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Depressive Symptom Trajectories Among Girls in the Juvenile Justice System: Findings from an RCT of Multidimensional Treatment Foster Care

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Abstract

Youth depression is a significant and growing international public health problem. Youth who engage in high levels of delinquency are at particularly high risk for developing problems with depression. The present study examined the impact of a behavioral intervention designed to reduce delinquency (Multidimensional Treatment Foster Care; MTFC) compared to a group care intervention (GC; i.e., services as usual) on trajectories of depressive symptoms among adolescent girls in the juvenile justice system. MTFC has documented effects on preventing girls' recidivism, but its effects on preventing the normative rise in girls' depressive symptoms across adolescence have not been examined. This indicated prevention sample included 166 girls (13–17 years at T1) who had at least one criminal referral in the past 12 months and who were mandated to out-of-home care; girls were randomized to MTFC or GC. Intent-to-treat analyses examined the main effects of MTFC on depression symptoms and clinical cut-offs, and whether benefits were greatest for girls most at risk. Depressive symptom trajectories were specified in hierarchical linear growth models over a two year period using five waves of data at six month intervals. Depression clinical cut-off scores were specified as nonlinear probability growth models. Results showed significantly greater rates of deceleration for girls in MTFC versus GC for depressive symptoms and for clinical cut-off scores. The MTFC intervention also showed greater benefits for girls with higher levels of initial depressive symptoms. Possible mechanisms of effect are discussed, given MTFC's effectiveness on targeted and nontargeted outcomes.

Keywords. MTFC, randomized controlled trial, depression, girls, juvenile justice, maltreatment

Depressive Symptom Trajectories Among Girls in the Juvenile Justice System: Findings from an RCT of Multidimensional Treatment Foster Care

Adolescent depression reduces quality of life, is a risk factor for suicide, and often worsens the outcomes of physical health problems (Lewinsohn, Rohde, & Seeley, 1998; Thapar, Collishaw, Pine, & Thapar, 2012). The continuity of depression into adulthood also has significant economic costs; according to a recent estimate, depression costs $83.1 billion annually in the United States (Greenberg, et al., 2003). The lifetime prevalence of mood disorders rises dramatically across adolescence to approximately 20% by early adulthood, with adolescent girls being about twice as likely as adolescent boys to experience major depressive disorder (Merikangas, et al., 2010; Thapar et al., 2012). Further, more than half of all psychiatric disease is preceded by mental illness before the age of 18 (Kim-Cohen et al., 2003).

Outcomes for girls with depressive symptoms can be further compounded by co-occurring problems with delinquency: evidence suggests a closer link between co-occurring trajectories of delinquency and depression for girls than for boys (Wiesner & Kim, 2006). Moreover, rates of delinquency in girls are rising, now comprising 30% of all juvenile arrests (Puzzanchera, 2009). Therefore, interventions that can prevent the development of depression in a sample of girls indicated for delinquency may impact their longer-term well-being and help reduce the societal costs of depression.

In the present study, we examined the trajectories of depressive symptoms in an indicated sample of girls in the juvenile justice system who were referred to out-of-home care. We tested whether Multidimensional Treatment Foster Care (MTFC), a behavioral intervention with demonstrated efficacy in reducing delinquency (e.g., Chamberlain, Leve, & DeGarmo, 2007), influenced adolescent trajectories of depressive symptoms. The main focus was on intent-to-treat

effects of the MTFC intervention. We also tested baseline risk factors (e.g., maltreatment history, delinquency, depression levels) as predictors of depression trajectories and as potential moderators of intervention effectiveness.

Co-Occurring Problems with Depression and Delinquency During Adolescence

It is increasingly recognized that mental health problems often co-occur; for example, Merikangas and colleagues (2010) reported that 40% of adolescents with lifetime histories of a disorder in either the mood, anxiety, behavioral, or substance use disorder class also had histories of a disorder in another class. In both clinical and community studies, adolescents with high levels of conduct problems are at risk for elevated depressive symptoms and vice versa (see Wolff & Ollendick, 2006). While some of this comorbidity may be attributed to shared genetic and environmental risk factors, multiple studies have traced how depression and delinquency influence each other's developmental course. One prominent theory, the failure model (Capaldi, 1992), posits that early delinquency leads to depressive symptoms due to the negative consequences that problem behaviors have for youth development. Specifically, delinquency interferes with school achievement and causes rejection by family, peers, and teachers, thus increasingly limiting reinforcement from the social environment and leading to negative mood states. Multiple prospective studies support the theory that conduct problems often precede and predict depression (e.g., Curran & Bollen, 2001; Rowe, Maughan, & Eley, 2006).

Delinquent girls are disproportionately affected by depression (Teplin, Abram, McClelland, Dulcan, & Mericle, 2002), possibly because of their higher rates of adverse background factors, including sexual and physical abuse (Chamberlain & Smith, 2003). In a recent meta-analysis, Fazel, Doll, and Langstrom (2008) found that 6-month prevalence of major depressive disorder among adolescent girls in the juvenile justice system was 29%, more than

twice the rate of their male counterparts and four to five times the rate of the general population of girls. Examining whether evidence-based delinquency interventions are also effective in reducing depressive symptom trajectories could therefore help identify alternative approaches to reducing elevated depression trajectories often seen among girls in the juvenile justice system.

Childhood Maltreatment, Delinquency, and Depressive Symptoms

Numerous researchers have documented associations between maltreatment and depression during adolescence, particularly for girls. For example, depression rates in the United States child welfare system exceed population norms and are more than twice as common among girls as compared to boys (17% for girls vs. 7% for boys; Orton, Riggs, & Libby, 2009). Girls in the juvenile justice system also show a high prevalence of child maltreatment (as high as 80%; Smith, Leve, & Chamberlain, 2006) and interpersonal trauma (Kerig, Ward, Vanderzee, & Moeddel, 2009). This work highlights the potential impact of childhood maltreatment on mental health; however, its moderating role in influencing intervention outcomes is unknown.

Interventions Aimed at Improving Depressive Symptoms in Adolescents

In a recent meta-analysis, Stice, Shaw, Bohon, Marti, and Rohde (2009) found that depression prevention programs can prevent or reduce symptoms, particularly with high-risk youth and girls. Such programs generally rely on intra-individual change processes and youth agency by targeting, for example, cognitive distortions or poor social skills. In contrast, prevention programs aimed at delinquency, aggression, and drug use often target the family and peer contexts that support these problems. In examining such programs, researchers have found that family-focused interventions that emphasize parent management and monitoring can ameliorate depressive symptoms, even though these problems are not explicitly targeted (e.g., Connell & Dishion, 2008; Mason et al., 2007). These programs may change common risk factors

or—consistent with the failure model—preempt the onset or worsening of depressive symptoms by impacting problem behaviors that developmentally precede them. For seriously delinquent youth, such context-directed approaches might be needed; those aimed at internal mechanisms of change might not be powerful enough to override influences of the chaotic, abusive, or noncontingent environments in which such youth have resided.

The Present Study

Multidimensional Treatment Foster Care (MTFC), a comprehensive, family-based behavioral intervention for youth in out-of-home care, is aimed at permanently changing the contexts that support serious conduct problems. The results from prior studies of girls support its efficacy relative to a services-as-usual group care intervention on targeted outcomes (criminal referrals, days in locked settings, self-reported delinquency, and deviant peer affiliation; Chamberlain et al., 2007; Leve, Chamberlain, & Reid, 2005) as well as secondary, non-targeted outcomes (pregnancy, school attendance, and homework completion; Kerr, Leve, & Chamberlain, 2009; Leve & Chamberlain, 2007). Given the pervasive effects that MTFC has demonstrated, we hypothesized that MTFC would also have protective effects on the course of depressive symptoms in an indicated sample of girls' selected for juvenile justice involvement. We proposed the following two aims: (1) to test the effects of MTFC on depression trajectories and (2) to examine the impact of hypothesized risk factors (baseline depression, baseline delinquency, childhood physical and sexual abuse) on depression trajectories and whether they moderate the hypothesized intervention effects such that MTFC would benefit girls who are most at risk. The focal intent-to-treat (ITT) hypothesis is that MTFC girls will show greater reductions in depressive symptoms and clinical cut off scores relative to girls randomized to the group care control intervention, controlling for baseline risk factors.

Method

Participants

Girls (n = 166) participated in one of two consecutively run randomized controlled prevention trials (ns = 81 and 85 for Trial 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). Participants had been mandated to community-based out-of-home care due to chronic delinquency. We attempted to enroll all referred girls who were 13–17 years old, had at least one criminal referral in the prior 12 months, and were placed in out-of-home care within 12 months following referral. Girls who did not meet the above enrollment criteria or who were pregnant at the time of recruitment were excluded from enrollment. The project coordinator randomly assigned girls to MTFC (n = 81) or GC (n = 85; see Figure 1) using a coin toss. Assessment personnel were independent from the clinical staff and were blind to group assignment at all time points. If, however, a girl was in a GC facility during an assessment, post-T1 blinding might have been compromised if the assessor thought that the girl had been randomly assigned to GC. However, girls often changed placement settings following random assignment (e.g., some MTFC-assigned girls spent time in GC settings, and some GC-assigned girls spent time in foster homes). Analyses included the entire ITT randomized sample, regardless of actual time spent in any given treatment setting. Average treatment duration was approximately 6 months and did not significantly differ by condition. Girls provided assent and their legal guardian provided consent to participate.

The girls were 13–17 years old at T1 (M = 15.31, SD = 1.17) and were assessed at five time points over roughly 24 months (baseline, 6, 12, 18, and 24 months); for girls in Trial 1, depressive symptoms were assessed at 3 months post-baseline rather than at baseline, an

irregularity that is accommodated by the person-specific timelines of hierarchical linear modeling, and statistical controls for initial status and trial (described in detail in the Analysis Plan). Placement in the intervention setting occurred following the baseline assessment. Seventy-four percent of girls were Caucasian, 2% were African-American, 7% were Hispanic, 4% were Native American, 1% were Asian, and 13% reported mixed ethnic heritage. At baseline, 61% of the girls lived with single-parent families, and 32% of the girls lived in families earning less than $10,000. There were no group differences on demographic characteristics, delinquency (self-report, days in locked settings, or official records), or childhood maltreatment at baseline. However, there was a significant group difference in depression symptoms, as described in the results and discussion section. This difference was believed to be a chance finding, given the random assignment procedures and the equivalence of groups on all other primary study variables included in the present report and those included in previous reports with this sample. Therefore, baseline levels of depression were entered as a covariate in the ITT longitudinal growth models to account for the possible effect of the baseline depression group difference.

MTFC Intervention Condition

The MTFC girls were individually placed in 1 of 22 highly trained and supervised homes with state-certified foster parents. Experienced program supervisors with small caseloads (i.e., 10 MTFC families) supervised the clinical staff, coordinated aspects of each youth's placement, and maintained daily contact with the MTFC parents. The intervention was individualized but included all basic MTFC components: daily telephone contact with foster parents to monitor case progress and program adherence; weekly group supervision and support meetings for foster parents; an in-home, daily point-and-level program for girls; individual therapy for girls; weekly meetings with behavioral support specialists in community settings; family therapy for the

aftercare placement family focused on parent management strategies; close monitoring of school attendance, performance, and homework completion; case management to coordinate the interventions; 24-hr, on-call staff support for foster and aftercare parents; and psychiatric consultation as needed. In the second trial, MTFC also included components targeting substance use (e.g., motivational interviewing and incentives for clean urinalyses) and risky sexual behavior (e.g., information on sexual behavior norms and education and instruction about strategies for being sexually responsible). For more information about the MTFC intervention, see Chamberlain (2003).

Group Care Control Intervention Condition

The GC girls were placed in 1 of 35 community-based programs in Oregon state; across the two trials, each site served 1–12 study participants (*M* [*SD*] = 2.18 [2.95]). The GC programs represented typical services for girls referred to out-of-home care by the juvenile justice system and had 2–83 youth in residence (*M* = 13) and 1–85 staff members (*Mdn* = 9). The facilities served girls only (68%) or both genders (32%) (but housed girls and boys separately). In terms of schooling, 41% required on-grounds schooling, 38% sent some girls to school off-grounds, and 21% sent all girls to off-grounds school. The program philosophies were primarily behavioral (67%) or multiperspective (33%). Eighty percent of the programs reported delivering weekly therapeutic services.

Measures

Brief Symptom Inventory (BSI): Depression subscale (Derogatis & Melisaratos, 1983). The BSI is the short form of the SCL-90R instrument, both of which have typically been used as objective methods of screening for psychological problems and measuring treatment progress. The depression subscale was computed as the mean of six items rated on a 5-point

Likert-type scale from 0 (*not at all*) to 4 (*very much*). Cronbach's alphas were .88, .87, .83, .86, and .90, respectively, over five waves. The clinical cut-off score was computed as a T-score of greater than 63, using the BSI manual guidelines (Derogatis, 1993). The sample showed levels of clinical depression that were consistent with or slightly higher than community-based adolescent samples (e.g., Lewinsohn et al., 1994), with evident declines across the five waves. Proportions were 23%, 14%, 9%, 10%, and 15%, respectively.

Intervention condition. Intervention condition was effects coded as 0 (*GC*) or 1 (*MTFC*).

Baseline risk factors and covariates. Relevant risk factors included total number of criminal referrals in the 12-months prior to baseline, total days in locked settings in the 12-months prior to baseline, baseline BSI, and maltreatment history. To assess maltreatment history, caseworkers were interviewed at baseline regarding whether there was a documented history of physical abuse and sexual abuse: 1 (*no*) or 2 (*yes*). Because caseworkers had weekly contact with the girl and her family and access to her child welfare records, these reports are believed to be fairly accurate, although some under-reporting is likely. The girls showed high rates of physical abuse (61%) and sexual abuse (55%) and these covariates were uncorrelated. Covariates included age at baseline, days from baseline to treatment entry (M = 12.25, SD = 91.34), minority status, and a sample contrast for Trial 1 vs. Trial 2.

Analysis Plan

In the first step of the analyses we examined missing data patterns across time. The main study hypotheses were then 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 depression outcomes 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 covariates and random assignment to intervention or control condition are Level 2 predictors of time-varying growth rates at Level 1. For the repeated measures at Level 1, HLM can provide an advantage of estimating growth rates based on each girl's person-specific assessment timeline. Person-specific models provide more precision in the estimates of change in depression. For the binary depression clinical cut-off 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.

For the continuous data, the Level 1 model was:

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

where the dependent variable for girl *i* is repeated over time *t*. Depressive symptoms was a function of the baseline intercept π_{0i} for girl *i*, a linear growth rate π_{1i} for girl *i* over 24 months, a quadratic or accelerated growth rate π_{2i}, plus a random error term. Time in the present analyses was weighted as years since baseline computed from girl's age at each assessment. After summarizing the individual intercepts (π_{0i}) and growth rate slopes (π_{1i} and π_{2i}) at Level 1, the Level 2 model then regresses intercepts and slopes on predictors as:

$$\text{Depressive Symptoms Intercept } \pi_{0i} = \beta_{00} + \beta_{01}(\text{girl age})_i .... + r_{0i}$$

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

$$\text{Quadratic Growth } \pi_{1i} = \beta_{20} + \beta_{21}(\text{girl age})_i + \beta_{22}(\text{group condition}).... + r_{2i}$$

where β_{00} is the initial status sample intercept adjusting for girl age and other covariates and risk factors, β_{01} is the effect of child age on initial status intercept, and r_{0i} is the random error variance. β_{10} represents the growth rate adjusting for covariates and risk factors, β_{11} is the effect

of girl age on growth, and β_{12} is the intent-to-treat MTFC intervention effect on linear growth while β_{22} is the MTFC effect on accelerated growth.

Results

We first conducted a test of random missingness (Little, 1988) for the five waves of BSI data evaluated simultaneously with all predictor variables entered in the models below. Results indicated the data were missing completely at random (MCAR) [Little's MCAR χ^2 (126) = 116.02, p = .73 (Little, 1988)]. HLM allows Level 1 missing data for estimates of growth, however, data must be non-missing for the Level 2 time-invariant fixed effects risk factor covariates (e.g., age, maltreatment history, days in locked settings, etc.). Because the data were MCAR, multiple imputation (MI) was warranted for the Level 2 nonresponse missingness (Jeličić, Phelps, & Lerner, 2009).

Next we examined the observed means, their 95th percent confidence intervals, and the mean trajectories plotted in Figure 2 by group condition. Baseline showed an elevated initial status for MTFC relative to GC controls followed by a decline in depressive symptoms over two years for both groups. The means, standard deviations, and depression cut-off scores are shown in Table 1.

Next we estimated the unconditional model characterizing the sample means and variances for initial status and growth. Results of the unconditional model indicated that initial status had a mean intercept significantly different from zero (β_{00} = 1.26, p < .000) as well as a significant variance component (σ^2 = .97, p < .001); meaning there were individual differences in depressive symptoms at baseline for the sample. The linear growth rate had a significant mean (β_{10} = -.62, p < .001) and significant variance (σ^2 = 1.01, p < .001); meaning the sample as a whole decreased in depressive symptoms over time and there were individual differences in

growth trajectories. The quadratic growth rate, or deceleration rate, also had a significant mean and variance (β_{20} = .15, p < .001 and σ^2 = .23, p < .001). When the linear change over time is characterized by increases, a positive quadratic departure from linearity is interpreted as acceleration, or accelerated increases in growth. When the linear change over time is characterized by decreases, as is the case with depressive symptoms in this study, then the positive quadratic is the rate of "deceleration" or accelerated decreases as shown by the MTFC means in Figure 2. The negative linear slope and the positive quadratic slope mean that the sample was characterized by rapid initial decline followed by a decelerating or leveling off over two years. The linear and quadratic growth rates were nearly collinear (r = -.98).

To test the ITT hypotheses, we entered Level 2 predictors of depressive symptoms in a multivariate conditional model. The ITT hypothesis was supported: girls in the MTFC condition realized greater reductions in depressive symptoms over time relative to the GC controls. The unstandardized coefficients and results of the prediction model are shown in Table 2. Focusing on the BSI initial status intercept in the first column only, sexual abuse history was marginally associated with higher levels of baseline depression (β = .16, p < .10). Focusing on linear growth in the second column, girls with higher levels of depressive symptoms at baseline were at greater risk for increases in depressive symptoms over time (β = .73, p < .001). Controlling for initial status and the other covariates and risk factors, girls in the MTFC condition exhibited linear decreases in depressive symptoms at a greater rate relative to girls in the control group (β = -.34, p < .05). On average, girls in Trial 2 also decreased at a greater rate relative to Trial 1 girls (β = -.38, p < .05). Focusing on quadratic deceleration in the third column, baseline depressive symptoms were also a risk factor for a slower or reduced rate of deceleration (β = -.21, p < .001). Similarly, Trial 2 also exhibited a greater rate of deceleration in depressive symptoms (β = .14, p

< .05). The model-based estimates of the linear MTFC intervention effect are plotted in Figure 3a.

In the second part of the ITT hypothesis, we estimated an HGLM nonlinear probability model predicting growth in clinical depression cut-off scores over two years. The results supported the MTFC intervention hypothesis and are shown in Table 3. The MTFC intervention was associated with a 43% reduction in clinical depression relative to the control condition (β = -.57, *OR* = .57, 95th percent CI = .39–.83). There was also a greater reduction in relative risk for Trial 2 relative to Trial 1, a greater risk in depression for older girls and girls reporting a history of physical abuse, and a greater risk for girls with higher baseline depression. The model-based estimates for the MTFC intervention effect on the probability of clinical depression are plotted in Figure 3b.

A final analysis tested whether MTFC benefited girls with the highest levels of risk factors. In this set of analyses, we entered interaction terms computed as an effects coded ITT group contrast variable times the effects coded maltreatment variables, and the effects coded ITT group contrast variable times the mean-centered baseline depressive symptoms. Holding trial and baseline depressive symptoms constant, there was a significant MTFC × baseline depressive symptoms effect on linear growth (β = -.22, p < .01) as well as an MTFC × baseline depressive symptoms deceleration effect (β = .01, p < .01). This meant that the MTFC intervention benefited girls with higher levels of initial depressive symptoms relative to girls with lower levels of depressive symptoms.

Discussion

Using an indicated prevention trial, our findings suggest that chronically delinquent girls in MTFC experience greater decreases in depressive symptoms across 2 years compared to GC

girls. Our use of an intensive therapeutic control condition that represented usual care offers a particularly stringent test of MTFC's effectiveness. Additionally, the minimal participant exclusion criteria and the inclusion of two separate trials increase confidence in external validity across populations, time periods, and the intervention teams. The evidence of MTFC's effectiveness in reducing girls' depressive symptoms is striking given that the intervention was not designed to directly impact these problems, and given that the tailored services provided in GC were allowed to vary and likely included depression-focused interventions (e.g., cognitive therapy). Thus, our findings add to the growing list of positive effects of MTFC on targeted and nontargeted outcomes in a sample of girls selected for delinquency.

The participants were not selected on the basis of depression diagnosis or risk. Thus, direct comparisons cannot be made between the effects found here and those of indicated interventions developed for adolescents with major depressive disorder (MDD). Still, it is important to note that researchers examining cognitive behavior therapy (CBT)—an evidence-based treatment for MDD—have found conduct disorder or conduct problems to predict slower recovery (Rohde, Seeley, Kaufman, Clarke, & Stice, 2006) and faster episode recurrence (Rohde, Clarke, Lewinsohn, Seeley, & Kaufman, 2001), and to be associated with the loss of initial differential treatment effects after 6 months (Rohde, Clarke, Mace, Jorgensen, & Seeley, 2004). Thus, it is impressive that MTFC led to enduring decreases in depressive symptoms relative to GC.

In addition, we examined the role of baseline depressive symptoms as a risk factor that might moderate the effects of MTFC on depressive symptoms. Results indicated that girls with more depressive symptoms at baseline benefitted most from the MTFC intervention. This is a promising finding, given that comorbidity (e.g., serious delinquency and depressive symptoms)

sometimes predicts a weaker or less enduring response to treatment (e.g., in cognitive behavior treatment of major depressive disorder; Rohde et al., 2004). These findings have implications for intervention development, as they suggest MTFC will improve depressive symptoms even without an enhancement that specifically targets such problems. Still, further research is needed to determine whether the findings would replicate using an indicated sample selected for both clinical diagnosis of a depressive disorder and involvement in the juvenile justice system; delinquent girls with MDD likely will require more than MTFC alone to achieve remission.

Given the disproportionate number of girls in the juvenile justice system who have been maltreated, we also examined the impact of maltreatment history on girls' depression. Results provided modest support for the direct effect of maltreatment on depression but no support for its moderating role. Girls with a history of sexual abuse showed a trend-level elevation in depressive symptoms, and showed a greater rate of deceleration in symptoms over time. In addition, girls with a history of physical abuse were more likely to meet the clinical cut-off for depression.

Although the mechanisms of MTFC effects were not examined, several pathways are possible and suggest directions for future study. First, consistent with the failure model, MTFC might have indirectly impacted girls' depressive symptoms by decreasing their problem behavior. Reducing delinquent behavior would be expected to reduce short-term stress in response to negative consequences (e.g., school suspension, arrest) and risk for longer-term developmental failures (e.g., school drop-out). Additional research might support this pathway as part of a broader intervention-related change in problem behavior trajectories. If so, then the life outcomes of MTFC girls should continue to diverge from those of girls who receive usual care, as developmental failures linked to problem behavior trajectories continue to accumulate.

Second, MTFC might have more effectively restricted girls' access to dysfunctional family and peer contexts that generate stress and trauma and increase depressive symptoms. Third, MTFC might have directly impacted girls' depressive symptoms by providing immediate increases in rates of positive reinforcement for adaptive behavior (i.e., home and school compliance, self-care, and self-regulation). Such changes would be expected to lessen depressive symptoms by decreasing helplessness and hopelessness and increasing self-efficacy (Garber & Flynn, 2001); these behavioral interventions were likely more intensive and systematic in MTFC than in GC.

Importantly, the reach of these latter two pathways might have continued after the foster placement because MTFC includes parent management training for the aftercare placement, emphasizing monitoring and consistent, nonharsh parenting. Finally, the MTFC girls might have been more likely to develop stable relationships with foster parents and behavioral support specialists than the GC girls. Such consistent and supportive relationships might have provided additional social reinforcement and stress-buffering social support, both of which would be expected to reduce depressive symptoms (Stice, Ragan, & Randall, 2004).

An unexpected finding was that the benefit of MTFC relative to GC in reducing clinical levels of depression appeared to be stronger for girls in Trial 2 than in Trial 1. As this portion of the study design was quasi-experimental (i.e., girls were randomly assigned to treatment condition but not to trial), this finding must be interpreted with caution. It is possible that the modules targeting sexual risk and substance abuse that were added to MTFC during Trial 2 had unintended but ameliorative effects on more severe levels of depressive symptoms. This would be surprising, however, given that Kerr et al. (2009) found no evidence for an impact of the module on pregnancy rates, an outcome more conceptually related to the module's sexual risk targets than depressive symptoms. Unfortunately, however, we are unable to evaluate these

mechanisms given the extant measures.

There were several limitations of the present study. First, our sample was selected for delinquency and not depression, and therefore only 23% of participants reached the clinical depression cut-off at T1. Thus, our findings might not generalize to girls with more severe symptoms or mood disorder diagnoses. Second, the study showed a random difference in baseline levels of depressive symptoms by condition, with MTFC girls having higher mean scores at baseline than GC girls. Although the slope for MTFC girls' depressive symptoms had a steeper gradient than that for GC girls, and the T3–T5 depressive scores were lower for MTFC girls than for GC girls, the baseline difference was unexpected. Nonetheless, the LGM models used all time points and considered this in the slope models, thereby analytically addressing this difference across all model tests. Third, our measurement of depressive symptoms was limited to a self-report instrument that was collected at the same time points in both trials. Fourth, although ethnic and racial diversity in the sample were locally representative, our results might not generalize to more diverse samples or to more urban settings.

In conclusion, our results suggest that a family-based, delinquency-focused intervention can reduce girls' depressive symptoms significantly more than GC without explicitly focusing on such issues. These results were particularly pronounced for girls with higher levels of initial depressive symptoms. Though not explicitly tested, our findings might be consistent with a corollary of the failure model: if negative developmental consequences of delinquency cause depressive symptoms, then these symptoms can be prevented or ameliorated through interventions that change delinquency trajectories. Our findings thus build upon the MTFC evidence base and offer significant prospect that the long-term outcomes of seriously delinquent girls—including those with a significant history of maltreatment—can be improved.

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References

Angold, A., & Costello, E. J. (1993). Depressive comorbidity in children and adolescents: Empirical, theoretical, and methodological issues. *American Journal of Psychiatry, 150,* 1779–1791.

Capaldi, D. M. (1992). Co-occurrence of conduct problems and depressive symptoms in early adolescent boys: II. A 2-year follow-up at grade 8. *Development and Psychopathology, 4,* 125–144. doi: 10.1017/S0954579400005605

Chamberlain, P. (2003). *Treating chronic juvenile offenders: Advances made through the Oregon multidimensional treatment foster care model*. Washington, DC: American Psychological Association.

Chamberlain, P., Leve, L. D., & DeGarmo, D. S. (2007). Multidimensional Treatment Foster Care for girls in the juvenile justice system: 2-year follow-up of a randomized clinical trial. *Journal of Consulting and Clinical Psychology, 75,* 187–193. doi: 10.1037/0022-006X.75.1.187

Chamberlain, P., & Smith, D. K. (2003). Antisocial behavior in children and adolescents: The Oregon Multidimensional Treatment Foster Care model. In A. E. Kazdin & J. R. Weisz (Eds.), *Evidence-based psychotherapies for children and adolescents* (pp. 282–300). New York: Guilford Press.

Connell, A. M., & Dishon, T. J. (2008). Reducing depression among at-risk early adolescents: Three-year effects of a family-centered intervention embedded within schools. *Journal of Family Psychology, 22,* 574–584. doi: 10.1037/0893-3200.22.3.574

Curran, P.J., & Bollen, K.A. (2001). The best of both worlds: Combining autoregressive and latent curve models. In L. M. Collins & A. G. Sayer (Eds.), New methods for the analysis of change (pp.105–136). Washington, DC: American Psychological Association.

Derogatis, L. R. (1993). *BSI Brief Symptom Inventory. Administration, Scoring, and Procedures Manual (4th Ed.).* Minneapolis, MN: National Computer Systems.

Derogatis, L. R., & Melisaratos, N. (1983). The Brief Symptom Inventory: An introductory report. *Psychological Medicine, 13*, 595–605. doi: 10.1017/S0033291700048017

Fazel, S., Doll, H., & Langstrom, N. (2008). Mental disorders among adolescents in juvenile detention and correctional facilities: A systematic review and metaregression analysis of 25 surveys. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*, 1010–1019. doi: 10.1097/CHI.0b013e31817eecf3

Garber, J., & Flynn, C. (2001). Predictors of depressive cognitions in young adolescents. *Cognitive Therapy and Research, 25*, 353–376. doi: 10.1023/A:1005530402239

Ge, X. J, Best, K., Conger, R. D., & Simons, R. L. (1996). Parenting behaviors and the occurrence and co-occurrence of adolescent depressive symptoms and conduct problems. *Developmental Psychology, 32*, 717–731. doi: 10.1037/0012-1649.32.4.717

Greenberg, P.E., Kessler, R. C., Birnbaum, H. G., Leong, S.A., Lowe, S. W., Berglund, P. A., & Corey-Lisle, P. K., (2003). The Economic Burden of Depression in the United States: How Did It Change Between 1990 and 2000? *Journal of Clinical Psychiatry, 64*, 1465–1475.

Hops, H., Lewinsohn, P., Andrews, J. A., & Roberts, R. E. (1990). Psychosocial correlates of depressive symptomatology among high school students. *Journal of Clinical and Child Psychology, 19*, 211–220. doi: 10.1207/s15374424jccp1903_3

Jelicic, H., Phelps, E., & Lerner, R. M. (2009). Use of missing data methods in longitudinal studies: The persistence of bad practices in developmental psychology. *Developmental Psychology 45*, 1195–1199. doi: 10.1037/a0015665

Kerig, P. K., Ward, R. M., Vanderzee, K. L., & Moeddel, M. A. (2009). Posttraumatic stress as a mediator of the relationship between trauma and mental health problems among juvenile delinquents. *Journal of Youth and Adolescence, 38,* 1214–1225. doi: 10.1007/s10964-008-9332-5

Kerr, D. C. R., Leve, L. D., & Chamberlain, P. (2009). Pregnancy rates among juvenile justice girls in two RCTs of Multidimensional Treatment Foster Care. *Journal of Consulting and Clinical Psychology, 77,* 588–593.

Kim-Cohen, J., Caspi, A., Moffitt, T. E., Harrington, H., Milne, B. J., & Poulton, R. (2003). Prior juvenile diagnosis in adults with mental disorder: Developmental follow-back of a prospective-longitudinal cohort. *Archives of General Psychiatry, 60,* 709–717. doi:10.1001/archpsyc.60.7.709

Leve, L. D., & Chamberlain, P. (2007). A randomized evaluation of Multidimensional Treatment Foster Care: Effects on school attendance and homework completion in juvenile justice girls. *Research on Social Work Practice, 17,* 657–663. doi: 10.1177/1049731506293971

Leve, L. D., Chamberlain, P., & Reid, J. B. (2005). Intervention outcomes for girls referred from juvenile justice: Effects on delinquency. *Journal of Consulting and Clinical Psychology, 73*, 1181–1185. doi: 10.1037/0022-006X.73.6.1181

Lewinsohn, P. M., Clarke, G. N., Seeley, J. R., & Rohde, P. (1994). Major depression in community adolescents: Age at onset, episode duration, and time to recurrence. *Journal of the American Academy of Child & Adolescent Psychiatry, 33*, 809–818. doi:

10.1097/00004583-199407000-00006

Lewinsohn, P. M., Rohde, P., & Seeley, J. R. (1998). Major depressive disorder in older adolescents: Prevalence, risk factors, and clinical implications. *Clinical Psychology Review, 18,* 765–94. doi: 10.1016/S0272-7358(98)00010-5

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83,* 1198–1202. doi: 10.2307/2290157

Mason, W. A., Kosterman, R., Hawkins, J. D., Haggerty, K. P., Spoth, R. L., & Redmond, C. (2007). Influence of a family-focused substance use prevention intervention on growth in adolescent depressive symptoms. *Journal of Research on Adolescence, 17,* 541–564. doi: 10.1111/j.1532-7795.2007.00534.x

Merikangas, K. R., He, J., Burstein, M., Swanson, S.A., Avenevoli, S., Cui, L., ... Swendsen, J. (2010). Lifetime Prevalence of Mental Disorders in U.S. Adolescents: Results from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A). *Journal of the American Academy of Child & Adolescent Psychiatry, 49,* 980–989.

Orton, H. D., Riggs, P. D., & Libby, A. (2009). Prevalence and characteristics of depression and substance use in a U.S. child welfare sample. *Children and Youth Services Review, 31,* 649–653. doi: 10.1016/j.childyouth.2008.12.005

Puzzanchera, C. (2009). Juvenile arrests 2008. *OJJDP Juvenile Justice Bulletin*. Retrieved January 30, 2011, from http://www.ncjrs.gov/pdffiles1/ojjdp/228479.pdf.

Raudenbush, S., Bryk, A., Cheong, Y. F., Condon , R. T., & du Tolt, M. (2011). *HLM7: Hierarchical linear & nonlinear modeling*. Lincolnwood, IL: Scientific Software International, Inc.

Rohde, P., Clarke, G. N., Lewinsohn, P. M., Seeley, J. R., & Kaufman, N. K. (2001). Impact of comorbidity on a cognitive behavioral group treatment for adolescent depression. *Journal of the American Academy of Child and Adolescent Psychiatry, 40,* 795–802. doi: 10.1097/00004583-200107000-00014

Rohde, P., Clarke, G. N., Mace, D. E., Jorgensen, J. S., & Seeley, J. R. (2004). An efficacy/effectiveness study of cognitive-behavioral treatment for adolescents with comorbid major depression and conduct disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 43,* 660–668. doi: 10.1097/01.chi.0000121067.29744.41

Rohde, P., Lewinsohn, P. M., & Seeley, J. R., (1991). Comorbidity of unipolar depression: II. Comorbidity with other mental disorders in adolescents and adults. *Journal of Abnormal Psychology, 100,* 214–222. doi: 10.1037/0021-843X.100.2.214

Rohde, P., Seeley, J. R., Kaufman, N. K., Clarke, G. N., & Stice, E. (2006). Predicting time to recovery among depressed adolescents treated in two group interventions. *Journal of Consulting and Clinical Psychology, 74,* 80–88. doi: 10.1037/0022-006X.74.1.80

Rowe, R., Maughan, B., & Eley, T. C. (2006). Links between antisocial behavior and depressed mood: The role of life events and attributional style. *Journal of Abnormal Child Psychology, 34,* 293–302. doi: 10.1007/s10802-006-9032-0

Smith, D. K., Leve, L. D., & Chamberlain, P. (2006). Adolescent girls' offending and health-risking sexual behavior: The predictive role of trauma. *Child Maltreatment, 11,* 346–353. doi: 10.1177/1077559506291950

Stice, E., Ragan, J., & Randall, P. (2004). Prospective relations between social support and depression: Differential direction of effects for parent and peer support? *Journal of*

Abnormal Psychology, *113*, 155–159. doi: 10.1037/0021-843X.113.1.155

Stice, E., Shaw, H., Bohon, C., Marti, C. N., & Rohde, P. (2009). A meta-analytic review of depression prevention programs for children and adolescents: Factors that predict magnitude of intervention effects. *Journal of Consulting and Clinical Psychology, 77,* 486–503. doi: 10.1037/a0015168

Teplin, L. A., Abram, K. M., McClelland, G. M., Dulcan, M. K. & Mericle, A. A. (2002). Psychiatric disorders in youth in juvenile detention. *Archives of General Psychiatry, 59,* 1133–1143. doi: 10.1001/archpsyc.59.12.1133

Thapar, A., Collishaw, S., Pine, D. S., & Thapar, A. K. (2012). Depression in adolescence. *The Lancet*. Advance online publication. doi:10.1016/S0140-6736(11)60871-4

Wiesner, M., & Kim, H. K. (2006). Co-occurring delinquency and depressive symptoms of adolescent boys and girls: A dual trajectory modeling approach. *Developmental Psychology*, *42*, 1220–1235. doi: 10.1037/0012-1649.42.6.1220

Table 1

Means and standard deviations for depressive symptoms and means for depression clinical cut-off scores over time by group

	(*n* = 81) MTFC Intervention		(*n* = 85) Group Care Controls		(*n* = 166) Full Sample	
BSI Depressive Symptoms	*M*	*SD*	*M*	*SD*	*M*	*SD*
Baseline	1.35	1.06	1.00	.92	1.17	1.00
6 months	1.00	.93	.93	.93	.96	.93
12 months	.73	.71	.78	.78	.78	.75
18 months	.65	.84	.71	.78	.68	.81
24 months	.64	.76	.81	1.06	.72	.92
BSI Depression Clinical Cut-off (proportion of sample)						
Baseline	.28		.18		.23	
6 months	.16		.12		.14	
12 months	.07		.12		.09	
18 months	.12		.09		.10	
24 months	.12		.19		.15	

Table 2

HLM prediction model of growth in depressive symptoms over two years

	Initial Status	Linear Growth Rate	Quadratic Deceleration
Intercept	2.74*	-2.90	0.53
Baseline BSI	–	0.73***	-0.21***
MTFC	0.15	-0.34*	0.09
Trial	0.12	-0.38*	0.14*
MTFC × Trial	-0.00	-0.08	0.02
Girl Age	-0.09	0.09	-0.01
Physical Abuse History	0.11	-0.05	0.01
Sexual Abuse History	0.16†	-0.36	0.11*
Minority Status	-0.04	0.01	0.02
Prior Criminal Referrals	-0.02	0.05	-0.01
Days in Locked Settings	0.00	-0.00	0.00
Days to Treatment Entry	0.00	-0.00	0.00

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

Table 3

HGLM nonlinear probability model of growth in depression clinical cut-off score

	Coefficient	Odds Ratio	95th % C.I.
Intercept	-8.41***	0.00	(0.00–0.03)
Baseline BSI	0.31**	1.37	(1.07–1.75)
MTFC	-0.57**	0.57	(0.39–0.83)
Trial	-0.45**	0.63	(0.44–0.90)
MTFC × Trial	-0.30*	0.73	(0.57–0.95)
Girl Age	0.44**	1.54	(1.15–2.07)
Physical Abuse History	0.32*	1.37	(1.02–1.86)
Sexual Abuse History	-0.11	0.89	(1.02–1.86)
Minority Status	0.19	1.21	(0.62 –2.34)
Prior Arrests	0.04	1.04	(0.98–1.11)
Days in Lock Up	0.00	1.00	(0.99–1.01)
Days to Treatment	-0.00	0.99	(0.99–1.00)

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

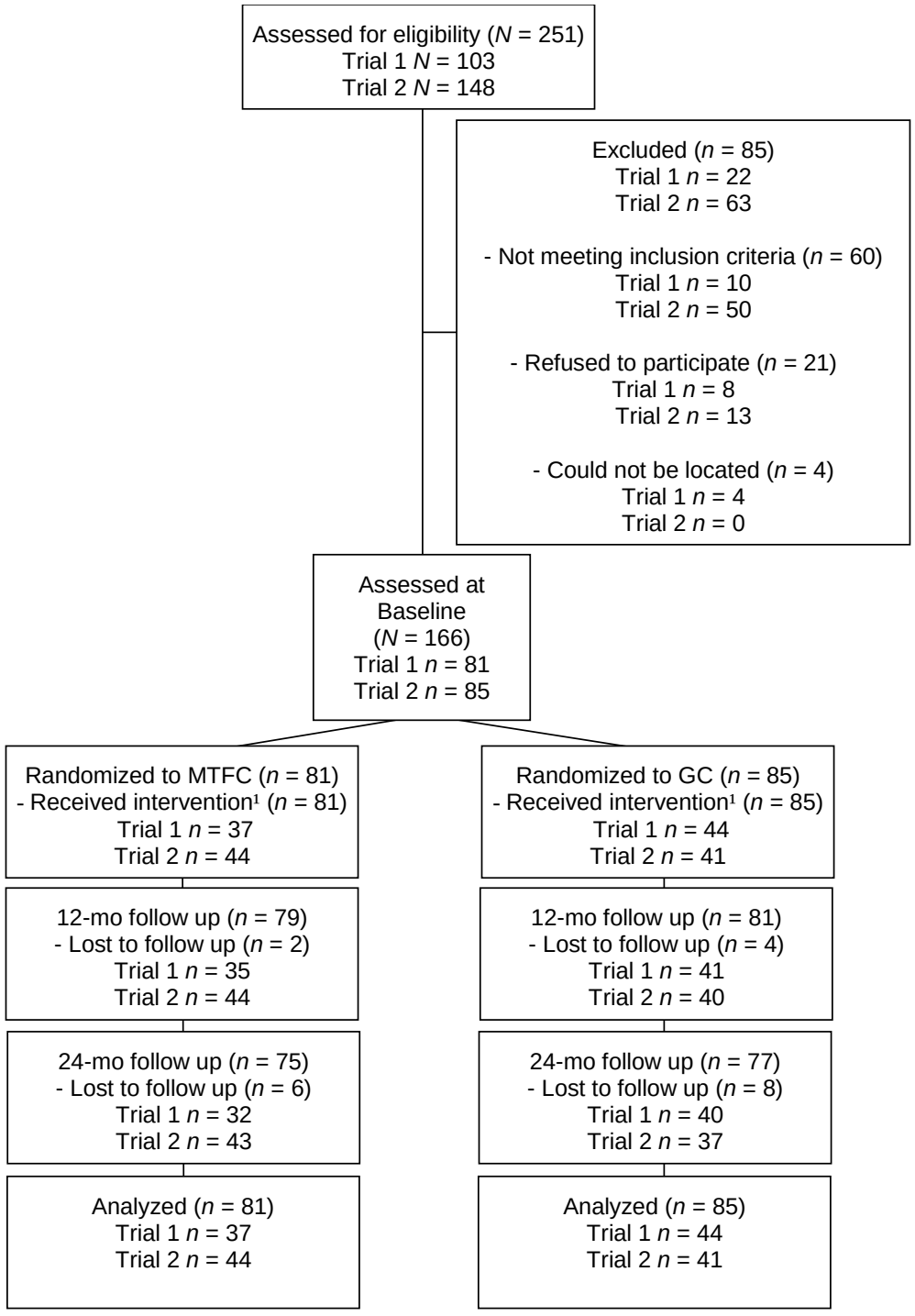


Figure 1. Consort diagram of participant flow for girls who completed any portion of the assessment at a given time point. *Note.* [a]Some intervention services were received by all youth, although intervention length varied. In addition, this diagram differs from Kerr et al. (2009), who used a cumulative method of computing participation at any assessment across the study period.

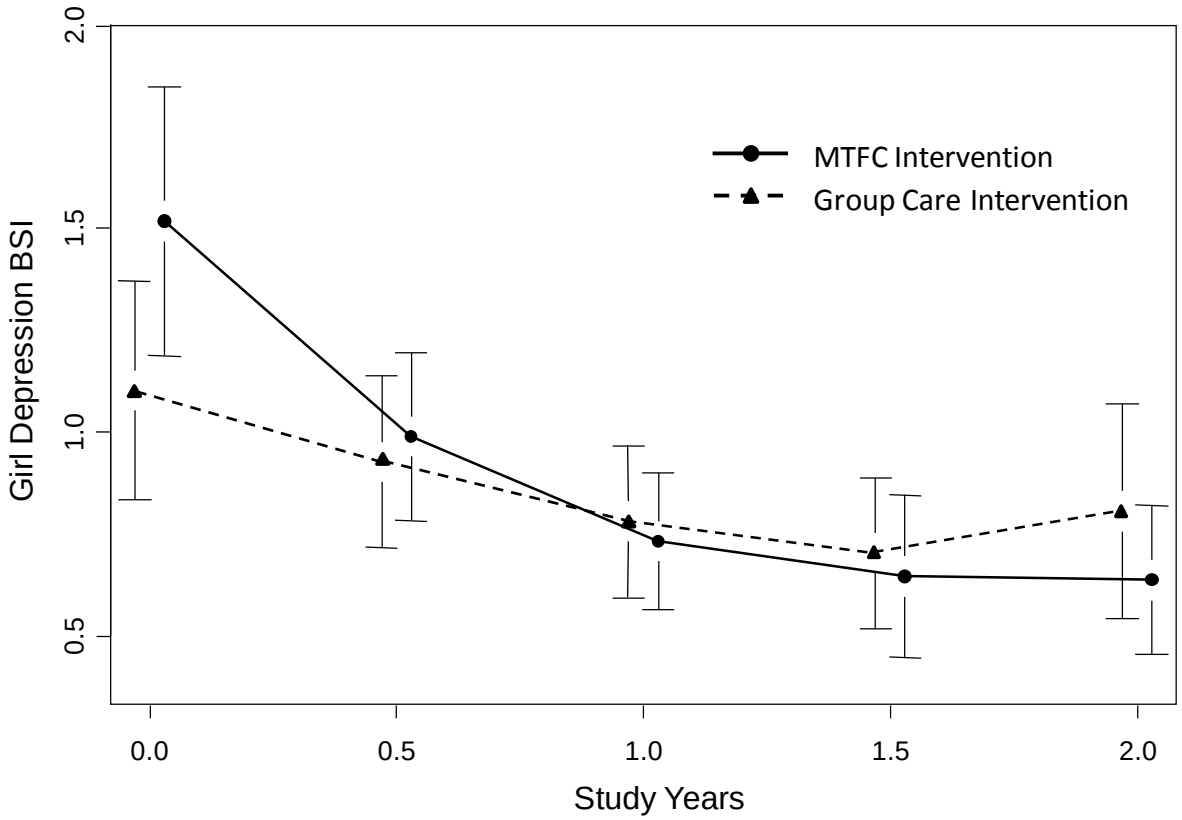
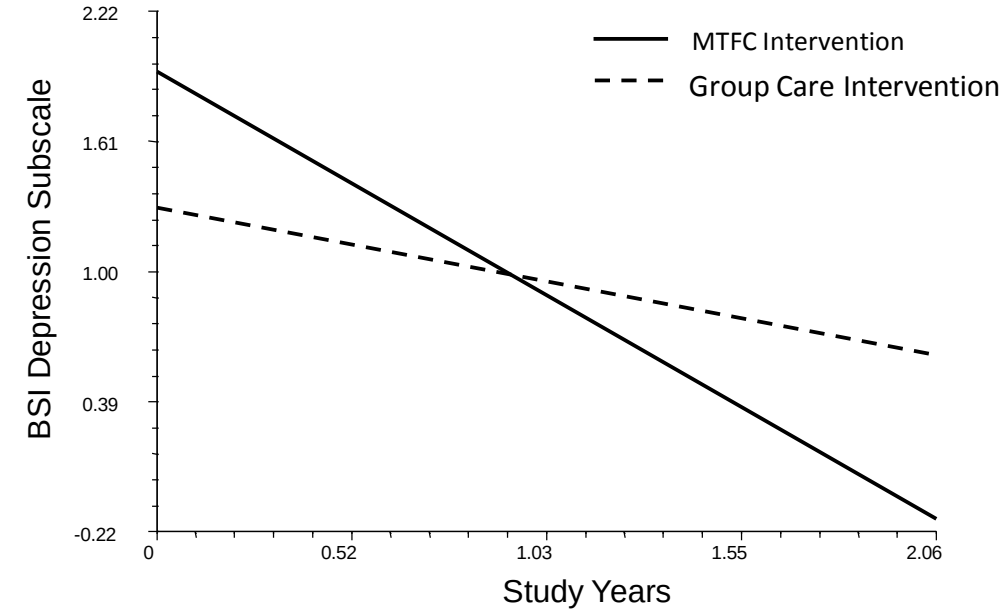


*Figure 2.*Observed depressive symptom means, their 95th percent confidence intervals, and mean trajectories by group condition over time.



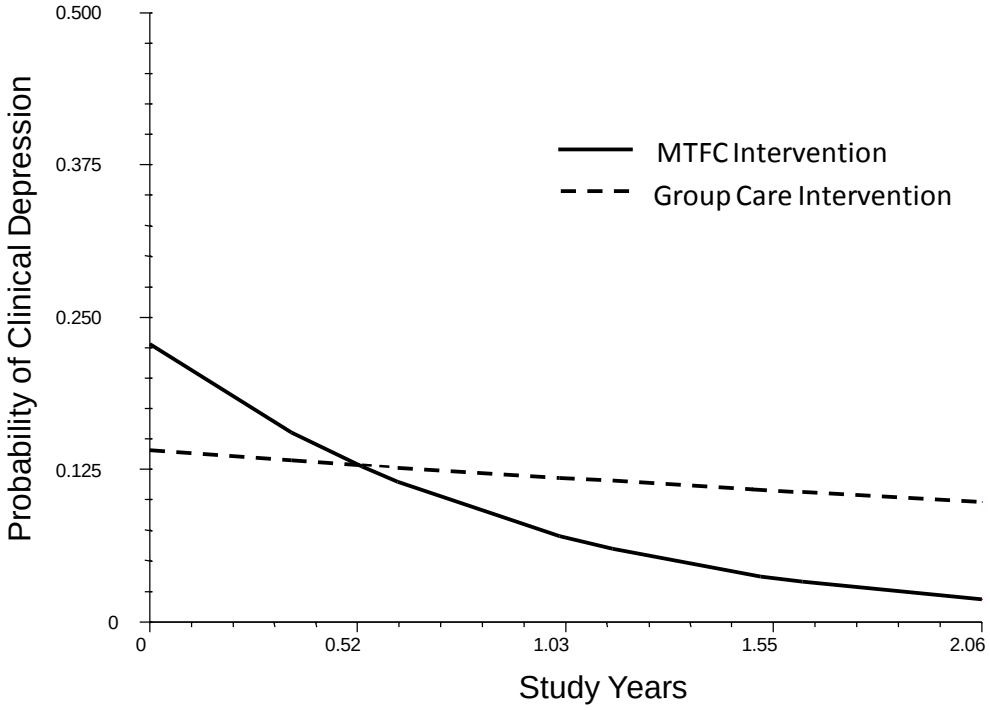


Figure 3a. The HLM estimated linear growth rates in depressive symptoms by group condition, controlling for initial status and baseline covariates and risk factors.

Figure 3b. The HGLM estimated nonlinear growth rates in depression clinical cut-off scores by group condition, controlling for initial status and baseline covariates and risk factors.