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Relationship of Childhood Trauma to Depression and Smoking Outcomes in Pregnant Smokers

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Abstract

Objective—We evaluated whether childhood trauma moderated the treatment effect on depression and smoking outcomes in pregnant smokers.

Method—The sample included pregnant smokers participating in a randomized trial evaluating the efficacy of a 10-session interpersonally focused therapy—cognitive behavioral analysis system of psychotherapy (CBASP), versus a time-matched health and wellness control (HW) for smoking cessation and depression reduction. Women ($N = 248$) who completed the Childhood Trauma Questionnaire (CTQ) were included. On average, women were 25 years old ($SD = 5.91$) and smoked 10 ($SD = 6.9$) cigarettes per day. Depressive symptoms were assessed with the Center for Epidemiological Studies-Depression Scale (CES-D) and women had an average score of 21 ($SD = 11.03$). Seventy-six percent of women had experienced some form of moderate to severe childhood trauma as assessed by the CTQ.

Results—In women with a history of moderate to severe childhood trauma, there was a dose-response association of treatment on depression outcome through 6 months postpartum; those with increasing amounts of childhood trauma benefitted more from CBASP, while those in the HW condition did not. Childhood trauma did not moderate the treatment effect on abstinence, although increasing amounts of trauma were associated with reduced likelihood of abstinence at 6 months post treatment.

Conclusions—An interpersonally-focused therapy may be beneficial for the treatment of depression during the prenatal period in pregnant smokers with childhood trauma histories and such treatment becomes increasingly more important with cumulative trauma experience. Childhood trauma increases risk for cessation failure in pregnant smokers.

Keywords

childhood trauma; pregnant smokers; depression

Childhood abuse and neglect are highly prevalent and major public health problems that lead to numerous adverse effects on physical and mental health which persist through late adulthood (Draper et al., 2008). The overall prevalence of neglect and physical, sexual and emotional abuse has been estimated to be 13.5% to 26% in population-based samples (Dube, Cook, & Edwards, 2010; Finkelhor, Turner, Ormrod, & Hamby, 2010), with prevalence being disproportionately higher in individuals with an annual income of less than \$19,999 (33%; Zielinski, 2009).

It has been well established that childhood trauma increases risk for the development of mood and substance use disorders. Individuals who have experienced abuse or neglect in childhood are 1.3 to 3.1 times more likely to experience lifetime major depressive disorder or dysthymia, depending on type, severity, and frequency of the trauma (Kendler et al., 2000; Widom, DuMont, & Czaja, 2007). The odds of alcohol and drug use and dependence disorders are increased in these individuals as well, ranging from 1.5 to 5.7 higher odds of lifetime and current disorders compared to those with no trauma history (Kendler et al., 2000; Nelson et al., 2002). In addition, there is increasing evidence that exposure to trauma during childhood is predictive of smoking. Findings from both epidemiological and clinical studies indicate that individuals who have experienced childhood trauma are more vulnerable to initiating smoking at an early age, smoking heavily, and having higher levels of nicotine dependence (Anda et al., 1999; Jun et al., 2008; Blalock et al., 2011).

Smoking and depressive disorders frequently co-occur. Epidemiological studies show that among individuals with current diagnoses of dysthymia and major depressive disorder (MDD), prevalence of smoking ranges from 38% to 46% (Lasser et al., 2000; Lawrence, Mitrou, & Zubrick, 2009). Six percent of current adult smokers in the United States met criteria for MDD within the past 12 months and 5% met criteria for dysthymia (Lawrence et al., 2009). Several researchers have emphasized the importance of childhood trauma as an etiological risk factor underlying psychiatric co-morbidity (Anda et al., 2006; Sinha, 2001). There are numerous lines of evidence showing that early life stress impacts brain structure and function and results in dysregulation of the hypothalamic-pituitary-adrenal axis (HPA). It has been hypothesized that these changes induce a persistent sensitization of stress-responsive neural circuits that increase sensitivity and reactivity to stress, and risk for development of mood and anxiety disorders (Anda et al., 2006; Heim & Nemeroff, 2001). These changes may also alter the sensitivity of dopamine systems to stress, thus increasing susceptibility to self-administration of substances of abuse (Anda et al., 2006; Sinha, 2001). Researchers have also noted behavioral, cognitive, emotional, and interpersonal sequelae to childhood trauma which have been found to be associated with increased risk for both depressive and substance use disorders. These include difficulty regulating affect, insecure attachment styles and associated difficulties with interpersonal relating, negative assumptions regarding self, and conditioned emotional distress responses to abuse stimuli and implicit/sensory and autobiographical memories (Briere, 2002; Pearlman & Courtois, 2005). Thus, childhood trauma-related dysregulation in neurological systems and psychosocial sequelae that are common to both depressive and substance use disorders may underlie a substantial proportion of the co-morbidity between substance use and depressive disorders (Anda et al., 2006; Heim, Plotsky, & Nemeroff, 2004).

Several researchers have argued that effective treatment of depression or substance use disorders in individuals with a history of childhood trauma may require psychosocial or

pharmacological interventions that directly target the neurobiological, interpersonal, cognitive, coping, and emotion regulation deficits that occur as a result of early trauma (Heim & Nemeroff, 2001; Hyman et al., 2008; Craighead & Nemeroff, 2005). Few studies have examined whether individuals with histories of childhood trauma respond differently to substance abuse treatments than those without trauma. Two studies utilizing quasi-experimental designs suggest that treatments that concurrently address trauma-related symptoms and substance abuse produce more favorable drug use outcomes than those that address only substance abuse in women who have experienced trauma (Cocozza et al., 2005; Cohen & Hein, 2006). Another study found that trauma history moderated the effect of treatment intensity on substance abuse outcomes, such that patients with trauma received greater benefit from more frequent contact than non-traumatized patients (Rosen, Ouimette, Sheikh, Gregg, & Moos, 2002).

Among individuals with childhood trauma histories, interpersonally-focused psychotherapies may be more effective in the treatment of depression than other treatment approaches given the chronic interpersonal deficits that have been noted in this population (Cloitre, Cohen, & Koenen, 2006). Four studies have examined the moderating effect of childhood trauma on depression response to interpersonally-focused psychotherapies in adults. Three studies have evaluated differential response of individuals with versus without childhood trauma to interpersonal therapy (IPT). In one study (Grote et al., 2012), there was no differential response to IPT versus usual care (UC) in depressed pregnant women with versus without a history of childhood trauma. In a second study involving outpatients with MDD (Harkness, Bagby, & Kennedy, 2012), patients with a history of childhood trauma had a significantly *poorer* response to IPT than to cognitive behavior therapy (CBT) and antidepressant medication, whereas in patients with no trauma history there were no treatment differences. In a third study involving inpatients with MDD (Zobel et al., 2011), patients with a history of childhood trauma had a significantly *better* response to combined IPT and antidepressant pharmacotherapy than pharmacotherapy alone, whereas there were no treatment differences in patients without trauma. A fourth study evaluated a different interpersonally-focused intervention, cognitive behavioral analysis system of psychotherapy (CBASP; Nemeroff et al., 2003). In this study, chronically depressed patients with a history of childhood trauma responded significantly better to CBASP alone, with or without combined antidepressant medication, versus medication alone, whereas chronically depressed patients without trauma responded significantly better to the combined CBASP and medication condition than CBASP or medication alone. Results from these studies provide mixed evidence for the hypothesis that interpersonally-focused depression treatments are more effective in patients with a history of childhood trauma.

Graded relationships between number of adverse childhood experiences and the degree to which childhood trauma impacts treatment response have not been identified in treatment studies. However, strong, graded relationships have been found in etiological studies of trauma and its relationship to addictive and depressive disorders (Anda et al., 1999; Chapman et al., 2004). It seems reasonable to predict that such relationships may exist between childhood trauma and treatment response. Demonstration of dose-response effects would strengthen causal conclusions regarding the moderating effect of childhood trauma on treatment response. It would also provide information regarding the level of cumulative trauma at which individuals might benefit from one treatment versus another.

Given the relationship between childhood trauma and depression, depression and smoking (Goodwin, Keyes, & Simuro, 2007; Blalock, Fouladi, Wetter, & Cinciripini, 2005), and the adverse consequences of both on birth outcomes, (Shah & Bracken, 2000; Grote et al., 2010), improving our understanding of treatment related predictors could have beneficial effects both on psychological and health-related outcomes in this predominantly low

socioeconomic status (SES), vulnerable population of women. The current study is a secondary subgroup analysis of data from a clinical trial evaluating the efficacy of CBASP as a smoking cessation intervention for pregnant smokers (Cinciripini et al., 2010). We sought to replicate and extend Nemeroff and colleagues' previous finding that CBASP was superior to antidepressant monotherapy in chronically depressed individuals with childhood trauma. (Nemeroff et al., 2003)

In the clinical trial from which the study is drawn, pregnant smokers were randomly assigned to receive CBASP versus a therapist time and contact health and wellness control condition (HW). CBASP is an interpersonally focused psychotherapy (McCullough, 2000; McCullough, Jr., 2006) that we hypothesized would be more effective than a supportive treatment like HW in addressing the areas that childhood trauma models have identified as being important for effective treatment, including development of secure therapeutic relationships, improvement in interpersonal and emotion regulation skills, reduction in avoidant behaviors, examination of implicit assumptions regarding relational expectations, and activation and processing of interpersonal schema and negative emotional states associated with traumatic relational memories (Briere, 2002; Cloitre et al., 2006; Pearlman & Courtois, 2005). As a result, we expected that CBASP would be differentially more beneficial than HW for individuals with a childhood trauma history versus those without for a) smoking cessation and; b) depression symptom reduction. We also hypothesized a dose-response effect of trauma on treatment effect such that differences in depression and smoking cessation response to CBASP versus HW would increase with increasing extent of childhood trauma exposure.

Method

Participants and Procedure

The current study is a secondary analysis of data from a randomized clinical trial evaluating a depression-focused treatment for smoking cessation in pregnant women. The main outcome findings of this trial have been previously published (Cinciripini et al., 2010). Participants included the 248 women who completed the Childhood Trauma Questionnaire (CTQ). The study was approved by the institutional review board at the University of Texas MD Anderson Cancer Center. Participants were recruited between January 2005 and January 2008. Out of the 266 women randomized to the parent study, 18 did not complete the CTQ, resulting in a total sample of 248 for the current study. Additional information regarding the sample can be found in the article reporting the main outcome findings (Cinciripini et al., 2010). Briefly, participants were recruited through newspaper, television ads, and physician referral. To be included in the trial women were required to be 16 years of age, 32 weeks pregnant, have smoked at least a puff or more during the past 7 days, have a telephone, and express a willingness to quit smoking during the study. Women were excluded if they were currently participating in psychotherapy or other smoking cessation treatment, had unstable medical conditions that would adversely affect attendance, or demonstrated psychological instability during the screening.

At the initial telephone contact, women were told that the study was evaluating two counseling methods for helping pregnant women quit smoking – one that would focus on health concerns related to pregnancy and one that would focus on learning to manage negative mood. Women were also informed that they would receive 10 weekly counseling sessions that would last about an hour each and would be asked to attend long-term follow-up assessment visits at 3 and 6 months postpartum. Women were informed that if they were enrolled in the study, they would be compensated \$40 for each of the treatment sessions they completed and for completion of the 3- and 6-month postpartum follow-ups.

Treatment

Participants in both treatment groups were scheduled to receive 10 individual counseling sessions of 60 minutes duration. Each session consisted of 15 minutes of standard behavioral and motivational smoking cessation counseling that was common to both groups, plus 45 minutes of either CBASP or the HW control. CBASP was originally developed for the treatment of chronic depression (McCullough, 2000; McCullough, Jr., 2006). It is an integrative model of psychotherapy that focuses on reducing interpersonal stress and on increasing the quality of one's relationships with significant others. The primary treatment strategy is a social problem solving exercise called Situational Analysis (SA), which is used to create awareness of the contingent relationship between participants' behavior and outcomes in stressful interpersonal situations, and to generalize what is learned to other situations. A second aspect of the CBASP approach involves addressing interpersonal issues in the therapeutic relationship, as needed. The therapist develops hypotheses concerning expectations the participant may have concerning the therapist's reactions towards her. These hypotheses are based on an assessment of the participants' interpersonal history with key significant others during childhood and adulthood, which elicits information concerning psychological insults and traumatic experiences perpetrated by significant others for those who have experienced such interpersonal events. Using this information, the therapist-patient relationship can be used to further motivate behavior change by helping the participant recognize differences in the quality of her relationship with the therapist relative to the earlier maltreatment relationships, to generate felt safety within the therapy dyad, and to generalize the felt safety to the participant's other relationships.

The purpose of the HW condition was to provide a time- and attention-matched control for CBASP that was pregnancy relevant but instructional in nature. Participants were allowed to choose from a list of discussion topics such as stress, pregnancy symptoms, sleep, exercise, yoga, and relaxation training. During the HW session, therapists reviewed the content contained in standardized handouts that addressed the chosen topic, noting the connection between the HW topics and smoking when appropriate. In this condition, therapists were allowed to provide reflective, supportive listening, but were prohibited from conducting solution-focused exercises related to HW topics or other problems that participants raised.

Global competence ratings, on a scale of 1 to 4, for overall level of therapist skill in delivering the interventions was 3.9 ($SD = 0.4$) for CBASP and 3.8 ($SD = 0.4$) for HW, with no significant differences between groups. Additional information on therapist training and treatment fidelity can be found in Cinciripini et al., 2010 and the online supplemental materials (Cinciripini et al., 2010).

Measures

Mood disorders were assessed at screening using the Mood Module of the Patient Edition of the Structured Clinical Interview for Axis I *DSM-IV* Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1994), supplemented with the Clinical Course Timeline method (McCullough, 2001), which provides lifetime information on the course and duration of mood disorder episodes. Level of depressive symptom severity was assessed using the Center for Epidemiologic Studies Depression Scale (CES-D), a 20-item self-report measure developed to assess depressive symptoms in community populations (Radloff, 1977). The CES-D was administered at all contacts and serves as a measure of change in depressive symptoms in the current study.

Smoking abstinence data was collected using a timeline follow-back (TLFB) interview (Brown et al., 1998) conducted at every in-clinic and telephone contact. Abstinence outcomes conformed to guidelines established by the Society for Research on Nicotine and

Tobacco (SRNT; Hughes et al., 2003). Seven-day point prevalence abstinence was defined as a self-report of no smoking, not even a puff, in the 7 days prior to the selected time point of interest. Prolonged abstinence served as the primary smoking outcome measure for the current study. Beginning at end of treatment (EOT), relapse was defined by either 7 consecutive days of smoking, or smoking at least 1 cigarette over two consecutive weeks within the period of interest (e.g., EOT to 3- and 6- months postpartum).

Childhood trauma was assessed with the Childhood Trauma Questionnaire (CTQ)-Short Form (Bernstein et al., 2003). The CTQ is a widely used 28-item self-report questionnaire that retrospectively assesses abuse and neglect that occurred in childhood. The CTQ includes five scales that assess traumatic childhood experiences, including emotional, physical, and sexual abuse and emotional and physical neglect. Item responses are made on a five-point Likert scale that measures frequency of traumatic events “when growing up” by assessing for level of agreement with statements about the occurrence of traumatic events, from “Never” to “Very often true.” The CTQ has demonstrated acceptable to good reliability and validity (Bernstein et al., 2003; Scher, Stein, Asmundson, McCreary, & Forde, 2001) and good convergent validity with clinician-rated interviews and therapist ratings (Bernstein & Fink, 1998). The relationship of treatment group to the five types of trauma was evaluated using a categorical measure. CTQ cut scores were used to classify trauma severity based on sensitivity and specificity data derived from two validation samples (Bernstein & Fink, 1998). These scores delineate none to minimal, low to moderate, moderate to severe, and severe to extreme levels of maltreatment. Scores were collapsed into two categories for each type of trauma: 1) none to low levels of trauma, and 2) moderate to severe levels of trauma. The moderate cut point was chosen to minimize the misidentification of nonmaltreatment cases, as this cut point has been shown to have a specificity of at least 95% while still achieving high sensitivities ranging from 49% to 72% (Bernstein & Fink, 1998). Similar to approaches taken in previous studies (Anda et al., 1999; Jun et al., 2008), a variable assessing cumulative trauma was created by summing the total number of the five trauma categories that participants experienced at the moderate or greater level of severity.

Nicotine dependence was measured with the Fagerström Test for Nicotine Dependence (FTND) at baseline, a 6-item questionnaire that assesses various components of smoking behavior such as daily intake, difficulty in refraining from smoking, and time to first cigarette (Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

Statistical Analyses

The primary unit of analysis for cessation was prolonged abstinence as measured by the TLFB and for depression, level of depressive symptomatology measured by the CES-D. A mixed models regression approach (Littell, Milliken, Stroup, Wolfinger, & Schabenberfer, 2006) was the primary analytic strategy to evaluate the effect of trauma on abstinence and depression treatment effects for both sets of analyses. Subject was included as a random effect. Likelihood ratio tests were conducted to evaluate model fit after the inclusion of additional variables and only models with significant increases were retained. Subsequent iterations of the model involved including other potential variables of interest such as nicotine dependence and baseline depressive symptomatology and testing for interactions.

Results

Participant Characteristics

Participant characteristics are presented in Table 1. On average, the women were 25 years old and smoked 10 cigarettes per day at baseline. The average CES-D score was 21. The

majority of the participants were not living with a partner and nearly half of the women were unemployed. Sixty-two percent of women received health care through Medicaid or county health care facilities. Seventy-six percent of the participants reported at least one type of moderate to severe trauma measured by the CTQ (see Table 2). There were no significant differences in any of the demographics between treatment groups or across levels of trauma.

In the full sample, ($N = 257$; see (Cinciripini et al., 2010) 76% of women had a lifetime history of MDD, 67% of whom had recurrent MDD. Twenty-three percent of women entered the trial with current MDD and 14% were in partial remission.

Abstinence

We used SAS PROC GLIMMIX (Version 9.1.3, SAS Institute Inc, Cary, NC), an adaptation of SAS PROC MIXED suitable for a mixed model evaluation of a dichotomous outcome variable. For prolonged abstinence outcome, the effect of trauma on treatment effect was evaluated separately for the 3 and 6 months post EOT endpoints, which occurred on average at 9.5 ($SD = 4.6$) and 17.5 ($SD = 7.3$) weeks postpartum respectively, using models that included treatment group (CBASP versus HW), nicotine dependence measured by the FTND, and baseline CES-D as between-subject fixed effects, and subject as a random effect. Results indicated that the amount of trauma significantly predicted abstinence status, $F(1,241) = 5.76$, $p = 0.0172$, such that higher amounts of trauma resulted in a smaller chance of being abstinent at 6 months past EOT, $OR = 0.75$, 95% CI [0.59, 0.95], (see Figure 1). Nicotine dependence, baseline depressive symptomatology, and treatment group did not significantly predict abstinence and there were no significant interactions between any of the predictors. This result was non-significant at the 3 months post-treatment time point.

Depression

The effect of cumulative trauma on depression treatment effect, as measured by the CES-D, was evaluated in a SAS PROC MIXED model that included treatment group (CBASP versus HW) and time (Visits 1-10; 2, 4 and 6 week post-treatment and 2 week postpartum phone calls; and 3 and 6 months postpartum visits) as between-subject fixed effects, baseline depression score as a covariate, 7-day point prevalence abstinence as a time varying covariate, and subject as a random effect. Significant effects were noted for baseline depression, $F(1,243) = 97.41$, $p < .0001$, time, $F(1,2544) = 14.74$, $p = .0001$, abstinence $F(1,2544) = 45.08$, $p < .0001$, trauma $F(1,243) = 17.70$, $p < .0001$, and the group by time by trauma interaction, $F(1,2544) = 8.41$, $p = .0038$. Closer inspection of this three-way interaction indicated that as number of trauma categories increased, individuals benefited significantly more from CBASP than HW in reducing depressive symptomatology over time (see Figure 2). Individuals with severe to moderate trauma in three or more categories experienced no significant decrease in depressive symptomatology if they were in the HW treatment group (slopes not significantly different from zero), while those in the CBASP treatment group experienced significant decreases in depressive symptomatology at all levels of trauma ($p < .0001$).

Discussion

The goal of this study was to examine the moderating influence of childhood trauma on depression and smoking abstinence treatment outcomes in pregnant smokers participating in a clinical trial evaluating a depression-focused smoking cessation treatment. We hypothesized that participants with histories of moderate to severe childhood trauma would have better depression and abstinence responses to a combined smoking cessation and interpersonally-focused depression treatment, than a combined smoking cessation and health and wellness control condition. We also hypothesized that the treatment differential would

be positively related to level of cumulative traumas in a dose-response fashion. Our hypothesis was supported for the depression outcome. In women with a history of moderate to severe childhood trauma, there was a dose-response association of treatment to depression outcome, in which the positive effect of CBASP on depression across the treatment period, through 6 months postpartum, increased in a step-wise fashion with the experience of increasing number of trauma categories. In contrast, women with moderate to severe childhood trauma who received the HW control condition experienced no reduction in depressive symptoms if they had experienced 3 or more types of childhood trauma. Our hypothesis for smoking abstinence was not supported. Childhood trauma did not moderate the treatment effect on abstinence. However, there was an inverse dose-response effect of childhood trauma on abstinence at 6 months post treatment, indicating that the more trauma categories women had experienced, the less likely they were to be abstinent.

Our findings have important implications for the treatment of smoking and depression in pregnant women. Rates of childhood trauma and adverse experiences have been found to range from 24% in a population-based study of pregnant women, to 70% in a community-based sample of low-income pregnant women and, similar to what has been found in the general population, number of childhood adverse events are related to depression and smoking in pregnant women in a dose-response manner (Chung, Mathew, Elo, Coyne, & Culhane, 2008; Chung et al., 2010). Because prenatal depression is associated with a number of adverse birth outcomes, independent of smoking (Grote et al., 2010), and is a risk factor for postpartum depression (Robertson, Grace, Wallington, & Stewart, 2004) and related negative health outcomes for children (O'Brien, Heycock, Hanna, Jones, & Cox, 2004; Schwebel & Brezaussek, 2008), effective treatment of depression during pregnancy is an important public health issue. Our findings suggest that for depressed, pregnant women with a history of childhood trauma, interpersonally-focused depression interventions will be more effective than supportive and/or brief interventions in reducing depression during the prenatal period, and that treatment with such interventions becomes increasingly more important with cumulative experiences of trauma.

Our findings also suggest that a history of childhood trauma is a risk factor for cessation failure in a group of smokers who are, overall, recalcitrant to treatment (Lumley et al., 2009), and that risk increases with accumulation of trauma experiences. In a previous study, we evaluated the relationship of childhood trauma to nicotine dependence in the same sample of pregnant smokers and found a dose-response relationship between nicotine dependence and number of types of trauma experienced in childhood (Blalock et al., 2011). Our current findings show that history of childhood trauma is a risk factor for smoking cessation treatment failure in pregnant women beyond the effect of nicotine dependence, thus increasing evidence that a history of childhood trauma may be a marker for cessation failure and relapse susceptibility in pregnant smokers.

Our findings replicate that of Nemeroff and colleagues (Nemeroff et al., 2003) in which individuals with histories of childhood trauma benefitted from CBASP, with or without antidepressant medication, to a greater extent than medication alone. The current study extends those findings by showing a differential treatment effect in favor of CBASP in those with trauma histories when compared to a supportive counseling condition that controlled for amount of therapist contact. There is evidence that several of the deficits hypothesized to arise from abusive child-caregiver attachment interactions (Briere, 2002; Pearlman & Courtois, 2005), mediate relationships between childhood trauma and affective states in adulthood including insecure attachment style (Bifulco et al., 2006), avoidant coping, emotional inhibition (Krause, Mendelson, & Lynch, 2003; Merrill, Thomsen, Sinclair, Gold, & Milner, 2001) and negative beliefs about self (Sachs-Ericsson, Verona, Joiner, & Preacher, 2006). CBASP's treatment components were developed to address several of these

deficits (McCullough, 2000; McCullough, Jr., 2006). Therapeutic relationship-based components are focused on the development of a secure alliance, examination of implicit assumptions regarding relational expectations, and activation and processing of interpersonal schema and negative emotional states associated with relational memories. The social problem solving component is focused on examining deficits in interpersonal skills and reducing avoidant behaviors in participants' interpersonal interactions with others. Thus, CBASP may be differentially effective for the treatment of depression in those with trauma histories because it more effectively addresses childhood trauma-related deficits than supportive or antidepressant medication therapies. Future studies should focus on identifying treatment mechanisms that are related to differential depression treatment effects in those with childhood trauma histories.

An important contribution of the current study is that the differential depression treatment response increased in a dose-response manner with increasing exposure to multiple types of trauma. While numerous studies have shown a dose-response relationship between severity of abuse, depression and other mental health outcomes (Anda et al., 2006; Chapman et al., 2004), we are unaware of previous studies that have shown childhood trauma to moderate a treatment effect in a dose-response manner. It has been suggested that multiple traumas increase vulnerability and symptom complexity by affecting a greater number of behaviors and brain systems than singular traumas (Anda et al., 2006; Briere, Kaltman, & Green, 2008). In the current study, women with the most complex trauma histories and greatest number of deficits may have had the most to gain from CBASP's treatment components in terms of reduction in depressive symptoms.

Our hypothesis that individuals with a history of childhood trauma would benefit to a greater extent from CBASP than the HW control condition was not supported for smoking abstinence. However, we found a main effect for a negative dose-response impact of cumulative childhood trauma on smoking cessation outcomes at 6 months post-treatment. We are aware of two studies that have reported a similar dose-response relationship between severity of childhood trauma and drug and alcohol relapse and escalation to cocaine following treatment. In both studies this graded effect was found in women, but not men (Heffner, Blom, & Anthenelli, 2011; Hyman et al., 2008). A third study in adolescents found no relationship between childhood trauma severity and frequency of substance use following treatment (Titus, Dennis, White, Scott, & Funk, 2003). Differences in trauma measurement, sample size, and substance using populations may explain these discrepant results.

Our findings suggest that while an interpersonally-focused treatment was differentially beneficial to individuals with childhood trauma histories in treating their depressive symptoms, it was not for treating smoking. Although we hypothesized that improvement in interpersonal functioning as a result of the CBASP treatment would have differentially positive effects on smoking cessation for participants with childhood trauma histories, there may be other more important mechanisms underlying the childhood trauma-smoking relationship that were not addressed by CBASP. Behavioral treatments that target emotional dysregulation, including dialectical behavior therapy (Linehan, 1993) and acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 1999) may be more effective in addressing problems with regulation of intense, negative emotions and use of avoidant coping strategies that may underlie increased vulnerability to dependence and relapse in smokers with childhood trauma histories. Examination of the relationship of emotion regulation processes to craving and tobacco use in smokers with childhood trauma histories may provide additional information about the relationship of such processes to smoking in this population. This information could be used to develop treatments tailored to address these factors.

Limitations

There are some limitations to note. The study is a secondary subgroup analysis, thus findings should be considered exploratory. However, findings do provide replication of a previous secondary analysis finding CBASP to be superior to antidepressant monotherapy in chronically depressed individuals with a history of childhood trauma versus those without trauma. (Nemeroff et al., 2003) The study focused on a very low SES group of treatment-seeking pregnant smokers, who had knowledge they would be compensated \$40 for attending study visits. These factors associated with the clinical trial from which the sample was drawn may limit the generalizability of our findings to the general population of pregnant smokers. Low income women are at increased risk for childhood trauma and may be the most likely to benefit from intensive-depression focused interventions such as CBASP. However, they are the least likely to have access to such psychotherapies. Future research could evaluate the feasibility and effectiveness of real-time remote delivery of such treatments via telecommunication technologies such as smartphones and tablets.

The index of cumulative trauma did not include traumatic events that occurred in adulthood. Given evidence that childhood trauma increases risk for traumatic experiences in adulthood (Amstadter et al., 2011; Elwood et al., 2011), and that adversity during childhood and adulthood are both independent and cumulative predictors of substance use and other psychiatric disorders (Lloyd & Turner, 2008; Turner & Lloyd, 2004), our findings may reflect the cumulative impact of lifetime stress rather than independent effects of childhood trauma. Inclusion of cumulative life stress measures in future studies would allow for evaluation of the additive effects of stress over time.

Because the definition of prolonged abstinence allows for limited smoking, it was not possible to provide direct biochemical verification for prolonged abstinence at 6 months post-treatment. However, we were able to biochemically verify 7-day point prevalence abstinence assessed at study visits which indicated that < 5% of the sample ($n = 19$) reported 7-day point prevalence abstinence that was discrepant from biochemical verification (see (Cinciripini et al., 2010)).

Despite these limitations, results of this study may have important implications for the treatment of smoking and depression in pregnant women, given evidence that rates of childhood trauma may be especially high in this population (Chung et al., 2008; Chung et al., 2010), and suggest that childhood trauma should be assessed in low income pregnant smokers when considering treatments for depression or smoking. Results also add to an emerging literature showing that a history of childhood trauma affects response to depression treatments (Harkness et al., 2012; Nemeroff et al., 2003; Zobel et al., 2011) and that such a history increases risk for poor treatment outcomes for addictive disorders (Hyman et al., 2008). An increased understanding of factors underlying these differential treatment responses may help inform development of tailored treatments for this vulnerable population that is at high risk for negative outcomes associated with depression and smoking (Brown et al., 2010; Felitti et al., 1998).

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Figure 1. Estimated mean abstinence rates at 6 months post-treatment by total number of moderate to severe trauma categories.

Figure 2.

Differential predicted depression response to CBASP versus HW across time by number of childhood trauma categories experienced at the moderate to severe level. CES-D = Center for Epidemiologic Studies Depression Scale; CBASP = cognitive behavioral analysis system of psychotherapy; HW = health and wellness.

Table 1

Demographic and smoking characteristics

Variable	<i>N</i> = 248
Age (years), mean (<i>SD</i>)	24.84 (5.91)
Weeks Pregnant, mean (<i>SD</i>)	19.60 (8.46)
Race/Ethnicity, <i>n</i> (%)	
African-American, Non-Hispanic	134 (54)
White, Non-Hispanic	82 (33)
Hispanic	24 (10)
Other	8 (3)
Education Level, <i>n</i> (%)	
Less than high school	81 (33)
High school/GED	87 (35)
Some college or greater	80 (32)
Marital Status, <i>n</i> (%)	
Married & living with partner	47 (19)
Not married & living with partner	54 (22)
Never married, not living w/ partner	123 (49)
Widowed, divorced, or separated	24 (10)
Employment Status, <i>n</i> (%)	
Employed/Student	76 (31)
Homemaker	55 (22)
Unemployed	117 (47)
Receiving Medicaid or County Health Care, <i>n</i> (%)	152 (62)
Annual Family Income, <i>n</i> (%)	
Less than \$10,000	92 (37)
\$10,000 - \$19,999	32 (13)
\$20,000 - \$29,999	12 (5)
More than \$30,000	55 (22)
Prefer not to say	57 (23)
Age started smoking (years), mean (<i>SD</i>)	15.59 (3.46)
Smoking rate before finding out pregnant (cigs/day), mean (<i>SD</i>)	16.24 (8.91)
Current smoking rate (cigs/day), mean (<i>SD</i>)	9.78 (6.90)
FTND score, mean (<i>SD</i>)	3.34 (2.05)
CES-D score, mean (<i>SD</i>)	20.79 (11.03)

Note. *SD* = standard deviation; FTND = Fagerström Test for Nicotine Dependence; CES-D = Center for Epidemiologic Studies Depression Scale.

Table 2

Frequency and Percentage of Moderate to Severe Trauma and Number of Trauma Categories in the Sample.

Abuse/Neglect Variable	<i>n</i> (%)
No Trauma	59 (24)
Emotional Abuse	74 (30)
Physical Abuse	52 (21)
Sexual Abuse	78 (31)
Emotional Neglect	80 (32)
Physical Neglect	64 (26)
1 Trauma Category	43 (17)
2 Trauma Categories	41 (16)
3 Trauma Categories	44 (18)
4 Trauma Categories	33 (13)
5 Trauma Categories	28 (11)