

Juvenile Justice Girls' Depressive Symptoms and Suicidal Ideation 9 Years After Multidimensional Treatment Foster Care

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Juvenile Justice Girls' Depressive Symptoms and Suicidal Ideation Nine Years After
Multidimensional Treatment Foster Care

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Objective: Multidimensional Treatment Foster Care (MTFC) has been found to reduce delinquency among girls in juvenile justice through 2-year follow-up. Given that such girls are at elevated risk for suicide and depression into adulthood, we tested MTFC effects on long term trajectories of suicidal ideation and depressive symptoms. **Method:** Girls [$n = 166$; mean (SD) age = 15.3 (1.2) years; 68% Caucasian] with a recent criminal referral who were mandated to out-of-home care were enrolled in two sequential cohorts. Girls were randomized to receive MTFC ($n = 81$) or group care (GC) treatment as usual (TAU; $n = 85$); the second MTFC cohort also received modules targeting substance use and risky sexual behavior. Depressive symptoms and suicidal ideation were assessed repeatedly through early adulthood [mean (SD) follow-up = 8.8 (2.9) years]. Suicide attempt history was assessed in early adulthood. **Results:** Girls assigned to MTFC showed significantly greater decreases in depressive symptoms across the long-term follow-up than GC girls ($\pi = -.86, p < .05$). Decreases in suicidal ideation rates were slightly stronger in MTFC than in GC as indicated by a marginal main effect [odds ratio (OR) = .92, $p < .10$] and a significant interaction that favored MTFC in the second cohort relative to the first [OR = .88, $p < .01$]. There were no significant MTFC effects on suicide attempt. **Conclusions:** MTFC decreased depressive symptoms and suicidal thinking beyond the decreases attributable to time and TAU. Thus, MTFC has further impact on girls' lives than originally anticipated.

Key words: depression, suicide, RCT, MTFC, juvenile justice

Juvenile Justice Girls' Depressive Symptoms and Suicidal Ideation Nine Years After Multidimensional Treatment Foster Care

Depression and suicide are major public health problems for young people. Depression takes a heavy toll on quality of life and perpetuates suffering across the life course through pervasive adverse impacts on development and adjustment. For example, major depressive disorder (MDD) and depressive symptoms in adolescence predict poorer family and peer functioning, negative educational outcomes and occupational attainment, and worsened physical health outcomes (Fergusson, Horwood, Ridder, & Beautrais, 2005; Lewinsohn, Rohde, & Seeley, 1998; Thapar, Collishaw, Pine, & Thapar, 2012). Suicide-related thoughts and behaviors are key concerns and targets of preventive intervention with adolescents given the predictive associations these problems have with not only suicide (see Bridge, Goldstein, & Brent, 2006), but also serious injury, costly emergency care and hospitalization, and a host of negative physical health, psychiatric, and adjustment outcomes in adulthood (e.g., Fergusson et al., 2005; Lewinsohn et al., 1998; Thapar et al., 2012). Suicidal thinking in adolescence is also linked with more severe clinical features of depression and slower recovery following treatment (Lewinsohn, Clarke, Seeley, & Rohde, 1994; Rohde, Seeley, Kaufman, Clarke, & Stice, 2006).

Adolescent girls show higher rates of depression and suicidal thoughts and attempts than boys (Thapar et al., 2012; Rohde, Lewinsohn, Klein, Seeley, & Gau, 2013), and girls in the juvenile justice system show especially high rates. For example, prevalence of MDD among adolescent girls in detention and correctional facilities is more than twice that of their male counterparts and four to five times that of girls in the general population (Fazel, Doll, & Langstrom, 2008). Studies of delinquent adolescent girls have found that 27% to 58% have attempted suicide (Abram et al., 2008; Rohde, Seeley, & Mace, 1997; Kerr, Gibson, Leve, &

DeGarmo, in press), rates that exceed those estimated for community adolescent girls [9.8% 12-month prevalence; Centers for Disease Control and Prevention (CDC), 2012] and adolescent girls diagnosed with MDD (20%; Rohde et al., 2013). For these reasons, identifying interventions that reduce depressive symptoms and suicide risk in adjudicated girls should be a public health priority.

Existing treatments for depression and suicide risk may have limited efficacy in juvenile justice populations. For example, although cognitive-behavioral therapy (CBT) is a well-supported treatment for depression among adolescents, it may not yield comparable benefit for youth with comorbid problem behaviors. Specifically, in CBT trials, youth with these problems show weaker treatment responses (Herman, Ostrander, Walkup, Silva, & March, 2007), attenuated differences from controls at 6-month follow-up (Rohde, Clarke, Mace, Jorgensen, & Seeley, 2004), and faster depression recurrence (Rohde, Clarke, Lewinsohn, Seeley, & Kaufman, 2001). Weaker effects for youth with comorbid behavior problems are not explained by poorer treatment engagement (Kaufman, Rohde, Seeley, Clarke, & Stice, 2005). Instead, limited efficacy may be due to the pervasive, entrenched nature of these adolescents' problems and the contexts that maintain them (Avenevoli & Merikangas, 2006; Rohde et al., 2006).

The treatment of mood disorders is a primary means of preventing suicide (Mann et al., 2005). Therefore, the modest efficacy of leading depression treatments with delinquent adolescents and the finding that suicidal youth are less likely to comply with treatment if they have a behavioral disorder (Burns, Cortell, & Wagner, 2008) indicate innovative approaches to reducing suicide risk require evaluation. Furthermore, identifying and treating high risk populations who do not present through usual mental health channels (i.e., for outpatient psychotherapy or psychiatric admission following acute suicidal crisis) offers an important

avenue for advancing suicide prevention.

One approach to reducing depression and suicide risk in delinquent youth may be to use methods that effectively treat their behavioral problems, given that these problems co-occur and share some etiological and maintaining factors (e.g., Capaldi, 1992). Multidimensional Treatment Foster Care (MTFC) is an efficacious family-based intervention for delinquency that is based on social learning theory (Chamberlain, 2003). Youth in MTFC are placed in homes with foster parents trained to implement a behavioral reinforcement model. Youth attend public school and receive intensive support and intervention in settings that closely parallel normative life. Parents or other caregivers with whom youth live after treatment are trained in effective parent management. Thus, MTFC aims to permanently change the contexts that support problem behaviors.

MTFC has been found to be an effective intervention for delinquency among girls. Specifically, girls receiving MTFC compared to those receiving community group care (GC) treatment as usual showed reduced delinquency (as indexed by rates of criminal referrals, days in locked settings, self-reported delinquency) at 24-month follow-up (Chamberlain, Leve, & DeGarmo, 2007). Furthermore, other beneficial MTFC effects persist well beyond the intervention period, including decreased associations with deviant peers (Leve & Chamberlain, 2005), increased school attendance and homework completion (Leve & Chamberlain, 2007), and reduced rates of teenage pregnancy (Kerr, Leve, & Chamberlain, 2009).

MTFC does not directly target depression or suicide risk. Still, such effects are possible given that: (1) reducing girls' problem behavior and justice system involvement may avert a chain of negative short- and long-term life consequences that lead to depression and increase suicide risk (c.f., Capaldi, 1992; Conner & Goldston, 2007); (2) MTFC may reduce these

problems by increasing reinforcement opportunities in family and school contexts, improving social support from prosocial adults and peers, and contributing to a sense of belongingness (Czyz, Liu, & King, 2012; King & Merchant, 2008), and (3) MTFC teaches and reinforces emotion regulation and non-aggressive communication skills that may help girls manage anger and irritability, which are features of depression and can increase suicide risk (Boergers, Spirito, & Donaldson, 1998; Conner, Meldrum, Wieczorek, Duberstein, & Welte, 2004).

Consistent with these expectations, Harold, Kerr, Van Ryzin, DeGarmo, Rhoades, and Leve (2013) found that delinquent adolescent girls who received MTFC showed greater reductions in depressive symptoms across a 2-year follow-up than did girls in GC. The present study builds on these findings by testing whether these beneficial effects persist to early adulthood, replicate using a different well-validated measure of depressive symptoms, and extend to a reduction in suicidal thoughts and attempt. We hypothesized that girls assigned to MTFC, compared to those assigned to GC, would show significantly stronger declines in rates of suicidal ideation and depressive symptoms from baseline to young adult follow-up and would be less likely to attempt suicide.

Method

Participants

Girls ($n = 166$) participated in a randomized controlled trial (RCT) in one of two consecutively run cohorts ($n = 81$ and 85 for Cohorts 1 and 2, respectively) conducted in the Northwestern United States between 1997 and 2006 to contrast MTFC and group care (GC; i.e., services-as-usual). Cohort 2 replicated the recruitment, assessment, and intervention procedures used in Cohort 1, and then augmented these with drug use and risky sexual behavior intervention and assessment components.

Participants had been court-mandated to community-based out-of-home care due to chronic delinquency. We attempted to enroll all referred girls ages 13–17 years old who had at least one criminal referral in the last 12 months, were placed in out-of-home care within 12 months after referral, and were not pregnant at the time of recruitment. Girls provided assent and their legal guardian provided consent to participate. The project coordinator randomly assigned girls to MTFC ($n = 81$) or GC ($n = 85$) using a coin toss. After the baseline assessment, girls were placed in the intervention setting. Clinical and assessment staff members were independent, and the latter were blind to treatment assignment.¹ Average treatment duration was approximately 6 months and did not differ by condition. Intent to treat (ITT) analyses included the entire sample, regardless of time in assigned treatment setting.

Participating girls were 13–17 years old at baseline ($M = 15.30$, $SD = 1.17$); the sample self-identified² as follows: 68.1% Caucasian, 1.8% African-American, 11.4% Hispanic, 0.6% Native American, and 0.6% Asian; 16.9% endorsed “multiracial” and 0.6% answered “other/unknown.” At baseline, 63% of the girls lived with single-parent families, and 54% lived in families earning less than \$10,000. There were no significant group condition or cohort differences in baseline age, suicide attempt history, or suicidal ideation. However, there was a marginal difference for baseline depressive symptoms by condition (MTFC: $M = 26.52$, $SD = 13.61$; GC: $M = 22.67$, $SD = 12.01$, $p < .07$) which we conservatively controlled in models.

Girls were assessed regularly for 24–36 months post-baseline as part of the original RCTs. A separately funded longterm follow-up study recontacted participants in 2009 and began

¹ Assessment staff blinding could have been compromised during the post-baseline intervention period if girls were assessed in a treatment setting, though during this period some MTFC girls spent time in GC and some GC girls spent time in non-MTFC foster care.

² Prior studies based on this sample had to rely on caregiver or caseworker reports of girls' race/ethnicity in many cases. The present percentages were updated with self-reports collected in early adulthood, and thus differ somewhat from those reported previously.

assessing them up to five times at 6-month intervals; 152 (92.6% of the 164 participants still living) participated in at least one of these young adult follow-ups. The longterm follow-up assessments began at means (*SD*) of 9.81 (1.73) and 4.69 (1.16) years post-baseline for Cohorts 1 and 2, respectively. Analyses accommodated individual and cohort differences in assessment timing, as detailed below. The CONSORT subject flow chart for the overall study can be accessed at [insert web address]. Though sample sizes differed for some outcomes (e.g., suicide attempt), our use of ITT and full information maximum likelihood in primary analyses makes use of data on the full sample. The original RCTs and follow-up studies were approved and regularly reviewed by our IRB.

MTFC condition. Girls in MTFC were placed in one of 22 homes³ with state-certified foster parents trained to implement a behavioral reinforcement program (e.g., point-and-level system). Experienced program supervisors with small caseloads supervised all clinical staff, coordinated all aspects of each youth's placement, and maintained daily contact with foster parents to provide ongoing consultation, support, and crisis intervention, and monitor treatment fidelity. Interventions were individualized but always included: daily telephone contact with foster parents; weekly group supervision and support meetings for foster parents; an in-home, daily point-and-level program for girls; individual therapy for each girl; family therapy for the aftercare placement family focusing on parent management strategies; close monitoring of school attendance, performance, and homework completion; case management to coordinate the interventions in the foster family, peer, and school settings; and 24-hr on-call staff support for foster and biological parents. In Cohort 2, MTFC also included components targeting substance use (e.g., motivational interviewing and incentives for clean urinalyses) and risky sexual

³ Multiple girls were served in these homes during the trial, but typically only one MTFC girl was placed with a family at a time.

behavior (e.g., information on behavior norms, and education and instruction about strategies for being sexually responsible). Otherwise, MTFC components were the same in Cohorts 1 and 2.

Group care (GC) condition. Girls in GC were placed in 1 of 35 community-based group care programs that represented community treatment as usual for girls being referred to out-of-home care by the juvenile justice system. Programs had 2–83 youths in residence ($M = 13$) and 1–85 staff members ($Mdn = 9$). Program philosophies were primarily behavioral (67%) or multiperspective (33%); 80% of the programs reported delivering weekly therapeutic services. Sites either required on-grounds schooling (41%), sent only some girls to school off-grounds (38%), or sent all girls to off-grounds school (21%). Chamberlain and colleagues (2007) provide further details.

Measures

Intervention group assignment was coded -1 (GC) or 1 (MTFC).

Study cohort was coded -1 (Cohort 1) or 1 (Cohort 2).

Age at baseline was calculated based on birth date and baseline assessment date.

Time since baseline was calculated based on baseline and each individual's assessment dates across the assessment periods. For Cohort 1, girls were assessed at baseline, and 3, 6, 12, 15, 18, 30, and 36 months post-baseline, and then again at long-term follow-up (mean = 9.81 years post-baseline), and 6, 12, 18, and 24 months later. Cohort 2 girls were assessed at baseline, and 3, 12, and 24 months later, and at long-term follow-up (mean = 4.69 years post-baseline), and 6, 12, 18, and 24 months later. Differences in the number and spacing of assessments by cohort are accommodated by person-specific timelines in the hierarchical linear modeling.

Depressive symptoms were measured with the 20-item Center for Epidemiologic Studies, Depression (CESD; Radloff, 1977). The score ranges from 0–60 and is based on summed items

using a 4-point scale (0–3) indicating frequency of events during previous week, ranging from *Rarely or none* (0–1 day) to *Most or all of the time* (5–7 days). Sample items were *felt depressed, fearful, lonely, hopeful about the future* ($\alpha = .84$ to $.94$ over time). The CESD is routinely used to measure depressive symptoms in adolescents and young adults, and has been found to provide more information at lower severity levels than related instruments (Olino et al., 2012). It does not contain an item related to suicidal thoughts or behaviors.

Suicidal ideation was measured from baseline to early adulthood using an item (“During the past week, how much were you bothered by thoughts of ending your life?”) from the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983). This outcome was recoded to the absence (“not at all” = 0) or presence (“a little bit” to “very much” = 1) of suicidal ideation. In support of validity, responses on this item were related to suicide attempt in the present sample (Kerr et al., in press); and other longterm studies of adolescents’ suicidal thinking have used this or similar dichotomized items (e.g., Kerr, Owen, & Capaldi, 2008; Rueter & Kwon, 2005).

Suicide attempt was assessed using the Columbia Suicide Severity Rating Scale (C-SSRS; Posner et al., 2008; 2011), lifetime version, beginning 12 months after the first young adult follow-up (or at age 18 years, whichever came later), when funding for this assessment began. Participants were interviewed again 6 and 12 months later using 6-month versions of the C-SSRS; thus, histories were collected to a mean (SD) of 12.17 (1.69) and 7.05 (1.16) years post-baseline for Cohorts 1 and 2, respectively. Standardized probes were used to elicit reporting of all acts potentially meeting criteria for Posner and colleagues’ (2008) definition of “actual attempt”; that is, “a potentially self-injurious act committed with at least some wish to die, as a result of the act.” For each act, interviewers then used further standardized probes to determine whether to consider it an actual attempt versus another act, such as “interrupted attempt” (being

interrupted by an outside circumstance, such as another person, from starting a potentially self-injurious suicidal act that otherwise would have occurred), “aborted attempt” (stopping oneself when an attempt was imminent), or non-suicidal self-injury (self-injurious act with no intent to die as a result of the act; Posner et al., 2008). Inter-rater reliability for 5 raters discerning actual attempt from all other act types on 108 randomly selected acts (44% of the 245 total acts reported) was $\kappa = .91$; individual rater agreement with the criterion rater (first author) ranged from 90–97%. Hereafter, we refer to actual attempt as suicide attempt.

We partitioned suicide attempts as having occurred either pre- or post-baseline. Attempts that occurred during the year of baseline were conservatively attributed to pre-baseline if the participant could not provide sufficient information (e.g., month of act) to properly classify the event as pre- or post-baseline. In a separate report on the validity of the C-SSRS in this sample (Kerr et al., in press), pre-baseline attempt status was significantly associated with other indicators of attempt history collected at baseline, and post-baseline attempt status was significantly associated with average levels of prospectively measured suicidal ideation. Post-baseline attempt history was coded as negative (0) or positive (1). The C-SSRS was completed by 148 participants [90% of those living ($n = 164$)]. One additional participant (assigned to GC in Cohort 1) is known to have died by suicide and was coded as having a positive post-baseline suicide attempt history; death record searches did not identify other participant deaths by suicide.

Analysis Plan

The main study hypotheses were evaluated with hierarchical linear growth models using HLM7 (Raudenbush, Bryk, Cheong, Congdon, & du Tolt, 2011). HLM is a multilevel regression framework also known as mixed modeling. Growth modeling is a form of multilevel modeling where the time-varying suicidal ideation and depressive symptoms scores are repeated measures

at Level 1 nested within individuals at Level 2 who were randomly assigned to intervention or control condition. Time invariant variables such as baseline age, random assignment, and cohort are Level 2 predictors of time-varying growth rates estimated at Level 1. For the Level 1 repeated measures, we specified the time metric for estimating growth rates using each girl's person-specific assessment timeline. For the binary suicidal ideation scores, we employed hierarchical generalized linear modeling (HGLM), a special case of HLM appropriate for binary outcomes using Bernoulli estimation or nonlinear logistic probability models. More specifically, models for the continuous level depressive symptoms employed restricted maximum likelihood (MLR) estimation. Models for the binary ideation outcome employed unit-specific robust standard errors using the (MLR) penalized quasi-likelihood (PQL) estimates. Formally, the probability, or log odds of ideation occurring was estimated at Level 1 as:

$$\text{Probability (Suicidal Ideation)}_{it} = \beta_{0i} + \beta_{1i} (\text{Time})_{it}$$

where the dependent binary variable for girl i is repeated over time t . Suicidal ideation then was a function of the baseline intercept β_{0i} for girl i and a nonlinear probability growth rate β_{1i} for girl i over (on average) 9 years. The time growth metric was specified as years since baseline computed from each girl's age at each assessment.

After summarizing the individual intercepts (β_{0i}), growth rate slopes (β_{1i}) and covariates at Level 1, the Level 2 model then regresses intercepts and slopes on predictors as:

$$\text{Suicidal Ideation Intercept } \beta_{0i} = \gamma_{00} + \gamma_{01} (\text{girl age})_i + u_{0i}$$

$$\text{Linear Growth } \beta_{1i} = \gamma_{10} + \gamma_{11} (\text{girl age})_i + \gamma_{12} (\text{group condition}) \dots + u_{1i}$$

Where γ_{00} is the initial status intercept adjusting for girl's age, γ_{01} is the effect of age on initial status intercept, and u_{0i} is the random error variance. γ_{10} represents the growth rate adjusting for covariates, γ_{11} is the effect of age on growth in ideation, and γ_{12} is the intent-to-treat MTFC

intervention effect on growth in ideation. In a similar fashion, effects for study cohort and baseline CESD were controlled as covariates in the model.

Growth in Depression

For linear growth in depressive symptoms measured as a continuous outcome we entered time-squared to obtain quadratic growth or rate of deceleration (Raudenbush & Chan, 1993).

Growth for continuous level outcomes was estimated with the following Level 1 and 2 equations:

Level 1:

$$\text{Depressive symptoms}_{i,t} = \pi_{0i} + \pi_{1i} (\text{Time})_{i,t} + \pi_{2i} (\text{Time})_{i,t}^2 + e_{i,t}$$

Level 2:

$$\text{Initial Status } \pi_{0i} = \beta_{00} + \beta_{01} (\text{girl age})_i + \beta_{12} (\text{group condition}) \dots + r_{0i}$$

$$\text{Linear Growth } \pi_{1i} = \beta_{10} + \beta_{11} (\text{girl age})_i + \beta_{12} (\text{baseline DEP}) + \beta_{13} (\text{group condition}) \dots + r_{1i}$$

$$\text{Quadratic Growth } \pi_{2i} = \beta_{20} + \beta_{21} (\text{girl age})_i + \beta_{22} (\text{baseline DEP}) + \beta_{23} (\text{group condition}) \dots + r_{2i}$$

Where $\pi_{1i} (\text{Time})_{i,t}$ and $\pi_{2i} (\text{Time})_{i,t}^2$ are the individually estimated linear and nonlinear growth rates in depressive symptoms at Level 1. β_{13} and β_{23} are the MTFC effects on growth rates controlling for initial levels of depressive symptoms and the other covariates. r_{1i} and r_{2i} are the random error terms or variance in random effects for linear and quadratic growth.

Results

Descriptive Statistics

Table 1 provides descriptive information by group condition using approximate assessment waves. MTFC and GC girls showed lower mean values of depressive symptoms and proportions of suicidal ideation over time. In total, 46.3% (69 of 149) of participants with follow-up data reported attempting suicide at least once in their lives or died by suicide (1 participant). One third ($n = 51$) of the sample reported at least one pre-baseline suicide attempt. Post-baseline

suicide attempt rates in the groups defined by cohort and intervention group assignment were as follows: in Cohort 1, 9 of 34 (26%) girls in GC (including one death by suicide), and 9 of 33 (27%) in MTFC; in Cohort 2, 5 of 39 (13%) in GC, and 7 of 43 (16%) in MTFC.

MTFC Intervention Effects

Because HLM accommodates missing data at Level 1 repeated assessments, the first step of the analyses was to evaluate whether missingness was random across the assessment waves. Simultaneous evaluation of suicidal ideation and depressive symptom data along with girls' age and treatment condition predictors indicated data were missing completely at random (MCAR) [Little's MCAR $\chi^2(1024) = 1007.31, p = .64$ (Little, 1988)], meaning missingness was not dependent on the observed or unobserved data. Both outcomes exhibited nonlinear mean trajectories indicated by elevated but decreasing levels in the early years after baseline and a deceleration through the longterm follow up.

MTFC effects on suicidal ideation trajectories. Results of the ITT hypothesis are presented in Table 2. For the intercept, girls' age was associated with lower ideation at baseline. Over time, girls' age and baseline depressive symptoms were associated with higher ideation growth rates and were held constant. The effects-coded MTFC main effect was marginal overall, which in the presence of the MTFC \times Cohort interaction (Cohen, Cohen, West, & Aiken, 2003), indicated a decreased likelihood of suicidal ideation over time [$\gamma = -.08, p < .10$, Odds ratio (OR) = .92], or roughly an 8% reduction in likelihood relative to the controls. The interaction indicated that the intervention effect was significantly more pronounced in the second cohort relative to the first ($\gamma = -.12, p < .01$, OR = .88), representing a 12% reduction in risk. Feingold (2009) recommends effect size for growth rates be calculated as the mean group difference in growth divided by the standard deviation of the unconditional growth rates. For this approach MTFC

obtained a medium effect ($ES = .46$). Figure 1 illustrates the MTFC effects using plots of model-based nonlinear probability trajectories.

MTFC effects on depressive symptom trajectories.

Results of the ITT hypothesis that MTFC would reduce longterm depressive symptom trajectories are presented in Table 3. The findings supported a main effect of MTFC relative to GC on linear declines in depressive symptoms ($\pi = -.86, p < .05$), and a marginal MTFC by cohort interaction indicating MTFC-related declines were stronger in Cohort 2 than in Cohort 1 ($\pi = -.68, p < .10$). The model based linear effect of MTFC on depressive symptoms is plotted in Figure 2. MTFC obtained a medium effect size ($ES = .38$) using standards for continuous growth rates (Feingold, 2009).

MTFC effects on suicide attempt. MTFC did not reduce the rate of post-baseline suicide attempt (logistic regression) [MTFC, Cohort, and MTFC \times Cohort β (SE) = .16 (.23), -.33 (.23), -.03 (.23); Odds Ratio (OR) = 1.17, .72, .97, respectively], controlling for baseline age, depressive symptoms, and attempts, (Model $\chi^2 = 12.845, p = .046$; -2 Log Likelihood = 128.591; Nagelkerke $R^2 = .137$).⁴ Baseline age was inversely related to the odds of later attempt [β (SE) = -.59 (.21), OR = .56, $p = .005$]. Baseline suicide attempts were not associated with post-baseline attempt [β (SE) = .29 (.26), OR = 1.34].

Discussion

The present findings demonstrate that the previously identified ameliorative effects of MTFC on depressive symptoms at 2 years post baseline (Harold et al., 2013) extend to early adulthood. MTFC also decreased the probability of suicidal ideation over the same period, an

⁴ At the request of reviewers, models were rerun using a less restrictive outcome that included interrupted and aborted attempts, and then again for an outcome that also included non-suicidal self-injury. Neither model yielded direct or indirect MTFC effects. In the latter model, pre-baseline acts predicted a post-baseline act [β (SE) = .43 (.19), OR = 1.54, $p = .024$]. Further information is available from the first author upon request.

effect that was stronger in the second cohort of girls, but otherwise marginally significant. Given the lack of evidence for effective treatments for depression and suicide risk for youth in the juvenile justice system, the present findings have public health and clinical significance.

Overall, nearly half of the participants had a lifetime history of suicide attempt, and approximately 20% reported at least one attempt after baseline. Rates are in excess of those estimated in community and clinically depressed samples (CDC, 2012; Rohde et al., 2013) and reflect the significant individual and contextual risks experienced by these participants. Unfortunately, there was no support for the hypothesis that MTFC reduced rates of suicide attempt compared to GC. However, MTFC impacted depressive symptoms and suicidal ideation, both of which are associated with suicide attempt in this and other samples (Bridge et al., 2007; Kerr et al., in press). Future studies would be improved by larger samples and repeated prospective measures of suicide attempt.

An important focus of suicide prevention has been to ameliorate key suicide risk factors. Most studies of this approach, however, have focused on depressed youth and depression-focused interventions, and together have had equivocal effects on suicide risk. In the Treatment of Adolescent Depression Study, CBT conditions more strongly reduced suicidal thoughts and were associated with fewer suicidal events than non-CBT conditions (March et al., 2007). However, meta-analyses of 6 trials of psychotherapy for adolescent depression (Weisz, McCarty, & Valeri, 2006) and 7 trials of CBT for adolescents (Tarrier, Taylor, & Gooding, 2008) found marginal or non-significant effects overall on suicide-related outcomes. Presently, it is not possible to determine the extent to which the generally weak effects of existing interventions on adolescents' suicidal thoughts and behaviors are explained by inadequate treatment models or limitations of current trial designs for detecting these effects, such as the exclusion of high risk

individuals, the likelihood that comparison/control conditions are significantly protective, and the statistical power limitations imposed by studying low rate events within relatively short follow-up periods. In one exception, when Multisystemic Treatment (MST), a treatment designed for antisocial youth, was adapted for psychiatrically hospitalized youth, it was found to decrease rates of suicide attempt relative to hospitalization (Huey et al., 2004). Our findings are notable because, unlike in these prior studies, we selected participants based on juvenile justice system involvement rather than on the basis of depression or suicide risk, and those in MTFC did not receive interventions intended to directly impact these conditions.

Examining mechanisms by which MTFC decreased depressive symptoms and suicidal ideation was beyond the scope of the present study. Both indirect and direct mechanisms are hypothesized. Foremost, indirect effects may have occurred because delinquency, criminal referrals, and time in locked settings were significantly reduced in MTFC relative to group care (Chamberlain et al., 2007). The failure model (that conduct problems developmentally precede and cause depressive symptoms; Capaldi, 1992) and life-course perspective (Elder, 1998) highlight the long term effects that cumulative developmental burdens and constricted life opportunities associated with problem behaviors and justice system involvement have on depression. Similar models of developmental failure have been used to explain the escalation of suicide risk from adolescence to early adulthood (Conner & Goldston, 2007). The shorter term consequences of delinquency also include the kinds of minor and major stressors associated with depression (Pettit, Lewinsohn, Seeley, Roberts, & Yaroslavsky, 2010), and the interpersonal and disciplinary crises known to precipitate suicide (Bridge et al., 2006). Thus, MTFC may impact girls' depressive symptoms and suicide risk by reducing delinquency and preventing a cascade of negative life consequences. Indeed, several prevention studies support that depression and

suicidal thoughts and behaviors in adolescence and adulthood may be impacted by successfully preventing earlier problem behavior (e.g., Connell & Dishion, 2008; Wilcox et al., 2008).

MTFC components designed to decrease delinquency also may have had direct unintended impacts on depression and suicidal ideation. First, MTFC may increase reinforcement opportunities and encourage supportive relationships with caregivers that improve mood, provide stress-buffering social support, and engender belongingness—a protective factor against suicidal thoughts and behaviors (Czyz et al., 2012; King & Merchant, 2008). Such conditions may contrast with those emphasized in GC and with those girls experienced in previous noncontingent, neglectful, and abusive environments. Second, MTFC teaches and reinforces the use of emotion regulation skills for managing anger and communicating in non-aggressive ways in the home, at school, and with peers. MTFC-related improvements in these skills may affect not only targeted problem behaviors, but also irritability and anger expression that are relevant to depression and suicidal thoughts (Boergers et al., 1998; Conner et al., 2004).

Future research should establish whether MTFC effects on depressive symptoms and suicidal ideation are mediated by reductions in delinquency and associated problem behaviors that are the focus of MTFC. A similar process may account for the effects of adapted MST on suicide attempt, though MST did not impact suicidal ideation or internalizing symptoms relative to control (Huey et al., 2004). Otherwise, this line of reasoning currently is supported only by descriptive and prevention studies with community samples (e.g., Capaldi, 1992; Masten et al., 2005; Wilcox et al., 2008). Determining whether disrupting problem trajectories among girls who are already seriously criminally-involved extends to changes in their depressive symptoms and suicide risk will be an important contribution to the etiological and prevention literatures.

A second direction for future research concerns an alternative causal pathway: that

intervention-related decreases in depressive symptoms and suicidal ideation may contribute to better outcomes for primary MTFC targets of delinquency and substance use. In support of this possibility, several epidemiological studies suggest that an “acting out” model (i.e., depression contributes to conduct problems) rather than the failure model (i.e., conduct problems contribute to depression) accounts for the developmental co-occurrence of conduct problems and depressive symptoms (e.g., Kofler et al., 2011). More specifically, the acting out model posits that depression is associated with irritability and interpersonal conflict that can worsen the trajectories of conduct problems. Similar to the acting out model, the affect-regulation (or “self-medication”) hypothesis holds that some adolescents use substances to cope with the negative affect and anhedonia that are characteristic of depression; this notion that depression contributes to substance abuse is supported by prospective studies (e.g., Mason, Hitch, & Spoth, 2009). In all, this evidence from naturalistic studies that depression can worsen problem behavior trajectories suggests that the effects of decreases in depressive symptoms and suicidal ideation on primary MTFC targets should be evaluated.

Only a few treatment studies have examined this possibility by considering the impact of depression-focused interventions on problem behaviors (Jacobs et al., 2010; Rohde et al., 2004; Rohde, Stice, Gau, & Marti, 2012); some have had promising results. Unlike these interventions MTFC was not designed to target depression. However, it remains possible that decreased depression could facilitate the effects of MTFC on delinquency and substance use by allowing the adolescent to engage more productively in the interpersonal context of this family-based intervention. Indeed, a prior study of MTFC for delinquent boys indicated that the quality of the relationship boys had with their caregiver (foster parent in MTFC or group home staff in GC) was an important mediator of changes in delinquency after one year (Eddy & Chamberlain,

2000). Also, as suicidal ideation is associated with hopelessness and decreased treatment engagement, reduced suicidal thinking might reflect some confidence on the part of youth that their cooperation and participation in treatment will lead to improved options and outcomes. Thus, future studies should examine whether effective treatment of problem behavior using MTFC influences the course of the outcomes considered here and vice versa, as these possibilities are not mutually exclusive.

This study had some limitations. First, we cannot answer why MTFC effects on suicidal ideation were stronger for girls in Cohort 2 than in Cohort 1, an interaction effect that also was marginal for depressive symptoms. Girls were not randomly assigned to cohort, and therefore we cannot rule out unmeasured cohort differences as explanations for the interaction effect (e.g., changes in characteristics of treatment as usual that were not under experimental control; unknown differences between the cohorts at baseline). It is possible that the modules targeting sexual risk-taking and substance abuse that were added to MTFC during Cohort 2 contributed to the treatment by cohort interaction effects. In our view, it seems unlikely that these secondary modules account for the present cohort effects, given the vastly greater intensity and duration of primary MTFC interventions. Still, the problems targeted by these modules can have negative developmental consequences (e.g., arrest, unwanted pregnancy, school drop-out, child welfare involvement as a young parent) that in turn worsen depression and suicide risk (e.g., Bridge et al., 2006; Leve, Kerr, Harold, 2013; McCarty, Mason, Kosterman, Hawkins, Lengua, & McCauley, 2008; Moffitt et al., 2002). Thus, future research should further consider whether changes in substance abuse, sexual risk-taking, and associated life course processes targeted by these modules mediate the MTFC by cohort interaction effects on suicidal ideation and depressive symptoms that were noted here.

A second limitation was that retrospective measures of suicide attempt are prone to error regarding if and when attempts occurred. Third, suicidal ideation was measured with a single dichotomous item (albeit repeatedly); future studies should use more comprehensive measures of the severity and frequency of suicidal thinking. Fourth, few attempts occurred, limiting statistical power to detect intervention effects if they were modest. Fifth, findings may not generalize to more ethnically diverse or urban dwelling populations or to samples showing more severe depression or suicide risk. Finally, marginally significant findings must be interpreted cautiously.

In conclusion, delinquent girls show high rates of depression, suicidal ideation, and suicide attempt, yet few intervention studies have examined effects on these problems. Our findings indicate that, relative to group care treatment as usual, MTFC delivered in adolescence reduces depressive symptoms and suicidal ideation through early adulthood. Thus, depressive symptoms and suicidal ideation are added to the growing list of developmental outcomes and critical public health problems—crime, teenage pregnancy, school engagement—that MTFC helps address.

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Table 1

Means and standard deviations for depressive symptoms and proportion endorsing suicidal ideation over time by group condition

	Depressive Symptoms (CESD)				Suicidal Ideation (BSI)	
	<i>(n = 81)</i>		<i>(n = 85)</i>		<i>(n = 81)</i>	<i>(n = 85)</i>
	MTFC		Group Care		MTFC	Group Care
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>Proportion</i>	<i>Proportion</i>
Time 1 (Baseline)	26.52	13.61	22.66	12.07	.24	.15
Time 2 (.25 Years)	22.96	12.23	20.56	13.18	.20	.18
Time 3 (1.0 Years)	18.49	11.80	18.19	11.02	.06	.06
Time 4 (1.5 Years)	16.72	12.02	16.62	11.16	.11	.06
Time 5 (2.0 Years)	16.84	11.79	19.20	14.35	.08	.12
Time 6 (7.0 Years)	14.79	10.98	13.96	12.01	.05	.04
Time 7 (7.5 Years)	11.46	10.14	14.08	11.76	.05	.02
Time 8 (8.0 Years)	11.27	10.88	15.20	12.10	.00	.05
Time 9 (8.5 Years)	12.99	11.62	13.62	11.22	.01	.01
Time 10 (9.0 Years)	13.67	11.19	14.24	12.43	.01	.01

Note. Differences in the timing of assessments by cohort and individual are simplified here, but were appropriately spaced and estimated in the analyses.

Table 2

Unstandardized coefficients, Odds Ratio, and 95th percent confidence intervals for HGLM nonlinear probability model of growth in occurrence of suicidal ideation. Models are Unit-Specific Restricted Maximum Likelihood Estimation (MLR) with Robust Standard Errors.

	<u>Coefficient</u>	<u>(SE)</u>	<u>Odds Ratio</u>	<u>95th % C.I.</u>
Intercept π_0				
Intercept β_{00}	2.432	(1.703)	11.388	(0.394–329.624)
Baseline Age β_{01}	-0.270*	(.112)	2.14	(0.612–0.952)
TIME slope, π_1				
Intercept β_{10}	-1.726**	(.507)	0.177	(0.064–0.493)
Baseline CESD β_{11}	0.004*	(.002)	1.004	(1.000–1.012)
Baseline Age β_{12}	0.080**	(.031)	1.084	(1.021–1.152)
MTFC β_{13}	-0.079†	(.047)	0.923	(0.843–1.012)
Cohort β_{14}	-0.161**	(.049)	0.850	(0.774–0.934)
MTFC \times Cohort β_{15}	-0.123**	(.048)	0.883	(0.804–0.972)

Note. *** $p < .001$; ** $p < .01$; * $p < .05$; † $p < .10$. Coefficients are the unstandardized values.

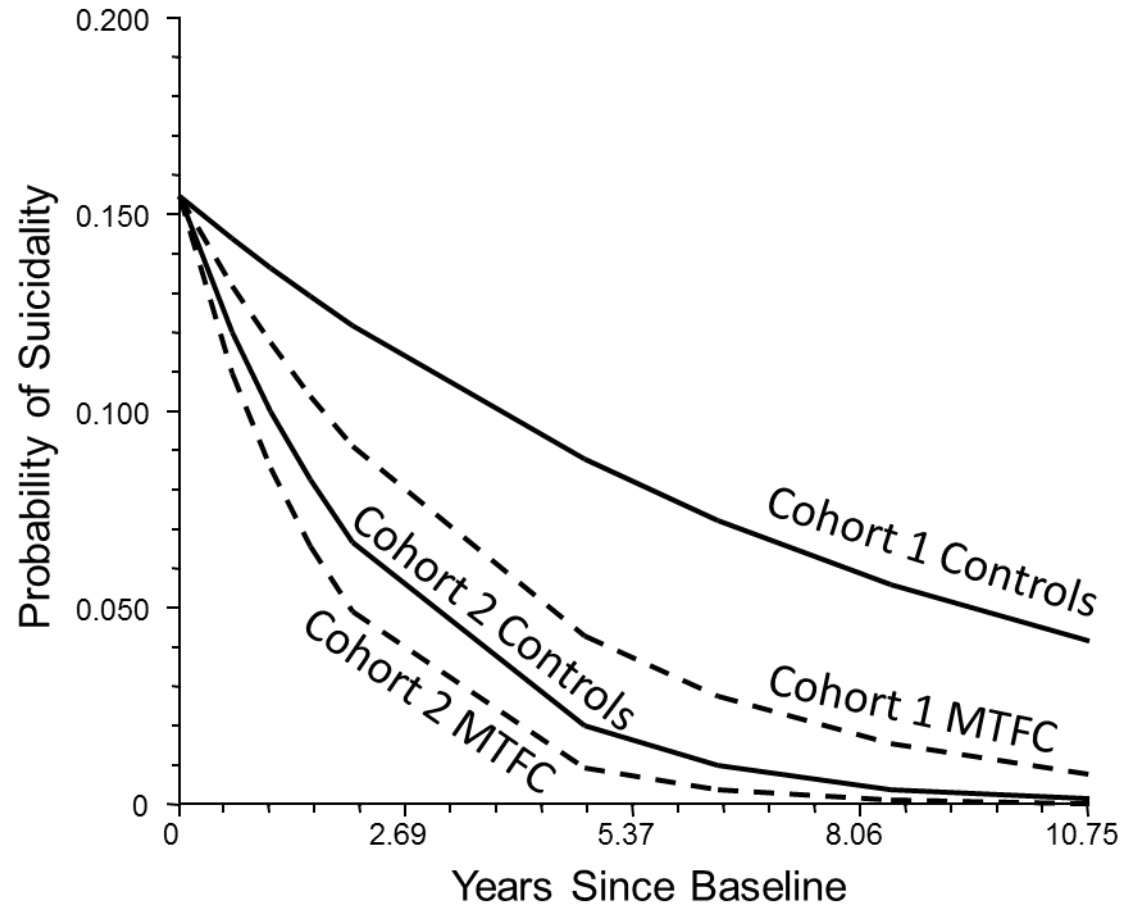


Figure 1

Model-based nonlinear probability trajectories of suicidal ideation for groups defined by cohort and random assignment to multidimensional treatment foster care (MTFC) or group care (GC) controls.

Table 3

Unstandardized coefficients (standard errors) for HLM prediction model of long term growth in depressive symptoms (CESD). Models are restricted maximum likelihood estimation with robust standard errors.

	Initial	Linear	Quadratic
	<u>Status</u>	<u>Growth Rate</u>	<u>Deceleration</u>
	π_0	π_1	π_2
Intercept	40.182*** (10.283)	-5.153 (4.044)	0.265 (0.343)
Baseline CESD	—	-0.029 (0.021)	0.003† (0.002)
Baseline Age	-1.167† (0.616)	0.201 (0.267)	-0.007 (0.022)
MTFC	1.501* (0.748)	-0.855* (0.390)	0.084† (0.048)
Cohort	1.278† (0.745)	-1.427*** (0.384)	0.165*** (0.047)
MTFC × Cohort	0.203 (0.744)	-0.675† (0.391)	0.075 (0.048)

Note. *** $p < .001$; ** $p < .01$; * $p < .05$; † $p < .10$.

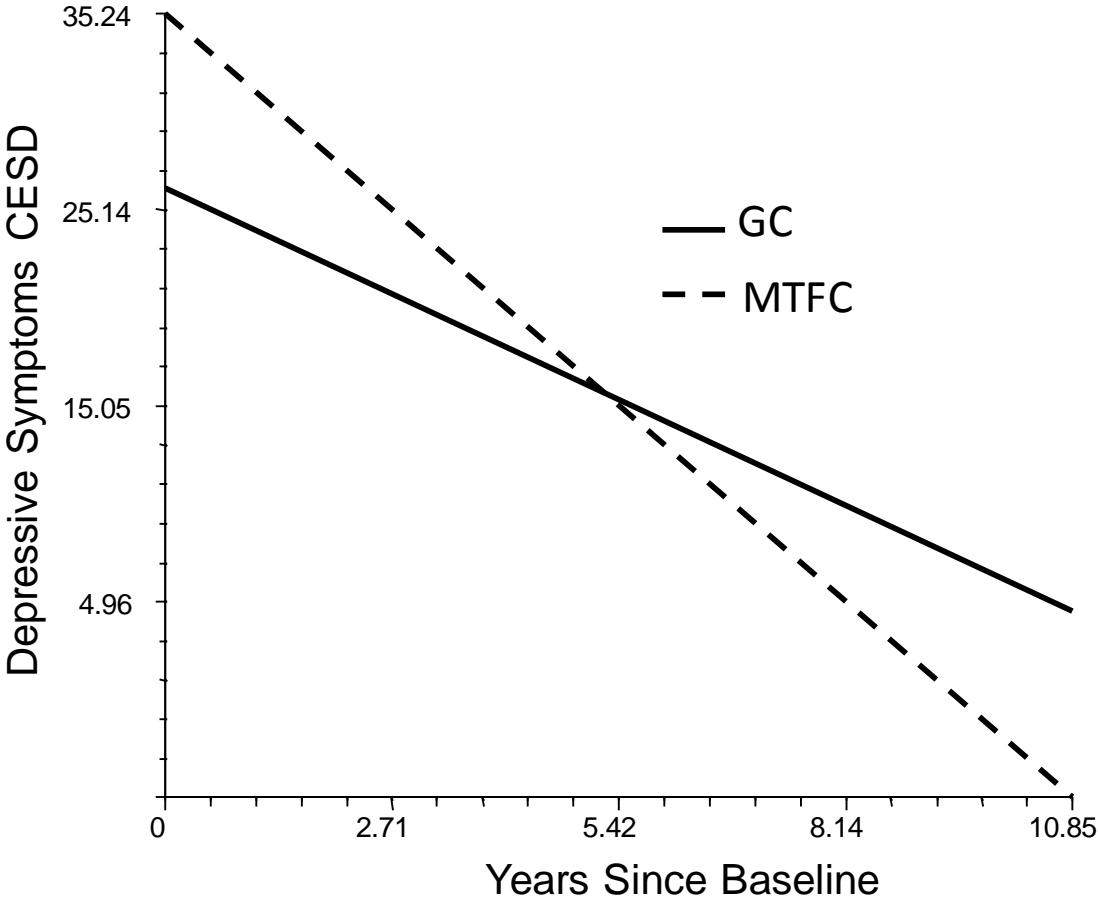


Figure 2

HLM model-based estimates of Multidimensional Treatment Foster Care (MTFC) compared to group care (GC) effects on long term linear growth in depressive symptoms controlling for covariates.