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The potential impact of trauma on the ability to prevent depression among low-income mothers

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Abstract

Background—Violent trauma is common in urban communities. We explored the hypothesis that past trauma could moderate the effect of a cognitive behavioral intervention designed to prevent depression among urban, low-income mothers.

Methods—Synthesis of two pilot randomized trials of problem solving education (PSE), among 93 mothers of children hospitalized in the neonatal intensive care unit or enrolled in community-based Early Intervention programs. Outcomes included depressive symptoms, perceived stress, social functioning. Results were adjusted for baseline depressive symptoms, then stratified according to subjects' trauma history.

Results—Fifteen of 44 PSE subjects (34%) experienced a moderately severe depressive symptom episode during the four-month follow-up period, as opposed to 21 of 45 control subjects (47%) – for a nearly significant adjusted odds ratio (aOR) of 0.36 (95% CI 0.13, 1.02). Among mothers without trauma histories, far fewer PSE mothers (5 of 24; 21%) experienced an episode of moderately severe depressive symptoms than control mothers (12 of 26; 46%), for a significant aOR of 0.15 (95% CI 0.03, 0.79). Conversely, among mothers with trauma histories, a similar proportion of PSE mothers (10 of 19; 53%) experienced an episode of moderately severe depressive symptoms as control mothers (9 of 19; 47%). Similar trends held for perceived stress and social functioning.

Conclusions—PSE may be more effective at preventing depression among mothers without trauma histories. Our results are consistent with the depression treatment literature, but are novel because they support the principle of intervention moderation in a risk-prevention – as opposed to treatment – paradigm.

Introduction

In 1994, the Institute of Medicine (IOM) published a seminal report, *Preventing Mental Disorders*, in which it outlined a series of principles for mental illness prevention (Mrazek et al. 1994). Since that time, increasing evidence has confirmed the basic premise that depression is a preventable condition. A recent meta-analysis by Cuijpers estimated that preventive interventions could conceivably reduce the incidence of depressive disorders by

22% (Cuijpers et al. 2008); and a follow-up IOM report concluded that depression prevention strategies that target populations based on risk – so called selective prevention – are more effective than broader, universal strategies (O'Connell et al. 2009). One well-described risk for depression is exposure to violent trauma, which often also leads to post-traumatic stress symptoms or post-traumatic stress disorder (PTSD).

Depression and post-traumatic stress symptoms, therefore, frequently co-exist (Hegarty et al. 2004; Nicolaidis et al. 2004; Nixon et al. 2004; Romito et al. 2005); and major depressive disorder – when accompanied by post-traumatic stress symptoms – can be less responsive to treatment than depression alone (Hegel et al. 2005; Holtzheimer et al. 2005; Shalev et al. 1998). Whereas the moderating effect of post-traumatic stress symptoms on depression treatment has been well described, there is a paucity of evidence concerning the relative effectiveness of depression prevention interventions in the presence or absence of trauma exposure. In urban low-income communities, where the prevalence of depression is disproportionately high and where up to half the general population has been exposed to violent trauma (Silverstein et al. 2010), exploring the impact of trauma on the ability to prevent depression is of substantial public health importance.

Therefore, in the context of two randomized pilot trials of an identical cognitive-behavioral depression prevention intervention for high risk mothers, we explored the potential of intervention moderation by subjects' past history of trauma. Both trials studied the feasibility of Problem Solving Education (PSE) in preventing depressive illness among urban, low-income mothers with developmentally vulnerable children: the first, among mothers of preterm infants hospitalized in the neonatal intensive care unit (NICU); the second, among mothers of young children with developmental delay, enrolled in community-based Early Intervention (EI) programs. The two study venues were chosen because they represent similar populations at different points on the developmental continuum, among whom maternal depression is disproportionately common. Because both trials were pilots, neither was powered to detect outcome differences. The following findings, therefore, are meant to formulate hypotheses on the impact of past trauma on the ability to prevent depression; they are not intended to be definitive.

Methods

Study design

We conducted two parallel group pilot trials of PSE, each with 1:1 randomization. Because identical outcome assessments were conducted in each study over a three-month follow-up period, data were combined and analyzed together.

Study settings

In the NICU study (n=50), subjects were recruited from two urban Level III NICUs within academic teaching hospitals; in the EI study (n=43), subjects were recruited from four community-based EI programs. No participants were enrolled in both trials.

Participants

Participants were enrolled in each trial based on their risk for depressive illness, and their children's risk for developmental impairment. NICU Mothers were enrolled if their infants were ≤ 33 weeks gestation. Because, by definition, children receiving EI services have – or are at risk for – developmental disability, we excluded no EI mothers based on their children's developmental status. Eligible participants were all English and Spanish speaking mothers with evidence of financial hardship, based on eligibility for either Women Infants

and Children services or state Medicaid. Mothers with psychosis, cognitive limitation or suicidal ideation were excluded.

Interventions

The intervention group received PSE. PSE is a manualized cognitive behavioral prevention intervention, adapted from Problem Solving Treatment, itself an evidence-based therapy for both major and subsyndromal depression (Barrett et al. 2001; Ciechanowski et al. 2004; Huibers et al. 2003). PSE is designed to impart recipients with stronger problem solving skills, which are theorized to reduce the negative impact of stress on personal-social functioning, and thereby prevent the development of impairing psychological distress (D'Zurilla and Nezu 2007). In a PSE session, educators guide subjects in selecting an objective, measurable problem; then proceed through a series of steps that include goal setting, brainstorming and evaluating solutions, choosing a solution, and action planning. In our studies, a full PSE course involved four to six one-on-one sessions (30 to 45 minutes), conducted weekly or biweekly. Sessions were conducted in locations of subjects' choosing – most often in the home.

For NICU enrollees, four graduate students – pursuing degrees in social work, public health, and graduate medical sciences – served as educators. For EI enrollees, existing EI social workers, occupational and physical therapists served as educators. Educator trainings for both studies were identical: one day of didactics, followed by three to five practice sessions conducted under the supervision of investigators (MS, MH). All training sessions were audiotaped, and each educator received individualized feedback until she met pre-defined criteria for protocol adherence. Control mothers received usual hospital or EI services.

Baseline characteristics

At baseline, we recorded subjects' age, work and education status, number of children, country of origin, race and ethnicity, and infants' gestational age. We assessed depression symptoms using the Quick Inventory of Depressive Symptoms (QIDS). Because the QIDS has a wide scoring range, it can be used to detect depressive illness in populations with moderate and low-level symptoms, and is sensitive to change over time (Keller et al. 1998). It is also valid in the post-partum period (Yonkers et al. 2001). We assessed perceived stress using the Perceived Stress Scale (Cohen et al. 1983), social functioning using the self-report Social Adjustment Scale (Weissman et al. 1978); and history of trauma and posttraumatic stress symptoms using the Modified PTSD Symptom Scale (Coffey et al. 1998). All scales represent valid and reliable measures with published psychometric properties.

Outcomes

We assessed three theory-based outcome parameters – depressive symptoms, perceived stress, and social functioning – over a three-month follow-up period, beginning after completion of the intervention. Depression symptoms were assessed monthly, for a total of four assessments over three months. Consistent with previous prevention studies, for our primary outcome, we analyzed follow-up depression scores relative to a pre-specified clinical threshold (QIDS score ≥ 11), corresponding to moderately severe symptomatology occurring during a one-week recall period. We also measured trajectories of depression symptom scores over the follow-up period. Secondary outcomes, perceived stress and social functioning, were assessed three months after intervention completion.

Sample size

The sample sizes of each study were determined as necessary to assess the feasibility of intervention delivery and subject assessment, and to estimate empiric study parameters

necessary to power a subsequent larger study. Although intervention moderation by trauma constituted an a priori hypothesis based on prior data from our study team (Silverstein et al. 2006; Silverstein et al. 2010), combining data from the individual studies was not part of the original research plan.

Randomization

Eligible mothers were allocated to PSE or control according to a computer generated randomization list. We randomized in blocks of randomly varying sizes of 2 and 4 to ensure balance between study arms. Randomization occurred independently within each individual study, and at each study site (2 NICUs and 4 EI programs). The allocation sequence was concealed from all study personnel in sequentially numbered, opaque, sealed envelopes.

Blinding

Outcome assessors, investigators, and hospital staff were blinded to study allocation.

Statistical methods

We assessed outcomes by intention-to-treat analysis. First, using logistic regression, we compared the proportion of mothers in each group to experience an episode of moderately severe depressive symptoms during the three-month follow-up period. Because minimizing the amount of symptomatic person-time is of substantial clinical importance to both mother and child, we used negative binomial regression to compare the incident rates of moderately severe depressive symptom episodes among mothers in each group. Lastly, we compared trajectories of depressive symptoms over multiple follow-up assessments using linear regression models with repeated measures. We used linear regression to compare perceived stress and social functioning scores after three months of follow-up.

Because of an imbalance in depressive symptom scores (presumably due to modest sample sizes) across study groups at baseline, we adjusted all models for baseline QIDS score. Because of possible, theoretical differences in participants recruited from our EI and NICU sites, we controlled for study venue as a fixed effect, and ruled out effect modification by venue by assuring that venue-by-study arm interaction terms were statistically non-significant in each of our models (Localio et al. 2001). Lastly, we assessed intervention moderation by baseline trauma exposure by analyzing our results in corresponding strata.

The Boston University Medical Center and Tufts Medical Center Institutional Review Boards approved this study.

Results

Sample

Research assistants screened 207 mothers for eligibility. Fifty-three refused participation; 61 were ineligible; 93 enrolled (Figure 1). The PSE (n=46) and control (n=47) groups were numerically balanced; however, whereas the PSE group had a higher proportion of Latina participants, the control group had a higher proportion of black participants. The PSE group had a higher proportion of women experiencing moderately severe depressive symptoms at baseline than the control group (41% vs. 28%). However, there were no clinically significant differences in the proportions of participants to be taking an anti-depressant medication, or to have experienced a significant trauma (Table 1).

Main effects

On aggregate, 15 of 44 PSE participants (34%) experienced a moderately severe depressive symptom episode during the three-month follow-up period, as opposed to 21 of 45 control subjects (47%) – for an aOR of 0.36 (95% CI 0.13, 1.02; Table 2). Those receiving PSE experienced an average 0.68 symptomatic episodes over the three months of follow-up, compared to 0.93 episodes among control mothers – for an adjusted incident rate ratio (aIRR) of 0.64 (95% CI 0.38, 1.07). Whereas the PSE group experienced a mean reduction of 3.21 (SD 4.67) points on the QIDS, the control group experienced a mean reduction of 1.13 (SD 5.85) points – for an adjusted difference of 1.45 points (95% CI –2.93, 0.03).

On aggregate, the PSE group appeared to have better social functioning than the control group after four months of follow-up, with the adjusted difference in social functioning score of –0.19 (95% CI –0.38, 0.00) equivalent to approximately one-third of a standard deviation.

Traumatic events

Thirty-eight of the 93 study subjects (41%) reported experiencing an unusually stressful or traumatic event in their lives. The most common traumas were sexual assault, physical assault, witnessing someone shot or killed, and witnessing the death of a family member (Table 3).

Trauma's impact on intervention effectiveness

Among mothers without trauma histories, far fewer PSE mothers (5 of 24; 21%) experienced an episode of moderately severe depressive symptoms than control mothers (12 of 26; 46%), for a statistically significant aOR of 0.15 (95% CI 0.03, 0.79 - Table 4). Conversely, among mothers with trauma histories, a greater proportion of PSE mothers (10 of 19; 53%) experienced an episode of moderately severe depressive symptoms than control mothers (9 of 19; 47%), for an aOR of 0.83 (95% CI 0.19, 3.72). This adjusted odds ratio differed in direction from the crude comparison between study groups because of an imbalance in baseline depression scores across PSE and control subjects.

Among mothers without trauma histories, those receiving PSE experienced an average 0.42 symptomatic episodes over the four follow-up time points, compared to 0.96 episodes among control mothers (aIRR 0.43, 95% CI 0.14, 1.30). By contrast, among mothers with trauma histories, those receiving PSE experienced an average 1.05 symptomatic episodes over the four follow-up time points, compared to 0.89 episodes among control mothers (aIRR 0.87, 95% CI 0.49, 1.55). Again, this adjusted rate ratio differed substantially from crude comparisons because of an imbalance in baseline depression scores across PSE and control subjects.

After four months of follow-up, PSE mothers in the non-traumatized sub-population experienced a trend in the direction of less perceived stress than control mothers (adjusted difference in stress score –1.42; 95% CI –3.05, 0.19); this, however, did not appear to be the case in the traumatized population.

Discussion

Although exploratory, our study provides suggestive evidence for trauma's potentially moderating influence on the effectiveness of a cognitive-behavioral intervention designed to prevent depression among urban, low-income mothers. On aggregate, PSE appeared to have a positive effect on preventing depression among our study population – close to half of which reported experiencing violent trauma in their lives. However, this impact appeared to

be attenuated among the subpopulation with a history of trauma. Conversely, among the subpopulation without trauma history, PSE appeared to reduce the rate of clinically significant depressive symptomatology substantially, and even achieve statistical significance in some of our models.

Our findings are consistent with a growing body of literature demonstrating that major depression, in the presence of post-traumatic stress symptoms, can be more refractory to treatment than depressive disorder alone (Holtzheimer et al. 2005). Our results are novel, however, because they suggest that the principle of intervention moderation extends to a risk prevention – as opposed to treatment – paradigm. Before an individual experiences a major depressive episode, antecedent risks are often present: sustained subsyndromal symptoms; poverty; or, in our case, the illness of a child. Similarly, before an individual develops post-traumatic stress symptoms or PTSD, she must experience an antecedent trauma. Our study, therefore, is an example of how antecedent risks to either depression or PTSD may interact to modify the success of a selective depression prevention strategy. To our knowledge, our study is the first to examine the impact of trauma – a common exposure among young urban women – on the ability to prevent depression.

Numerous recent reports on maternal depression's high prevalence, as well as its adverse impact on children, have attempted to inform practice and policy debates. Facilitating and mandating reimbursement for maternal depression screening in clinical settings, furthermore, has been a centerpiece of many recent policy and legislative agendas (Earls 2010; Illinois 2007; New Jersey 2006). Largely absent from this discussion, however, has been a focus on violence exposure, trauma, or post-traumatic stress, and how these coexistent risks may inform depression screening, treatment, or prevention practices. In a previous report, our group estimated that approximately one quarter of depressed urban mothers could have comorbid PTSD, and that over half report significant trauma exposure (Silverstein et al. 2010). Our current report suggests that such exposure may have clinical ramifications relative to the ability to prevent depression.

This study has a number of limitations. First, it is exploratory; and in the context of our pilot work, we consider our finding to be more hypothesis-generating than confirmatory. Second, our study sample represents a combination of two distinct pilot trials; and it could be that our findings would not stand up if tested within a single, larger study. However, because our trials shared a common intervention, common measures, and a common study team, combining them is methodologically equivalent to conducting a single, stratified RCT. Third, although we obtained trauma histories from a valid and reliable PTSD instrument, we did not probe specifically for multiple traumas, timing of exposure, or recurrence. Although this lack of granularity in measuring trauma would most likely cause a conservative bias, it could be that certain traumas produce more substantial moderating effects than others. Fourth, we did not have enough subjects with high levels of PTSD symptoms to conduct an analysis of potential effect modification by PTSD symptom burden, or to assess whether the impact of trauma exposure is mediated through such symptomatology. Lastly, myriad other exposures, psychiatric comorbidities, ongoing life stressors, and concurrent treatments (medications or psychotherapy) could play clinically significant roles in modifying the effect of depression treatment and prevention programs; and it was beyond the scope of both our aims and sample size to test these influences.

These limitations notwithstanding, our results lend credence to the hypothesis that trauma exposure may limit the effectiveness of certain depression prevention strategies. In future studies of depression prevention interventions – particularly among urban populations – investigators should give careful consideration to granular measurement of stressful life exposures and post-traumatic stress symptoms, and to measuring the moderating impact of

such exposures and symptoms on intervention impact. If such a finding proves to be consistent, it may be that trauma-specific elements need to be incorporated into future prevention strategies.

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Table 1

Study groups at baseline

	PSE (n=46)	Control (n=47)
NICU (n)	25	25
EI (n)	21	22
Mean age, years (SD)	29.13 (7.17)	31.00 (8.74)
Black (%)	15 (33%)	21 (45%)
Latina (%)	19 (41%)	11 (23%)
US born (%)	29 (67%)	28 (62%)
Mean number of children (SD)	2.24 (1.74)	2.28 (1.30)
High school graduate (%)	37 (80%)	38 (81%)
Work outside of the home (%)	16 (35%)	19 (42%)
Mean depression score (SD)	9.52 (4.82)	8.32 (4.29)
Quick Inventory of Depressive Symptoms ≥ 11 (%)	19 (41%)	13 (28%)
Depression medication (%) (n=38)	5 (25%)	3 (17%)
Mean perceived stress score (SD)	10.39 (3.48)	10.79 (2.72)
Mean social adjustment score (SD)	2.08 (0.46)	2.15 (0.47)
Experienced a significant trauma (%)	19 (42%)	19 (40%)

Depressive symptoms were measured using the Quick Inventory of Depressive Symptoms; perceived stress was measured using the Perceived Stress Scale; social adjustment (functioning) was measured using the Social Adjustment Scale – Self-Report; and trauma was measured using the stem question of the Modified PTSD Symptom Scale.

Table 2

Main effects

	Control (n=47)	PSE (n=46)	Measure of association (95% CI)	P value
Number (%) of subjects to experience moderately severe symptom episode during follow-up period	21 (47%)	15 (34%)	aOR 0.36 (0.13, 1.02)	0.06
Mean number (SD) of moderately severe symptom episodes follow-up period	0.93 (1.27)	0.68 (1.12)	aIRR 0.64 (0.38, 1.07)	0.09
Mean change in QIDS score over follow-up period (SD)	-1.13 (5.85)	-3.21 (4.67)	-1.45 (-2.93, 0.03)	0.06
Mean perceived stress score after 4 months of follow-up (SD)	9.68 (3.50)	9.05 (3.15)	-0.75 (-1.96, 0.48)	0.23
Mean social functioning score after 4 months of follow-up (SD)	2.06 (0.49)	1.89 (0.48)	-0.19 (-0.38, 0.00)	0.05

All models are adjusted for baseline QIDS score and for study venue.

Table 3

Trauma exposure at baseline (total n=93)

Trauma	Frequency (%)
Rape/sexual assault	10 (11)
Witnessing death of a family member	7 (8)
Intimate Partner Violence	4 (4)
Physical assault	3 (3)
Witnessing someone shot or killed	3 (3)
Did not want to disclose	3 (3)
Other	9 (10)

Table 4

Stratified by trauma exposure

	No Trauma				Trauma			
	Ctrl (n=28)	PSE (n=26)	Measure of association (95% CI)	P value	Ctrl (n=19)	PSE (n=19)	Measure of association (95% CI)	P value
Number (%) of subjects to experience moderately severe symptom episode during follow-up period	12/26 (46%)	5/24 (21%)	0.15 (0.03, 0.79)	0.02	9/19 (47%)	10/19 (53%)	0.83 (0.19, 3.72)	0.81
Mean number (SD) of moderately severe symptom episodes follow-up period	0.96 (1.37)	0.42 (0.97)	0.43 (0.14, 1.30)	0.13	0.89 (1.15)	1.05 (1.22)	0.87 (0.49, 1.55)	0.64
Mean change in QIDS score over follow-up period (SD)	-0.82 (6.57)	-3.25 (4.47)	-2.04 (-3.99, -0.09)	0.04	-1.56 (4.87)	-2.94 (5.05)	-0.94 (-3.38, 1.50)	0.44
Mean perceived stress score after 4 months of follow-up (SD)	9.91 (3.49)	8.35 (2.85)	-1.42 (-3.05, 0.19)	0.09	9.38 (3.59)	9.78 (3.44)	-0.14 (-2.01, 1.72)	0.88
Mean social functioning score after 4 months of follow-up (SD)	2.06 (0.48)	1.82 (0.44)	-0.22 (-0.46, 0.02)	0.08	2.06 (0.52)	1.98 (0.52)	-0.15 (-0.46, 0.15)	0.33

All models are adjusted for baseline QIDS score and for study venue. The only exception is the negative binomial models for symptomatic episodes. Due to lack of model convergence, we removed study venue from these models.