions of counts are highly skewed due to an excess of zeroes (e.g., individuals with no criminal convictions; Lambert, 1992). We computed all ZIP regressions using the Mplus (Version 4; Muthén & Muthén, 2007) statistical package and used maximum-likelihood estimation. Treatment condition was dummy coded with IT equal to 1 and MST equal to 0. Descriptive statistics and regression coefficients are presented in Table 3.

We calculated an odds estimate (OE) and rate estimate (RE) for each outcome variable. OE values reflected inferential estimates of the odds of posttreatment arrests and sentencing outcomes as predicted by treatment condition. RE values reflected estimates of the frequencies of criminal outcomes as predicted by treatment condition. For both OEs and REs, a value greater than zero represented a higher likelihood of an outcome among IT siblings relative to MST siblings. The results of the ZIP regressions indicated that the estimated odds of any crime, any felony, and any misdemeanor, respectively, were approximately three times (OE = 3.49), five times (OE = 4.80), and two times (OE = 2.54) as high for IT siblings as for MST siblings. In addition, the estimated odds of having been sentenced to incarceration or probation were approximately twice as high for IT siblings as for MST siblings. Regarding rates, IT siblings were estimated to be sentenced to approximately 11 times as many years of incarceration and seven times as many years of probation as were MST siblings (REs = 11.50 and 6.95, respectively). Although all other RE values favored MST over IT, none were statistically significant.

Potential Moderators of Criminal Activity

ZIP regression analyses were also used to evaluate the effects of potential moderators (sibling age, socioeconomic status [SES], gender) of MST effectiveness. These potential moderators were examined for all outcomes with significant or near significant treatment effects (i.e., number of felonies, number of misdemeanors, years sentenced to incarceration, years sentenced to

probation). For each regression analysis, a dummy variable that represented treatment group, the moderating variable, and the cross-product term of the treatment group and the moderating variable were entered simultaneously. Moderator variables that were continuous (i.e., age and SES) were centered around their means in each cross-product term. A significant regression coefficient (i.e., OE or RE value) for the cross-product term indicated whether MST was differentially effective with siblings from divergent backgrounds. There were no significant moderators for any outcome variable. Although these results suggest that MST was equally effective with siblings of different backgrounds, it should be noted that power to detect moderating effects was low for some variables due to relatively few participants in certain subgroups. For example, there were a small number of minority youths in each treatment condition. Thus, any conclusions about moderators of MST effectiveness should be considered tentative.

Discussion

The findings clearly demonstrate the impact of MST on criminal activity in closest-in-age siblings of serious and violent juvenile offenders. Over a follow-up period of 25.0 years, siblings of MST participants were significantly less likely to have been arrested than were siblings of IT participants (43.3% vs. 72.0%, respectively). More specifically, the odds of arrest for felony or misdemeanor offenses were two to three times lower for siblings of MST participants than for siblings of IT participants. Moreover, the number of years sentenced to incarceration or probation was seven to 11 times lower for siblings in the MST condition than in the IT condition. Furthermore, consistent with conclusions from recent reviews regarding the cultural effectiveness of MST (e.g., Henggeler, 2011; Huey & Polo, 2008), the relative efficacy of MST was not moderated by measured demographic characteristics, suggesting that MST was not differentially effective with siblings from different backgrounds.

The present study is the first to examine the efficacy of MST in altering the criminal trajectories of siblings of serious juvenile offenders beyond adolescence (see Rowland et al., 2008) and into middle adulthood. The results indicate that MST produced a 40% reduction in siblings' overall arrest rates and a 55% reduction in their felony arrest rates. Although the childhood behavioral histories of the siblings in our study are not known, it is possible that this sample of youths includes many of the life-course persistent offenders (see Moffitt, 1993) about whom policymakers and researchers are most concerned. Indeed, during the follow-up period, the vast majority (i.e., 72%) of siblings in the IT condition had at least one arrest, and more than a third (i.e., 34%) of these siblings had a felony arrest. Viewed together, the present findings suggest that MST is an effective treatment for families in which more than one member is at high risk to engage in criminal behavior (see Farrington, Jolliffe, Loeber, Stouthamer-Loeber, & Kalb, 2001).

Although an examination of specific mechanisms of change for sibling outcomes was beyond the scope of the present study, the results are consistent with other findings demonstrating that changes in environmental risk factors (e.g., improved parenting behaviors, decreased youth association with deviant peers) mediate outcomes of MST for serious and violent juvenile offenders (Deković, Asscher, Manders, Prins, & van der Laan, 2012; Henggeler, Letourneau et al., 2009; Huey, Henggeler, Brondino, & Pickrel,

Table 3
Descriptive Statistics and ZIP Regression Results for Criminal Outcomes

Variable	MST		IT		ZIP coefficients	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	OE	RE
Crime type (number)						
Any crime	1.33	2.24	2.46	3.63	3.49*	3.29
Any felony	0.38	1.14	0.58	0.93	4.80**	1.18
Any misdemeanor	0.95	1.62	1.88	3.08	2.54*	2.86
Adult sentencing (years)						
Incarceration	1.69	6.00	2.31	3.93	2.46*	11.50*
Probation	1.35	2.76	3.36	5.02	2.31*	6.95**

Note. ZIP = zero-inflated Poisson; OE = odds estimate; RE = rate estimate; MST = multisystemic therapy; IT = individual therapy. For all analyses, only those youths with complete 25.0-year follow-up data were included. Sample sizes for therapy conditions are as follows: MST ($n = 60$); IT ($n = 50$).

* $p < .05$. ** $p < .01$.

2000). It seems likely that similar changes in risk factors mediated the effects of MST on siblings inasmuch as these risk factors are shared in families of juvenile offenders. If so, our results suggest that other evidence-based treatments for serious and violent juvenile offenders (e.g., multidimensional treatment foster care [Chamberlain, 2003]; functional family therapy [Alexander & Parsons, 1982]) may also have long-term positive effects on siblings, given similar clinical emphases (i.e., focus on key causes and correlates of youth antisocial behavior, ecologically valid service delivery). Conversely, treatments that fail to target the multiple causes and correlates of antisocial behavior in a youth's social ecology, such as the IT condition in the present study, are unlikely to benefit siblings.

Increasingly, policymakers are under pressure to address public concerns about crime with interventions that not only improve public safety but also are cost beneficial to taxpayers and crime victims. The preventive effect of MST on sibling criminality is important for policymakers to consider when allocating scarce financial resources to treatments for serious and violent juvenile offenders. A recent economic evaluation of taxpayer and crime victims benefits with the 176 juvenile offenders from our original clinical trial (Borduin et al., 1995) indicated total cost benefits ranging from \$75,111 to \$199,374 for each youth receiving MST, or benefit-to-cost ratios of \$9.51 to \$23.59 for every dollar spent (Klietz, Borduin, & Schaeffer, 2010). The relative efficacy of MST in reducing sibling criminality and incarceration should result in even greater cost benefits of MST per family, creating a persuasive argument for increased funding for MST and other cost beneficial family interventions and decreased funding for individually-focused interventions like those in the alternative treatment condition.

The present study has several methodological limitations. First, the design of this study does not allow for an examination of whether the favorable results for siblings in the MST group were due to (a) the specific effects of MST, (b) the general effects of a family-based intervention, or (c) the more general effects of any intervention. Nevertheless, our findings are consistent with the view that treatments that involve the entire family and that target shared environmental risk factors are ideally suited to have a positive impact beyond the individual offender. Second, we assessed criminal activity during the follow-up period using official arrest records, which underestimate the actual number of crimes committed by serious offenders (Loeber & Farrington, 1998). However, arrest records are one useful index of criminal involvement and likely resulted in an accurate estimate of the relative effectiveness of MST versus IT in reducing criminal activity. Third, we were unable to confirm that siblings maintained continuous residency in Missouri throughout the follow-up period. Therefore, we cannot rule out the possibility that some siblings committed crimes in other states or that other siblings with more positive outcomes moved to other states to pursue a college education or a career. Even so, complete follow-up data were available for the vast majority (85.3%) of our sample. Finally, we examined arrest records for the closest-in-age sibling of each juvenile offender but not for other siblings. Because siblings who are close in age are more likely to share similar risk factors for antisocial behavior than are siblings with wider age spacing, closest-in-age siblings may be most likely to benefit from MST-related changes

in their social ecologies (e.g., improvements in family functioning, decreases in delinquent peer affiliation).

In summary, the results of this study indicate that a comprehensive intervention addressing multiple determinants of antisocial behavior in youths' natural environments can successfully prevent criminal activity in siblings of serious and violent juvenile offenders. Over the longest follow-up period ever examined in an MST clinical trial, MST produced lasting reductions in a broad range of criminal outcomes for brothers and sisters of juvenile offenders. Our results likely correspond to improved life outcomes for these siblings, increased cost savings for taxpayers, and decreased risks of victimization for community members. As evidence-based treatments are disseminated more broadly, our findings should be considered by policymakers and service providers in the adoption of interventions for serious juvenile offenders (and their families). Furthermore, we hope that the favorable results of this study encourage researchers to examine whether other treatment models for child and adolescent clinical populations produce long-term benefits for siblings.

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