Butler, S; Baruch, G; Hickey, N; Fonagy, P; (2011) A randomized controlled trial of multisystemic therapy and a statutory therapeutic intervention for young offenders. **J Am Acad Child Adolesc Psychiatry** , 50 (12) 1220 - 35.e2. 10.1016/j.jaac.2011.09.017.

RESEARCH ARTICLE

A randomized randomised controlled trial of Multisystemic Therapy and statutory therapeutic intervention for young offenders

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ABSTRACT

Objective: (1) to evaluate whether Multisystemic Therapy (MST) is more effective in reducing youth offending and out-of-home placement in a large, ethnically diverse, urban UK sample than an equally comprehensive management protocol; and (2) to determine whether MST leads to broader improvements in youth sociality and in mediators believed to be responsible for change in MST. Method: 108 families were randomized to either MST (n=56) or the comprehensive and targeted usual services delivered by youth offending teams (YOT, n=52). Results: although both MST and YOT interventions appeared highly successful in reducing offending, the MST model of service-delivery reduced significantly further the likelihood of non-violent offending during an 18-month follow-up period. Consistent with offending data, the results of youth-reported delinquency and parental reports of aggressive and delinquent behaviors show significantly greater reductions from pre-treatment to post-treatment levels in the MST group. Conclusions: The superiority of the MST condition in reducing offending and antisocial behavior suggests that MST adds value to current UK statutory evidence-based youth services. The provision of MST cannot supplant existing services but is best used to facilitate the appropriate and cost-effective organization of statutory services for young persons and their families.

Introduction

Juvenile delinquents are poorly served by current statutory systems, and demand for effective therapies is acute. Serious and repeated antisocial behavior during childhood and adolescence is relatively common and can have significant and costly long-term consequences for individuals, their families and society.[1,2] Of juveniles with diagnosable conduct disorder (CD), over three-fifths have severe problems: 29% have pervasive CD with an average of 8eight symptoms including aggression; a further 29% endorse on average six symptoms including theft and other property- oriented offenses (but not physical violence); and 3% appear to be primarily aggressive.[1] Most serious youth antisocial behavior is committed by a very small group of persistent offenders.[3] Antisocial behavior in childhood generally progresses through adolescence and becomes antisocial personality disorder (ASPD) in adult life.[4–9]

Multisystemic Therapy (MST)[10] is an intensive family-and-home-based intervention for young people with serious antisocial behavior. It aims to prevent re-offending and out-of-home placements. MST was developed in response to research on the multi-determined nature of antisocial behavior, and adopts a social-ecological approach to intervention.[11] MST improves behavior by intervening in the many systems of which juveniles are part. A large body of evidence supports the efficacy of MST in reducing recidivism and custodial sentences amongst serious juvenile offenders.[12] MST has been widely applied in the US and in other countries including Canada, Holland, Norway, Sweden, Denmark, New Zealand, and, most recently, the UK.

A number of good-quality randomized controlled trials (RCT) suggested that MST was the most effective treatment for reducing adolescents' recidivism and improving individual and family pathology.[13–17] However, more recent reviews have been less positive.[18–20] Studies in Canada[21] and Sweden[22] found that MST failed to reduce antisocial behavior more than in usual service conditions did. In the first RCT of MST conducted in the

US without direct involvement of the treatment developers, re-offending rates in the MST group remained high (even though the intervention significantly reduced re-offending compared to treatment as usual [MST 66.7% vs. TAU 86.7%]).[23] For trials of MST involving the developers, effect sizes associated with efficacy are substantially higher (.81) than effectiveness in studies conducted without their close involvement (.27).[24] This may be due to reduced treatment adherence,[25] the quality of TAU in the US, or the options for legal dispositions when dealing with young offenders.[26]

Internationally, the replicability of the US findings from the US has been mixed. This suggests that MST's relative success may not be due to the rigorous application of MST principles but rather to the poor quality of the standard US services for managing CD. Thus, for MST to be considered valuable, its superiority should be demonstrated outside the US in legal jurisdictions and regions where: (a) the evidence-base (EB) for TAU (associated with socialized healthcare systems) is stronger than for TAUs identified in earlier clinical trials initiated by the developers of MST (e.g. individual psychotherapy); (b) the motivation of therapists delivering MST is lower than the motivation of those who were involved in MST's development; and (c) standards with regard to sentencing policy do not result in a comparison with toxic alternatives such as custodial sentences.

In the UK, a relatively generous supportive framework is provided by usual services. This offers a better testing ground for the value added by MST. In England and Wales, the Crime and Disorders Act (1998)[27] established a new youth-justice system and Youth Offending Teams (YOTs), the principal aim of which is to prevent offending by young people. Under this framework, EB interventions address the personal, family, social, educational and health factors that put a young person at risk of offending, and build on protective factors to ameliorate their difficulties. As in MST, interventions target well-known risks (e.g. non-attendance at school, poor anger-management and poor problem-solving skills). Parents' responsibilities are reinforced although treatment is not focused on

parenting. An allocated YOT social worker works to encourage young persons to develop responsibility for their behavior and consideration for the victims of their crimes.

The present study is the first RCT of MST that contrasts it with the current protocols for youth offenders in the UK. The involvement of MST developers was limited to launching the service and ensuring fidelity to the model; the evaluation was independently conducted. Finally, unlike Scandinavian studies, the compatibility of the US and UK legal systems permits primary and secondary outcomes to be compared with those from the early efficacy studies conducted in the US. The English system provides primary outcomes, objective offending data and custodial rates. These have not been available in other European trials[22,28–29] because antisocial behavior in these countries is dealt with by the child welfare system. Hence, it is difficult to compare these previous European MST trials to US studies in the US and to generalize to the UK.

The study aims to: (1) evaluate in a large, ethnically diverse, urban UK sample whether MST is more effective in reducing youth offending and out-of-home placement than a similarly comprehensive management protocol not based on MST principles; and (2) determine whether MST leads to broader improvements in youth sociality, family function and potential mediators of change (such as parenting skills, parent-adolescent communication, and disassociation from deviant peers).[30]

Method

This study was approved by the local Research Ethics (IRB) Committee.

Setting and Inclusion Criteria

From November 2003 to December 2009, the trial used consecutive referrals from two local youth offending services in North London. Young people were included in the study if they were: (i) between 13 and 17 years old; (ii) living in the home of and being brought up by a parent or principal carer; and (iii) on a court referral order for treatment, a supervision order of at least three months duration, or, following imprisonment, on license in the

community for at least 6 months. They were excluded if they: (i) were a sex offender; (ii) presented only with substance misuse; (iii) were diagnosed with a psychotic illness; or (iv) posed a risk to trial personnel. They were also excluded if: (v) there was incompatible agency involvement (e.g. ongoing care proceedings).

Participants

Figure 1 shows the flow of participants through the trial. Four-hundred-and-seventy-eight young people were referred to the treatment team during the study period, of whom 370 were excluded because they could not be contacted, refused to consent to assessment, did not meet one or more inclusion criteria, or met one of the exclusion criteria. Families declined to participate mostly because the parent or carer felt there were no recent, current or anticipated difficulties with a young person's behavior. This left 108 to be randomized into MST (n=56) or YOT (n=52). There was no difference in the distribution of completer categories across the groups (χ^2 =1.87, df=2, p=.18).

Table 1 shows the demographic and clinical details of this sample. The majority was male (about equal numbers Caucasian and Black) and had an average of more than 2two offenses at intake (range 0–6). Over half the convictions included violent offenses and 41% had only non-violent convictions. Across the sample, the age of contact with youth offender services (14.9 years) and number of convictions (2.03) were representative of the population of young offenders in the London area that the sample was drawn from.[31] Only a small minority was living with two parents; over two- thirds lived with their mothers but not their fathers, and less than 10% with their fathers but not their mothers. Only one- third was in mainstream education. Thirty-one per cent of the parents had left school with no academic qualifications; 40% had no vocational qualifications; and 54% were without income. In sum, almost all subjects lived in socio-economically disadvantaged families.

Randomization

Following acceptance of the referral, a standard initial letter in the family's first

language was sent to parents (and separately to young persons 16 or older), informing them about the trial, the standard explanatory visit and a standard consenting procedure. After 1-2 weeks, a member of the MST team visited the family to explain what participation might involve and to arrange an appointment. At this stage, some exclusion criteria were identified (e.g. risk to personnel, incompatible agency involvement, and severe substance dependence). Consent forms were usually signed after the family had adequate time to consider their participation (7 days following the visit). Pre-randomisation questionnaires and measures, and the final evaluation for eligibility were completed. Finally, treatment allocation was made offsite using a stochastic minimization programme (MINIM) balancing for type of offending (violent vs. non-violent), gender and ethnicity. The MST supervisor informed patients of their assignment.

Within four weeks of treatment terminating for a family in the MST group, the initial assessment battery was repeated with that family and the YOT family recruited closest in time. Families were paid £25 for each assessment.

Treatment Conditions

MST

MST is a family- and community-based intervention that uses intense contact with families to understand and address the drivers of a young person's antisocial behavior.[32] It targets drivers related to the young person's individual adjustment, their family relationships, school functioning, and peer group affiliations. Parental involvement is considered central to achieving treatment goals and maintaining them post-intervention. Therefore, therapists are therefore very active in helping carers to develop the necessary skills and strategies to effect change in the relevant domains.

For this study, the MST team comprised three therapists and a supervisor. Staff changed minimally during the trial and a total of five therapists delivered all the interventions. The therapists held master's-level qualifications in counseling psychology or social work,

and had a minimum of 2 years' experience working with families. They received MST training as part of the study. All five were female. Four were Caucasian and one was Bangladeshi. In accordance with the treatment model, the therapists: had low caseloads (max. maximum three families per therapist); were intensively involved with the families, usually visiting them at least three times per week; and were available by telephone to support them 24 hours per day and 7 days per week. The lengths of the interventions ranged from 11 to 30 weeks (mean 20.4). Families who were randomized to MST could also receive statutory services where necessary; this normally included contact with a social worker.

In common with all MST sites, the trial site was licensed by MST Services Inc., Charleston, South Carolina, and therefore participated in MST Services' quality assurance procedures. As well as a weekly supervision with the MST supervisor, there was a weekly one-hour consultation (via by telephone) with an MST expert, on-site booster training sessions four times per year, and twice yearly implementation reviews by the expert. The supervisor guided clinical work according to the *MST Supervisory Manual*.[33] In delivering MST, the trial team adhered to the *MST Organizational Manual*.[34]

The MST Therapist Adherence Measure (TAM)[35] measured the team's adherence to the nine MST treatment principles. The TAM is a 28-item measure completed by parents or primary carers. In the trial it was administered by telephone by the MST Project Coordinator. Data was collected from the second week of MST treatment and four-weekly thereafter. In this study, TAM scores were available for all MST participants treated by the five therapists.

YOT (Usual Services)

Based on assessments, young people in the YOT group received a tailored range of interventions aimed at preventing re-offending. As in MST, typical interventions are extensive and multi-component. They include: helping the young person re-engage in education; help with substance misuse problems and anger management; social problem-solving skills training; and programs for vehicle-crime, violent-offending and knife-crime

awareness. Victim awareness and reparation interventions were also commonly included. The treatments are evidence-based interventions recommended by the National Institute for Health and Clinical Excellence (NICE (National Institute for Health and Clinical Excellence).[26] The treatments are delivered by professional social workers, specialist therapists, or probation officers. The key differences between MST and YOT are that interventions are not normally organized to be delivered in a family context by a single person. No overarching model governs the selection of treatments, and there are no set of principles comparable to MST to organize the therapies offered. Rather, interventions are offered on an 'as needed' on a case-by-case basis by specialist agencies to which the young person is referred. The young people allocated to YOT received considerable attention from a range of professionals delivering individual evidence-based protocols; the average client received about 21 professional appointments over the period that MST was administered (M=20.88, SD=12.88). On average, 67.3% of appointments were with social workers (M=14.06, SD=10.03), 7.2% with a reparations worker (M=1.50, SD=2.0), 7.2% with a parenting worker (M=1.46, SD=3.17), 6.2% with a group worker (M=1.30, SD=2.62) and 6.0% with a drugs worker (M=1.26, SD=2.64).

Overall, young people in the YOT condition attended a significantly greater number of appointments ($F_{1,101}$=5.28, p<0.05), as well as a significantly greater number of appointments with social workers ($F_{1,101}$=4.80, p<0.05), than those in the MST arm.

Outcomes and measures

Primary outcomes were reports of offending behavior based on police computer records including custodial sentences. These measures were taken at 6six monthly intervals: for the 6six months before randomization, for the 6six months covering the intervention period, and then half-yearly until the 18 months follow-up point. The number of records of offending behavior (count data) was obtained and six6-month periods free of any offending behavior were also recorded (binary data). Records were obtained from the

National Young Offender Information System (YOIS) database. YOIS records detailed offense information, court appearances, criminal orders, police custody records and arrest rates.

Secondary outcomes were self- and parent-rated symptoms of antisocial behavior, delinquency linked cognitions, personality functioning and parenting variables. All secondary outcome measures were obtained at baseline and after MST treatment was completed (about 6 months after randomization for both MST and YOT groups). Antisocial behavior was assessed using: the Self-Report of Youth Behavior (SRYB), a brief, valid measure of the prevalence and incidence in pre-adolescent and adolescent children of delinquent behavior such as vandalism, theft, burglary, and fraud;[36] and the delinquency and aggression subscales of the Youth Self-Report (YSR) and the parent-completed Child Behavior Checklist (CBCL).[37] Other measures included: the Antisocial Beliefs and Attitudes Scale (ABAS), which assesses beliefs and attitudes toward standards of acceptable behavior in social and familial contexts;[38] Loeber et al.'s parent-completed measure of positive parenting and disciplinary practices (PP) along with parent monitoring and supervision;[39] a family measure completed by both the young person and primary carer looking at the quality of the emotional bond between adolescent and parent (emotional connectedness) and the degree of age-appropriate autonomy shown by the young person; the Antisocial Process Screening Device (APSD), a parent-completed measure of youth psychopathic traits;[40] and a 16-item scale measuring the youth's involvement with delinquent peers (IDP) adapted from the 'Youth in Transition Study'.[41] For more information about the measures used in the study please see the supplementary materials.

Demographic Data

A demographic data form was designed to gather information regarding participants' ethnicity and socio-economic background. All categories were based on the 2001 population census for England and Wales (Office for National Statistics, 2003).[31] For

socio-economic status (SES), we used a three-point scale (1–3) integrating information on parent education (6 six categories from none to higher degree) and occupation (six categories from without income to professional employment) in order to allow discrimination in this low SES sample. Parent SES was low (1) if one of the parents was in the bottom two categories for at least one variable, and high (3) if they were in either of the highest two categories for one variable. Using this method approximately 33% of the sample fell into each of the three groups.

Data Analysis

Power calculation was conducted using the effect size for offending behavior from an earlier efficacy study with chronic juvenile offenders.[42] Following the recommendations of Kraemer,[43] we defined a minimally important difference in outcomes between the two conditions as a reduction of more than 25% in the rate of combined violent and non-violent offending episodes over a 6-month treatment period. A sample size of 50 per arm will give 86% power to detect a 25% difference in offending behavior. To take account of within-therapist correlation of outcomes, we assumed an intra-class correlation (ICC) of 0.02 and a total of eight therapists, giving design effects of 1.22 in the MST arm and 1 in the YOT arm, and thus reducing the power to 80%.

The study was powered to 86% with a sample size of 50 youths per arm. All results were analyzed using an intention-to-treat analysis based on treatment assignment, as well as an adherent sample of those patients whose TAMS scores were above cut-off (indicating that they received MST as described in the treatment manual). We computed outcomes for adherent and non-adherent treatments, although our small sample precludes conclusive comments on the importance of adherence to treatment.

The adequacy of randomization randomization was assessed by conducting between-group comparisons of baseline characteristics on all measures using χ^2 for

frequency variables and t-tests for continuously distributed ones. Most of the primary outcome measures were not normally distributed and were relatively low frequency events. The primary outcome measures assessed at 6-month intervals were analyzed analyzed using multi-level mixed-effects Poisson regression models for frequency and mixed-effects logistic regressions for binary data with participants treated as random effects. Both intercepts and slopes were allowed to vary randomly. Additional non-parametric tests (Wilcoxon-signed rank tests and Chi-square tests) were used to examine the statistical significance of group differences at particular time points and Kendall's W test was used to test the significance of changes within each group over the study period. Secondary outcomes of normally distributed variables were analyzed with mixed-effects linear growth-curve models and general estimating equations. Mixed-effects models and general estimating equations use all available data. Where effect sizes are provided, these were based on bias corrected Hedges g's derived from mean differences. Missing values were not a significant problem in the analysis of the data set for primary outcomes (<5%) and data for all participants were used for secondary outcomes, although three individuals in the MST and one in the YOT group provided no self-report information. SPSS version 18 and Stata version 11 were used throughout the statistical analysis.

Results

Study Sample and Baseline Comparison

Analyses of the primary and secondary outcomes were based on the intent-to-treat sample of 108 families. The 56 families randomized to MST and 52 randomized to YOT did not differ at baseline in a statistically significant way on any measured variable (see Table 1).

Analysis of Primary Outcomes

Means and standard deviations of primary outcome variables are shown in Table 2. In both groups, the number of offenses offenses significantly decreased. Although young

people in both groups made statistically significant improvements, MST was associated with greater improvements than YOT for all offenses. This was confirmed by the significant interaction between group outcomes and time. Figure 2a displays the observed mean frequencies of offenses for the two groups across the 30 months covered by the study. Not surprisingly, offenses were highest in the 6 months prior to referral, and decreased dramatically for both groups in the subsequent 6 months (Wilcoxon signed ranks test z=4.2, $p<0.001$ and z=3.2, $p<0.001$ for MST and YOT groups respectively). As Figure 2a illustrates, the mean number of recorded offenses offenses did not substantially differ between the groups over the first 18 months of the trial. Mann-Whitney U-test yielded insignificant comparisons for all 6six-month periods until the first year of the follow-up (FU) period (post-treatment: z=0.87, n.s.; 6-months FU z=0.34, n.s.; 12 months FU z= 1.0, n.s.; 18 months FU z=3.5, $p<0.001$). Table 2 also displays the numbers of participants with 6-month periods free of offenses. These increased more markedly in the MST group as indicated by the significant interaction term of the logistic mixed-effects regression. In the 6 months prior to referral, only 25% of the sample had not had a recorded offense. This decreased to nearly 70% in the following 6 months. Fewer youths in the YOT group (63%) than in the MST group (90%) committed no offense offense ($\chi^2(1)=12.0$, $p<.001$, RR=1.44, 95% CI: 1.14,1.82).

We explored the impact of MST on violent and non-violent offenses. Table 2 includes means and standard deviations for both types of offense. The mixed-effects Poisson regression yielded a significant time-effect for violent offenses corresponding to their substantial and rapid decline in both groups. Figure 2b illustrates this, although it also shows the low mean number of such offenses offenses after the initial presentation (when 34% of the sample had violent-offense offense records). During the second half of the first year of follow-up, youths receiving MST tended to have somewhat fewer recorded violent offenses (Wilcoxon rank-sum test: z=1.43, $p<0.08$); but over the next 6 months the drop in such

offenses in the YOT group meant that only 5% of the sample had records of violent offenses in the last 18 months of the study period. In the light of this floor effect, it is not surprising that the difference between the groups was not significant ($\chi^2(1)=2.23$, p=0.13; RR=4.42, 95% CI: 0.49,39.33). The interaction term of the Poisson random-effects model was also not significant (see Table 2). The number of individuals with violent offense records was too few to show meaningful differences between the groups.

Figure 2c illustrates the rate of reduction in non-violent offenses over the 30 months covered by the study. Both the count and dichotomous data showed a reduction in non-violent offences in both groups. The rate of improvement was significantly greater in the MST group (IRR = 1.37; 95% CI: 1.06,1.76). At 12 months follow-up the groups were not significantly different in either number of non-violent offenses (z=0.69, n.s.) or in the proportion of youths free of offenses over this 6-month period ($\chi^2(1)=0.56$, n.s., RR=1.32, 95% CI: 0.54,3.77). However, in the last 6 months of the follow-up, differences in numbers of offenses became marked (z=3.29, $p<0.001$): only 8% in the MST group compared to 34% in the control group had one record or more of a non-violent offense during this period ($\chi^2(1)=10.6$, $p<.001$, RR=4.42, 95% CI: 1.57,12.45).

There were no custodial sentences for any of the youths upon recruitment to the study although this increased steadily in both groups over the study period. The statistical analyses of the frequency of custodial sentences apparently also suffered from a floor effect, although the proportion of individuals with sentences over the last period of the study increased markedly only for the control group. During the last 6-month period of the study, fewer youths in the MST group had custodial sentences, although this was not significant (10% vs. 17%, $\chi^2(1)=1.18$, n.s., RR=1.77, 95% CI: 0.61, 5.1). However, during the period covered by the study, the increase in the number of custodial sentences was only significant for the YOT group (Kendall's W=0.07, $\chi^2(4)=15.5$, $p<0.0;1$; Kendall's W=0.03, $\chi^2(4)=6.41$, $p<0.2$; for the YOT and MST groups respectively). Longer follow-up is needed to show that

these differences are indeed statistically meaningful.

Secondary outcomes

Table 3 contains the means and standard deviations as well as the results of the mixed-effects maximum likelihood regressions for internalizing and externalizing problems as reported by parents and youths. The models for internalizing data were barely significant, yielding no significant coefficients for either change over time or differences between the slopes representing change for the two groups. Externalising problems, however, as rated by parents, declined significantly over the course of the study (ES=0.37, 95% CI: 0.08,0.66). Although the slope for the MST group declined somewhat more steeply than that for the YOT group, the difference in rate of change for individual trajectories was not significant. However, the key scales of the CBCL pertinent to the hypotheses of the study (aggression and delinquency) both yielded significant interaction terms. This suggests that the slopes of individual trajectories were steeper on the whole for the MST group than for the control group (see Table 3). The effect- size of the change was in both cases medium (ES=0.41, 95% CI: 0.04,0.85; ES=0.45, 95% CI: 0.10,0.90, for aggression and delinquency respectively). None of the YSR scales yielded significant interactions. The SRYB, indicating the frequency with which a youth engaged in various delinquent behaviors over the previous 6 months, did suggest a significantly greater reduction in the MST group. The effect size, however, was small (ES=0.28, 95% CI: -0.17,0.72). Table 3 also includes a self-reported measure of association with delinquent peers (IDP). Although in both groups deviant affiliations tended to decline, this was not significant; nor was there any indication that decline occurred at different rates in the two groups.

Table 4 reports data from personality, relational and cognitive measures included in the study. The APSD total scores as rated by the parents declined substantially over the study period. This decline was significantly more marked in the MST group than in controls

(ES=0.53, 95% CI: 0.14,0.93; ES=0.06, 95% CI: -0.34,0.47; for MST and control groups respectively). Self-reported APSD scores showed no change. Table 4 also reports the total positive parenting (PP) ratings as completed by parents and youths. There was a significant interaction between treatment group and pre- to post-treatment ratings. Although neither group changed substantially, positive parenting increased in the MST group but decreased in the control group (ES=0.29, 95% CI: -0.12,0.70; ES=-0.21, 95% CI: -0.65,0.23; for MST and control group respectively). As rated by youths, positive parenting measures showed no change. Our relational measures of emotional connectedness (whether rated by parents or by youths) also showed no significant change. However, an intriguing interaction with youth-reported autonomy ratings was, however, suggested. Although it did not quite reach significance, autonomy appeared to increase only in the control group (ES=0.08, 95% CI: -0.34,0.51; ES=0.48, 95% CI: 0.02,0.93; for MST and control group respectively). Cognition measures yielded no significant changes or asymmetries between groups.

We explored whether changes in positive parenting as rated by the parents could account for changes in offending behavior. We repeated the mixed-effects Poisson regressions entering the change in positive parenting as a covariate. Change in positive parenting did not account for a significant proportion of the variance (IRR = 1.03; 95% CI: 0.98,1.06, $p<0.20$). Nor was the model including positive parenting a better fit to the data on a likelihood ratio test ($\chi^2(1)=1.79$, $p<0.20$). This makes it unlikely that increased positive parenting as measured by parent ratings could account for the observed differences in the behavior of the groups.

Finally, we wished to explore the significance of adherence to MST standards. In previous studies, close relationships had been observed between adherence to manual (based on parents' independent reports about their therapy) and the child's outcome. To examine whether the degree of adherence accounted for a significant proportion of variance in outcome we created Poisson regression models for adherence as a continuous variable

and also using a minimal adherence score of 0.61 (specified by MST Services) as the cut-off. The computed TAM scores did not make a significant contribution to the primary outcome variable (all offenses) either as main effect (IRR = 0.77; 95% CI: 0.08,6.8, n.s.) or in interaction with the rate of change of offense frequency (IRR = 1.15; 95% CI: 0.46,2.9, n.s.). Using the cut-off in a mixed-effects logistic regression, more adherent treatments appeared no more likely to reduce the likelihood possibility of offenses (main effect: OR=0.31, 95% CI: 0.03,3.4, n.s.) or increase the slope of the decline (interaction: OR=1.4, 95% CI: 0.66,3.3, n.s.).

Discussion

This is the first RCT to evaluate the effectiveness of MST in reducing offending and custodial placements in young offenders, while at the same time comparing it to a well structured alternative treatment including many of the components of MST (with the significant exception of MST principles and family work delivered by a single therapist). Though both YOT and MST interventions appeared highly successful in reducing offending, the key finding of the trial was that the MST model reduced significantly more the likelihood of non-violent offending during the follow-up period. By the last 6 months of the study, only 8% in the MST group, compared to 34% in the control group, had one or more records of a non-violent offense. Differences in rates of violent offending were not demonstrated, but this negative result should be considered in the context of the low rate of violent offending at randomization combined with the modest sample size. For similar reasons, it was challenging to demonstrate differences in rates of custodial placements between the two treatment conditions. At the 18-month follow-up, we found a significant increase in custodial placements only for the YOT group. Longer follow-up is needed to establish whether these differences become statistically significant and clinically meaningful. Importantly, these results are the first to show that MST impacts on objective indicators of offending even in

countries where the safety net of social services is more robust than it was in the US when MST was originally trialed.

Significant reductions in objective offending across both intervention groups are consistent with results from the large, multi-site trial with Canadian youth offenders.[21] There, decreases in offending were found in the MST and TAU conditions at 2 and 3-year follow-up. In our trial, we believe that significant declines in offending in the YOT condition are most likely due to the comprehensive and targeted evidence-based interventions available to young offenders in the UK. Data gathered on the YOT condition show that the average young person attended a substantial number of professional appointments (primarily with social workers, drugs workers and reparations workers). The offending data show the superiority of MST and suggest that this intervention adds value above and beyond statutory services.

The results of youth-reported delinquency ratings and parental reports of aggressive and delinquent behaviors show significantly greater reductions in the MST group, consistent with the results from our objective offending data. The findings from these measures suggest significant improvements in the broader social behavior of young people in the MST group compared to the YOT group. Moreover, parental ratings of young people's psychopathy traits declined substantially over the study period, and this decline was also significantly more marked in the MST group. This is a surprising observation and calls into question the uniquely biological nature of the so called 'callous-unemotional' trait.[44]

Young people's self-reported data from standardized checklists were not consistent with data from parents, and analyses of youth-rated measures of externalizing behavior failed to show changes from pre-treatment to post-treatment. Rates of agreement between young people and parents about externalizing behaviors are typically low,[45,46] and young offenders often endorse aggressive behavior less than their carers.[47] It should be noted that: questionnaire data from both parents and youths is limited as we were only able to collect

secondary outcomes at two points (baseline and 6 months); and between groups significant effects for our objective offending data only manifested 18 months from the point of randomization. Future transportability studies using a structured treatment comparison will benefit from data collection of both primary and secondary outcomes at multiple times over long-term follow-up periods.

The significant improvements found in offending and broader antisocial behavior in the MST group relative to YOT compare favourably with the earlier effectiveness trials conducted by Henggeler and colleagues in the United States.[13,15] Our trial reports an absolute risk-reduction for re-offending of about 25% (11% vs. 37%, ARR=-0.27, 95% CI: -0.43,-0.11) while at approximately 14 months post-intervention Borduin et al.[13] report reductions in recidivism compared to TAU of around 20% (42% vs. 61%, ARR=-0.2, 95% CI: -0.41,0.02). Greater risk-reduction was reported for a larger sample of young offenders who received MST instead of individual therapy, which is now counter-indicated for this group (26% vs. 71%, ARR=-0.46, 95% CI: -0.59,-0.33).[15] It is relevant to note that our sample of offenders is characterized by less-severe offending histories than in samples from the US.

While the results of our trial suggest that MST may be an effective additional intervention for youth offenders in the UK, it is does not help us to understand the process of change. Surprisingly, we did not observe significant group differences at post-treatment in domains (such as increased parental supervision, family warmth and communication, and reduced deviant peer affiliation) that were expected to mediate the effect of MST in reducing antisocial behavior. Given that the significant reductions in offending in the MST condition emerged gradually over the follow-up period, it could be that young people and their carers in the MST arm did not immediately experience greater changes in family or peer networks following treatment compared to the YOT group; but that these differences emerged later (when YOT parents and youth were more likely to return to pre-treatment patterns). Unfortunately, we do not have data to substantiate this hypothesis.

We did find that adolescents in the YOT services rated themselves as significantly more autonomous compared to those in the MST group following the intervention. MST is a family-based intervention that encourages parents to structure and place greater limits on adolescent behavior, and to provide greater supervision of peer affiliations and activities outside the home, thus curtailing adolescent autonomy. The usual service conditions were unlikely to have maintained such a focus. Moreover, parents rated young people as significantly lower on psychopathic traits in the MST condition than in the YOT condition following treatment. These findings are encouraging given research with younger children that suggests that a group high in psychopathic traits is less likely to benefit from parenting-based interventions.[48,49]

Limitations

This study has several limitations. First, due to the relatively small sample size, we had insufficient power to detect more modest treatment effects across the 18-month follow-up period. Additionally, the sample had fewer chronic and violent offenders than comparable studies in the US (although it was similar in chronicity and severity to samples studied by Norwegian and Swedish investigators). The sample was representative of the larger group of youth offenders in the two boroughs from which it was drawn, suggesting that young people are not prosecuted for a substantial number of violent offenses in these areas. The study was not designed to investigate adequately the possible treatment mechanisms underpinning change. We had not measured key parameters during the follow-up period, when differences in objective measures between the treatment arms began to emerge. Therapeutic mechanisms have not been adequately addressed in the MST literature and require a much larger pool of young people, ideally from several sites across the UK. Building on our promising findings, we are currently implementing a much larger evaluation (across nine UK sites) that will enable us to address these issues.

Clinical implications

As a pragmatic research trial evaluating the efficacy of MST, the results of this study demonstrate that MST can be integrated into the typical services available to antisocial youth through youth offending services in the UK. The superiority of the MST condition in reducing offending and antisocial behavior suggests that MST adds value to current UK services. MST does not supplant existing services but is best used to facilitate the appropriate and cost-effective organization organisation of statutory services for the young person and his family. In a cost-effectiveness study (to be reported separately) we found that the additional cost of MST was offset by the savings in legal and clinical costs when compared to YOT groups.[50]

Our study does not indicate what aspects of MST are the most beneficial or unique in addressing the problems of youths and families. However, it is worth noting, however, that the ethos and practises of MST are different than YOT in several important respects. First, MST therapists work with young people and their families at home and in the community and are available 24 hours a day, 7 seven days a week. Second, the therapists assume responsibility for clinical outcomes with families, and, in doing so, are highly motivated and persistent in attempting to bring about change. They also adopt a non-blaming, problem-solving approach with young people and their carer(s). These practices build strong alliances with hard-to-serve families, laying the groundwork for therapeutic change. When interviewed about their experiences of the intervention, the young people and their carer(s) in our trial said the strong relationship with the therapist was both an antidote to previous mental health involvement and a key to promoting change.[51]

Taken together, the study's quantitative findings and qualitative observations suggest that MST is a promising approach to addressing youth offending in the UK (and, by extension, in other countries where a socialized health-care system exists but its organization may not optimally serve hard-to-reach families). In the light of the limitations

noted above, larger scale studies will be required to answer questions about the generalizability of the findings to groups of more severe offenders, and to indicate where the additional expenditure entailed by this intensive treatment is justified.

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Table 1: Pre-treatment demographics and diagnostic data for the MST and YOT samples

	MST	YOT		
	or n	SD or %	or n	SD or %
Demographic characteristics				
Number	56		52	
Mean age (months)	182.7	12.3	180.6	12.9
Female gender	9	16.4%	10	19.2%
Mean SES (range 0–6)	2.5	1.6	2.0	1.7
Ethnicity				
White British/Europea	24	49.1%	13	25.5%

n				
Black African/Afro-Caribbean	15	27.3%	20	39.2%
Asian	2	3.6%	3	5.9%
Mixed/Other	11	20%	15	29.4%
Offenses in year prior to referral				
Total number	2.5	1.6	2.4	1.8
Violent offenses	0.75	1.0	0.73	0.9
Non-violent offenses	1.8	1.6	1.7	1.7
Number with custodial sentences	0	0	0	0
IPPA score	94.2	SD24.6	100.3	SD19.6

Table 2 (page 1 of 3): Treatment outcomes for participants by treatment assignment. The coefficients are odds ratios (ORs) for binary data, incidence rate ratios (IRRs) for count data

	6 months prior to treatment	During treatment		
	MST	YOT	MST	YOT
All offenses (violent and non-violent)				
Proportion with offense	45/55 (82%)	35/52 (67%)	15/55 (27%)	18/52 (35%)
Average count (SD)	1.51 (1.17)	1.37 (1.31)	0.44 (0.83)	0.67 (1.29)
Violent offenses only				
Proportion with offense	20/55 (36%)	16/52 (31%)	5/55 (9%)	8/52 (15%)

Average count (SD)	0.49 (0.72)	0.39 (0.66)	0.11 (0.37)	0.23 (0.67)
Non-violent offenses only				
Proportion with offense	33/55 (60%)	29/52 (56%)	11/55 (20%)	12/52 (23%)
Average count (SD)	1.02 (1.11)	0.98 (1.09)	0.33 (0.77)	0.44 (0.96)
Custodial sentences				
Proportion with sentence	0/55 (0%)	0/52 (0%)	3/55 (5%)	2/52 (4%)
Average count sentences (SD)	0 (0)	0 (0)	0.18 (0.88)	0.21 (1.07)

Table 2: (page 2 of 3): Treatment outcomes for participants by treatment assignment. The coefficients are odds ratios (ORs) for binary data, incidence rate ratios (IRRs) for count data

–	6 months follow-up		12 months follow-up		18 months follow-up		
–	MST	YOT	MST	YOT	MST	YOT	
All offenses (violent and non-violent)							
Proportion with offense	17/53 (32%)		18/51 (36%)	11/53 (21%)	14/48 (29%)	4/52 (8%)	17/47 (36%)
Average	0.55 (1.05)		0.63 (1.17)	0.4 (0.95)	0.71 (1.75)	0.10 (0.36)	0.51 (0.78)

count (SD)						
Violent offenses only						
Proportion with offense	10/53 (19%)	9/51 (18%)	3/53 (6%)	7/48 (15%)	1/52 (2%)	4/47 (9%)
Average count (SD)	0.26 (0.68)	0.20 (0.45)	0.08 (0.33)	0.21 (0.65)	0.02 (0.14)	0.09 (0.28)
Non-violent offenses only						

Proportion with offense	10/53 (19%)	13/51 (25%)	10/53 (19%)	12/48 (25%)	4/52 (8%)	16/47 (34%)
Average count (SD)	0.28 (0.75)	0.43 (0.90)	0.32 (0.75)	0.50 (1.22)	0.08 (0.27)	0.43 (0.68)
Custodial sentences						
Proportion with sentence	4/53 (8%)	4/51 (8%)	3/53 (6%)	5/48 (10%)	5/52 (10%)	8/47 (17%)
Average	0.34 (1.21)	0.25 (1.04)	0.06 (0.23)	0.27 (1.01)	0.21 (0.75)	0.77 (1.84)

count sentences (SD)						
–						
–						

Table 2 (page 3 of 3): Clinical outcomes for participants by treatment assignment. The coefficients are odds ratios (ORs) for binary data, incidence rate ratios (IRRs) for count data (with 95% CI)

	Wald statistic $\chi 2$ (df=3)	p <	Change over time Coefficient (expβk)	Group effect over time p <	Coefficient (expβk)	p <
All offenses (violent and non-violent)						
Proportion with offense	47.22	0.000 1	0.17 (0.08, 0.33)	0.000	1.93 (1.30, 2.87)	0.001
Average count (SD)	64.1	0.000 1	0.35 (0.24, 0.53)	0.000	1.32 (1.05, 1.66)	0.02
Violent offenses only						
Proportion with offense	23.6	0.000	0.54 (0.33, 0.88)	0.02	1.11 (0.82, 1.49)	n.s.

		1				
Average count (SD)	22.15	0.000 1	0.34 (0.18,0.66)	0.001	1.30 (0.89,1.88)	n.s.
Non-violent offenses only						
Proportion with offense	27.95	0.000 1	0.21 (0.10, 0.44)	0.000	1.78 (1.19, 2.67)	0.005
Average count (SD)	39.80	0.000 1	0.34 (0.22,0.54)	0.000	1.37 (1.06, 1.76)	0.02
Custodial sentences						
Proportion with sentence	23.86	0.000 1	1.13 (0.56, 2.29)	n.s.	1.29 (0.82, 2.02)	n.s.
Average count sentences (SD)	10.48	0.02	4.97 (0.46, 53.9)	n.s.	1.58 (0.70, 3.58)	n.s.

Table 3: Parent and self-report outcomes for participants by treatment assignment and results of multi-level random effects analysis

	MST (n=53†)	YOT (n=51†)	Rate of change (slope) of individual trajectory (expβk)						
t						nge over time		ect over time	
	Baseline mean (SD)	6 months mean (SD)	Baseline mean (SD)	6 months mean (SD)	Wald Statistic χ^2 (*p*<)	Coefficient	p <	Coefficient	p <
Internalizing									
Parent (CBCL)	60.5(9.7)	58.2 (9.5)	62.1 (11.8)	57.7 (11.3)	8.56 (0.04)	-0.51 (-7.4, 6.4)	n.s.	-1.77 (-6.2, 2.7)	n.s.
Youth (YSR)	48.2 (10.1)	49.5 (9.0)	49.3 (10.4)	47.4 (10.8)	1.44 (n.s.)	3.74 (-2.7, 10.2)	n.s.	-2.56 (-6.8, 1.6)	n.s.

Externalizing									
Parent (CBCL)	67.7 (8.4)	63.4 (10.2)	66.4 (9.8)	63.7 (9.9)	21.39 (0.0001)	-7.09 (-12.4, -1.8)	0.009	2.19 (-1.2, 5.6)	n.s.
Youth (YSR)	53.8 (10.7)	52.8 (11.0)	54.6 (10.2)	51.0 (10.8)	6.05 (0.1)	1.26 (-5.0, 7.5)	n.s.	-2.41 (-6.5,1.7)	n.s.
Aggression									
Parent (CBCL)	69.4 (12.9)	64.2 (11.4)	66.9 (11.6)	65.9 (11.9)	13.2 (0.004)	-9.77 (-16.6, -3.0)	0.005	4.33 (.04, 8.7)	0.05
Youth (YSR)	59.1 (10.4)	57.3 (10.4)	59.2 (8.1)	56.6 (8.0)	9.87 (0.02)	-1.46 (-6.1, 3.1)	n.s.	-0.62 (-3.6, 2.4)	n.s.
Delinque									

ncy									
Parent (CBCL)	73.4 (8.3)	67.9 (8.6)	73.0 (7.9)	70.9 (8.5)	27.56 (0.0001)	-8.64 (-13.6, -3.7)	0.001	3.28 (0.1, 6.4)	0.05
Youth (YSR)	65.1 (8.8)	62.9 (9.8)	65.6 (8.1)	63.3 (9.9)	5.07 (0.2)	-2.36 (-8.1, 3.3)	n.s.	0.18 (-3.5, 3.9)	n.s.
Youth (SRYB*)	83.3 (4.6)	20.7 (3.3)	69.9 (6.6)	38.1 (4.4)	36.5 (0.0001)	-2.02 (-3.4, -0.9)	0.001	0.65 (0.07, 1.4)	0.05
Delinquent peers	28.8 (9.2)	24.4 (8.4)	30 (9.1)	26.5 (10.3)	13.95 (0.003)	-5.15 (-11.3, 1.0)	0.10	1.06 (-3.0, 5.1)	n.s.

CBCL = Child Behavior Checklist, YSR = Youth Self Report, SRYB = Self Report of Youth Behavior; *means are geometric means; †three participants in the MST and one participant YOT group did not provide self report data but all participants were included in the analysis

Table 4: Personality, relational and cognitive measures (parent and self-report) for participants by treatment assignment and results of multi-level random effects analysis

	MST (n=53†)	YOT (n=51†)	Rate of change (slope) of individual trajectory (expβk)						
t						ıge over time		ect over time	
	Baseline mean (SD)	Post-treatment mean (SD)	Baseline mean (SD)	Post-treatment mean (SD)	Wald Statistic χ2 (*p*<)	Coefficient	p <	Coefficient	p <
Psychopathy									
Parent (ASPD)	21.6 (7.8)	17.6 (7.3)	19.6 (7.2)	19.1 (8.9)	17.0 (0.001)	-7.82(-12.4, -3.1)	0.001	3.55 (0.6, 6.5)	0.02
Youth (YASPD)	16.1 (5.5)	14.1 (6.7)	16.4 (5.7)	14.6 (6.9)	6.52 (0.10)	-2.4 (-6.7, 1.8)	n.s.	0.47 (-2.3, 3.3)	n.s.
Positive parenting									

Parent (PPP)	38.7 (4.8)	40.2 (5.7)	39.1 (5.2)	37.9 (6.0)	5.54 (n.s.)	4.09 (0.5, 7.7)	0.03	-2.5 (-4.9, -0.2)	0.04.
Youth (PPY)	36.5 (10.4)	37.8 (10.2)	38.9 (9.1)	41.0 (7.5)	5.64 (0.1)	0.94 (-4.6, 6.5)	n.s.	0.49 (-3.1, 4.1)	n.s.
Emotional connectedness									
Parent (RS)	7.1 (4.6)	7.7 (4.2)	6.8 (5.0)	8.3(3.9)	3.55 (n.s.)	-0.68 (-4.5, 3.1)	n.s.	1.15 (-1.3, 3.6)	n.s.
Youth (YRS)	1.9 (6.6)	4.0 (5.9)	2.1 (6.3)	3.7 (7.1)	6.11 (.10)	2.02 (-2.6, 6.6)	n.s.	-0.11 (-3.1, 2.8)	n.s.
Autonomy									
Parent (RS)	3.9 (4.9)	5.7 (4.7)	4.0 (4.1)	6.1 (4.3)	15.0 (0.002)	2.07 (-0.9, 5.1)	n.s.	-0.12 (-2.0, 1.8)	n.s.
Youth (YRS)	3.4 (85.1)	3.8 (4.3)	1.4 (4.9)	3.5 (3.9)	9.08 (0.03)	-1.89 (-5.5, 1.7)	n.s.	2.09 (-0.3, 4.4)	0.08
Cognitions									

(BAS)									
Criminal sentiments	30.9 (8.6)	30.5 (9.4)	30.9 (11.4)	29.1 (12.5)	1.27 (n.s.)	0.71 (-4.4, 5.8)	n.s.	-1.03 (-4.3, 2.3)	n.s.
Tolerance for aggression	8.9 (5.0)	8.1 (4.6)	8.1 (4.4)	7.2 (4.2)	4.82 (0.20)	-0.70 (-3.3, 1.9)	n.s.	-0.09 (-1.8, 1.6)	n.s.
Antisocial thinking	67.5 (19.6)	64.8 (21.2)	66.3 (22.3)	60.9 (25.2)	4.76 (0.20)	-0.54 (-10.9, 9.9)	n.s.	-2.04 (-8.8, 4.7)	n.s.

*ASPD = Antisocial Process Screening Device; PPP = Parent completed Positive Parenting; PPY = Youth completed Positive Parenting; RS = Relational Survey completed by parent; YRS = Relational Survey completed by youth; BAS = Basic Assumptions Scale

†three participants in the MST and one participant YOT group did not provide self-report data but all participants were included in the analysis