ORIGINAL ARTICLE

An open trial of mindfulness-based cognitive therapy for the prevention of perinatal depressive relapse/recurrence

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Abstract Pregnant women with histories of depression are at high risk of depressive relapse/recurrence during the perinatal period, and options for relapse/recurrence prevention are limited. Mindfulness-based cognitive therapy (MBCT) has strong evidence among general populations but has not been studied among at-risk pregnant women to prevent depression. We examined the feasibility, acceptability, and clinical outcomes of depression symptom severity and relapse/recurrence associated with MBCT adapted for perinatal women (MBCT-PD). Pregnant women with depression histories were recruited from obstetrics clinics in a large health maintenance organization at two sites and enrolled in MBCT-PD ($N=49$). Self-reported depressive symptoms and interview-based assessments of depression relapse/recurrence status were measured at baseline, during MBCT-PD, and through 6-months postpartum. Pregnant women reported interest, engagement, and satisfaction with the program. Retention rates were high, as were rates of completion of daily homework practices. Intent to treat analyses indicated a significant improvement in depression symptom levels and an 18 % rate of relapse/recurrence through 6 months postpartum. MBCT-PD shows promise as an acceptable, feasible, and clinically beneficial brief psychosocial prevention option for pregnant women with histories of depression. Randomized controlled trials are needed to examine the efficacy of MBCT-PD for the prevention of depressive relapse/recurrence during pregnancy and postpartum.

Keywords Pregnancy · Depression · Prevention · Mindfulness · Cognitive behavioral therapy

Women who enter pregnancy with histories of major depression are at increased risk of depressive relapse/recurrence during pregnancy and postpartum (O'Hara and Swain 1996). Wide-ranging negative correlates and consequences of depression during these time periods for women and their offspring underscore the potential advantages of preventing relapse/recurrence among this vulnerable group (Goodman et al. 2011a). Although data support the efficacy of maintenance antidepressant medication for pregnant women with depression histories who are successfully treated prior to pregnancy, most studies indicate high rates of both discontinuation and subsequent relapse/recurrence (Cohen et al. 2006; Roca et al. 2013). In fact, naturalistic longitudinal studies of pregnant women with histories of depression suggest that up to 30 % will experience relapse during the perinatal period (Goodman and Tully 2009). Moreover, the use of antidepressant medication requires individualized ongoing assessment of risks and benefits and can present patients and providers with complex clinical decision-making demands (Patel and Wisner 2011; Wisner et al. 2000; Yonkers et al. 2010). Such factors highlight the potential value of making available an array of options for depressive relapse/recurrence prevention, including non-pharmacological approaches.

Recent studies provide support for the benefits of non-pharmacological relapse/recurrence prevention approaches among at-risk pregnant women. Cognitive behavioral therapy

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has demonstrated clinical benefits compared to usual care among pregnant low-income, Latina women (Le et al. 2011; Munoz et al. 2007) and low-income, predominantly African American women (Tandon et al. 2011), although it failed to outperform an educational control condition in another trial (Austin et al. 2008). Interpersonal therapy has demonstrated relapse/recurrence prevention effects among financially disadvantaged pregnant women (Zlotnick et al. 2001, 2006). Multi-component, lifestyle modification interventions also have evidence of benefit for Latina pregnant women (Kieffer et al. 2013).

One of the most widely studied depressive relapse/ recurrence prevention approaches in the general population, mindfulness-based cognitive therapy (MBCT; Bondolfi et al. 2010; Godfrin and van Heeringen 2010; Kuyken et al. 2008; Ma and Teasdale 2004; Segal et al. 2002b; Teasdale et al. 2000), has not been studied among perinatal women with histories of depression, for whom a depression episode during pregnancy or postpartum would be a relapse/recurrence. MBCT has a strong evidence base in the prevention of depressive relapse/recurrence (Kuyken et al. 2010; Ma and Teasdale 2004; Segal et al. 2010; Teasdale et al. 2000). Recent promising data were reported in an application of MBCT for the treatment of elevated anxiety symptoms during pregnancy (Goodman et al. 2014) and pregnant women with self-reported histories of "mood concerns" (Vieten and Astin 2008); however, neither of these studies targeted depression relapse/recurrence specifically. MBCT for depression relapse/ recurrence prevention targets vulnerability processes associated with the most robust risk factor for perinatal depression— prior history of depression (Beck 2001; O'Hara and Swain 1996). In addition, MBCT has shown promise in treating residual depressive symptoms among patients with histories of depression (Geschwind et al. 2012; Kuyken et al. 2008; Segal et al. 2010; Van Aalderen et al. 2012), which is important given data suggesting that even subclinical depressive symptoms during pregnancy can have adverse consequences for women and fetal development (Goodman et al. 2011b).

MBCT includes a combination of mindfulness meditation and cognitive behavioral strategies and is based on both theory and empirical evidence that individuals with histories of depression are vulnerable during dysphoric states, during which maladaptive patterns evident during previous episodes are reactivated and can trigger the onset of a new episode (Scher et al. 2005; Segal et al. 2006; Teasdale et al. 2002). Formal and informal mindfulness practice and cognitive behavioral skills are taught to help participants shift away from automatic modes of relating to thoughts, emotions, and sensations associated with depression to mindful modes and skillful action. As a brief, non-pharmacological preventive approach, MBCT may have high applicability for at-risk pregnant women, defined by prior history of depression.

Using an iterative process, we modified MBCT (Segal et al. 2002b) to include a focus on perinatal depression (MBCT-PD). The modifications took into account developmental processes associated with the perinatal period, characteristics and correlates of perinatal depression, and the physical aspects of pregnancy. We evaluated the MBCT-PD program within routine obstetric clinical settings in a two-site open trial of 49 pregnant women with histories of depression. We addressed three primary aims, including to examine (1) the feasibility of MBCT-PD with respect to identification and enrollment of women at risk of perinatal depression based on a history of depression; (2) the engagement of women with the MBCT-PD approach with respect to retention, completion of daily practice assignments, and satisfaction; and (3) clinical outcomes including change in depression symptom levels and rates of relapse/recurrence over the course of the intervention and through a 6-month postpartum follow-up.

Method

Participants

The study protocol was approved by the institutional review boards and through institutional agreement at the University of Colorado Boulder, Emory University, Kaiser Permanente Colorado (KPCO), and Kaiser Permanente Georgia (KPGA), and all participants provided written informed consent. Participants were referred between 2008 and 2010 by obstetric care providers, self-referred, or contacted by study staff following an informational letter sent to pregnant women with a history of depression in their medical record. Project staff described the study to potential participants as involving participation in a perinatal depression relapse/recurrence prevention and repeated assessment. If interested, the potential participant completed a phone screen to assess initial eligibility criteria, including age, past and current depression, and gestational age, and was invited to ask questions about the study. Potential participants who were interested and eligible were asked to complete an in-person baseline interview to determine eligibility.

Primary inclusion criteria included pregnant women (a) up to 32 weeks gestation, (b) meeting criteria for prior major depressive disorder (MDD), (c) available for group intervention scheduled meetings, and (d) aged 18 years or older. Exclusion criteria included a diagnosis of MDD in the last 2 months, given the focus on prevention rather than acute intervention. Participants also were excluded for other DSM-IV-TR axis I or II psychiatric disorders (APA 2000) that necessitated priority treatment not provided by the study, including schizophrenia or schizoaffective disorder, bipolar disorder, or current psychosis; organic mental disorder or pervasive developmental delay; current eating disorder;

current substance abuse or dependence; antisocial, borderline, or schizotypal personality disorder; or imminent suicide or homicide risk. Finally, given the inclusion of a physical movement component in the MBCT-PD program, participants were excluded for high-risk pregnancy status as determined by obstetrician report (e.g., pre-term labor, placental abnormality, multiple gestation, required bed rest, or morbid obesity). Participants were neither excluded nor constrained during the study from receiving psychotropic medications or psychotherapy. Table 1 displays participant baseline demographic and clinical characteristics.

Over the course of the study, a total of ten cohorts were recruited (five at each site), with group sizes ranging from three to six women. Participants were compensated a maximum of $115 for completing study assessments, and were further compensated for travel and childcare costs if either presented a barrier to participation; each participant also was sent a nominal gift after the birth of her baby.

Measures

All assessments were conducted at KPCO or KPGA facilities, in participants' homes, or by phone, with written or online format (using a password-protected secure survey website).

Baseline diagnostic status The Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Patient Version (SCID-I/P; First et al. 2002) was used at the intake interview to assess psychiatric diagnoses. In addition, the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First et al. 1997) was used to assess the presence of

Table 1 Participant baseline characteristics

Participant characteristic	
Age, M (SD)	31.83 (4.19)
Week of intake gestational age, M (SD)	17.25 (6.90)
Ethnicity/race	
Asian	4 %
African American	6 %
Hispanic	4 %
White	82 %
Other	4 %
Currently married or cohabiting	93 %
Primiparous	57 %
Past number of episodes	
One	47 %
Two	29 %
Three or more	24 %
Any current or lifetime anxiety disorder	31 %
Any lifetime alcohol/substance abuse or dependence	33 %

exclusionary personality disorders. Trained bachelor's and master's level clinical evaluators administered both the SCID-I/P and SCID-II. A set of audio-recorded interviews randomly selected for measurement of inter-rater reliability of current and past major depressive episode ($n=8$) indicated a perfect level of inter-rater agreement.

Participant engagement and satisfaction Engagement was operationalized as class attendance and use of assigned daily practices. Completion was defined as attendance at a minimum of four classes, consistent with MBCT studies (e.g., Teasdale et al. 2000). Participants were asked to practice at least 6 days per week (42 total days) and to complete daily written reports, recording the number of times of practice and type of practice, which was classified as either formal (body scan, yoga, mindfulness of breathing meditation, loving kindness meditation) or informal (3-min breathing space, mindfulness in everyday life, including with baby, noticing automatic pilot).

The eight-item self-report Client Satisfaction Questionnaire (Attkisson and Zwick 1982) (CSQ-8) was administered at post-intervention to measure satisfaction with MBCT-PD. The CSQ-8 is designed to yield a homogeneous estimate of general satisfaction with services, with scores ranging from 8 to 32 (higher scores indicating greater satisfaction).

An Exit Interview also was administered at the study endpoint (approximately 6 months postpartum) by study evaluators to provide a qualitative assessment of participant satisfaction with MBCT-PD. Exit Interviews were digitally audio-recorded and transcribed for coding. Three questions specifically inquired about the helpfulness of MBCT-PD: "Has the mindfulness course been helpful to you?" "Has the mindfulness course changed how you cope with intense emotions, like sadness, anger, fear, or shame?" and "Has the mindfulness course changed how you cope with times when you feel you may start to become depressed again?" Nineteen additional open-ended questions were used to elicit participant descriptions of their experiences in MBCT-PD, which were thematically coded by two research assistants, based on four qualitative themes selected from Allen et al. (2009) that best represented the targets of the intervention: *depression objectified* (i.e., relating to depressive thoughts and feelings as characteristics of depression, not of oneself), *discerning depressive relapse/recurrence* (i.e., recognizing early warning signs and triggers), *taking action* (i.e., actions taken in response to early warning signs), and *impact of activities* (i.e., how tools learned in the course improve mood and alter one's perspective). A randomly selected subset of 20 % of interviews was independently coded for inter-rater reliability; percent agreement between coders was high (88 % for whether or not a theme was ever mentioned).

Depression symptom severity and relapse/recurrence The Edinburgh Postpartum Depression Scale (EPDS) (Cox et al.

1987) was used as our primary measure of depression symptom severity and was administered at intake, at each MBCT-PD session, post-intervention, monthly during the remainder of pregnancy, and through 6 months postpartum. The EPDS is the most commonly used self-report measure of perinatal depressive symptom severity; total scores across the ten items range from 0 to 30 (higher scores indicating greater severity). The EPDS has strong psychometric properties among both pregnant and postpartum samples (Cox et al. 1987; Murray and Carothers 1990).

The Longitudinal Interval Follow-up Evaluation (LIFE; Keller et al. 1987), a semi-structured interview, was used to ascertain diagnostic status post-intervention and at 1 and 6 months postpartum, using DSM-IV-TR diagnostic criteria (APA 2000). The LIFE provides psychiatric status ratings (PSRs) obtained retrospectively for each study week, ranging from 1 (absence of symptoms) to 6 (definite and severe presence of symptoms), with relapse/recurrence defined as at least 2 weeks of ratings of 5 or greater. We use the term "relapse/recurrence" to denote episodes of depression that may constitute a relapse (i.e., symptom elevation prior to having attained a full remission) or a recurrence (i.e., a new episode after full remission). Another evaluator or study investigator reviewed interviews indicating relapse/recurrence; in cases of disagreement, consensus was achieved through discussion and these consensus ratings were used for analysis. Raters were bachelor's and master's level research assistants who were trained, monitored, and certified to conduct study evaluations, following which they were supervised weekly to prevent drift in ratings. A randomly selected subset of interviews (n=14) showed high inter-rater reliability, with kappa= 0.76 for the weekly PSR depression ratings.

Utilization of other concurrent interventions Data on utilization of concurrent treatments for the study period, specifically psychotropic medications and psychotherapy, were obtained using data extraction of mental health related pharmacy, diagnosis, and procedure codes from a virtual data warehouse that is populated with electronic medical records data.

Treatment

All enrolled women were assigned to receive MBCT-PD. The eight-session groups were delivered consistent with the standard MBCT treatment manual (Segal et al. 2002b), with modifications for the perinatal period. The standard MBCT program includes psychoeducation and training in cognitive-behavioral and mindfulness meditation practices designed to prevent depressive relapse/recurrence and promote wellness. Specifically, participants learn formal mindfulness practices (i.e., sitting and walking meditation, body scan, and yoga stretching), informal mindfulness practices (i.e., mindfulness of daily activities and the 3-min breathing space), and

cognitive behavioral skills (i.e., monitoring pleasant and unpleasant events, identifying thoughts and beliefs and their relationship to emotion, identifying relapse signs, and developing action plans). Modifications for perinatal depression focused primarily on increased attention to brief informal mindfulness practices (e.g., washing dishes and driving), mindfulness and yoga practices customized for the perinatal period (e.g., "being with baby" informal practice, and prenatal yoga poses), psychoeducation about perinatal depression and transition to parenthood, and self-compassion, self-care, and social support. Audio-recorded files were provided each week to guide mindfulness meditation practices at home (recorded for the study by expert meditation teacher Sharon Salzberg) and a DVD was provided to guide yoga practice (recorded for the study by expert perinatal yoga teacher De West).

Ten series of classes were delivered from 2009 to 2010 in KP clinics, with each series including eight 2-h class sessions. Following the eight class sessions, participants were given the option of attending a monthly follow-up class. The groups were delivered by two of the study investigators (both licensed clinical psychologists with PhDs and trained by one of the MBCT founders) and a KP behavioral health provider as a co-therapist. The majority of providers had completed a 5-day residential intensive training program in MBCT. The study therapists met weekly during the intervention to discuss the clinical delivery of MBCT-PD.

The 13-item MBCT Adherence Scale (Segal et al. 2002a), adapted for MBCT-PD (MBCT-PD-AS), was used to rate the degree to which therapists delivered the intervention with fidelity. MBCT-PD-AS items are scored on a three-point scale, indicating evidence of the behavior by the therapist from 0 (no evidence), 1 (slight evidence), to 2 (definite evidence). Consistent with the original MBCT-AS, the threshold for adequate adherence was defined as a mean score of greater than 1 (Segal et al. 2002a). In line with Webb et al. (2012), we sampled the same sessions across all cohorts, and recordings of one session in the early phase of therapy (session 2) and one later session (session 6) were selected to represent thematically distinct samples of the intervention. Trained raters (one doctoral student and one master's level research assistant), both blind to intervention outcome, completed all adherence ratings. Inter-rater reliability was determined by calculating intraclass correlation coefficients (ICCs) for a random 25 % of the sessions, treating the raters as random effects (Shrout and Fleiss 1979), with results indicating high inter-rater reliability, ICC(2, 2)=0.82. The mean adherence score was 1.48 (SD= 0.19), which indicated above-adequate instructor adherence to the protocol.

Data analysis

All analyses were conducted with the intent-to-treat sample; 100 % of participants completed at least one of the

study follow-up assessment measures during MBCT-PD, as did 80 % during the remaining months of pregnancy and postpartum. To examine feasibility and engagement, we examined descriptively enrollment and patient flow, completion of classes and daily practice assignments, and satisfaction based on both questionnaire and coded interview responses. To examine change in depression symptom levels over the eight-session intervention, we implemented a hierarchical linear model (HLM; Raudenbush and Bryk 2002). HLM consists of two levels: within-person level and the between-person level. For the within-person level, we modeled an individual's change as a function of time, which we modeled as a linear equation of time. Hence, each person's trajectory of time was summarized based on an intercept value and a slope value. For the between-person level, the individual intercept and individual slope deviate from an overall-average intercept and an on-average overall slope. These deviations were quantified by random effect terms referred to as a random intercept and random slope. Additionally, we examined depressive symptom levels through the 6-month postpartum follow-up to determine if gains made during the intervention phase would sustain over time. We therefore fit a multiphase mixed effects model (MPMEM; Cudeck and Klebe 2002), which models change over time differentially as a function of phases (intervention, remainder of pregnancy, and postpartum periods). In this model, change is modeled as linear within each phase, but disconnected across the three phases. This implementation of the MPMEM simultaneously models three HLMs, with each modeling change within the respective phase. The MPMEM addresses the within-subject correlation attributable to the repeated assessments across an individual and allows for an elevation or deflation of severity as participants transition through the three phases of the study: MBCT-PD class, remainder of pregnancy following the MBCT-PD class, and postpartum. To examine the stability of depressive symptoms over time, we compared on-average change during the remaining months of pregnancy and through 6 months postpartum to the baseline. A significant effect would indicate that the benefit of the course through the pregnancy and postpartum period was maintained such that participants, on average, were significantly less depressed compared to how they were at baseline, despite the progression through the later period of pregnancy and subsequently birth and the first 6 postpartum months. To evaluate depressive relapse/recurrence, we examined descriptively rates of depressive relapse/recurrence through the 6-month postpartum follow-up.

Results

Participant enrollment and flow

Participant enrollment and flow rates (illustrated in Fig. 1) indicate that it was feasible to identify, enroll, and retain women at high risk of perinatal depression based on a history of depression. The most frequent reason for ineligibility, based on the phone screen, was lack of history of major depression (37 %), followed by women who were interested but reported symptoms of current MDD (23 %). The remaining women were excluded for the following reasons: other diagnosis (5 %), did not speak English (3 %), too far advanced in pregnancy (14 %), premature delivery (3 %), no longer had Kaiser insurance (3 %), or other (14 %). Among women who completed the phone screen, 53 women (16 %) declined for the following reasons: distance to the KP clinic where the group was held was too far to travel (6 %), time commitment

Fig. 1 MBCT-PD open trial participant flow chart
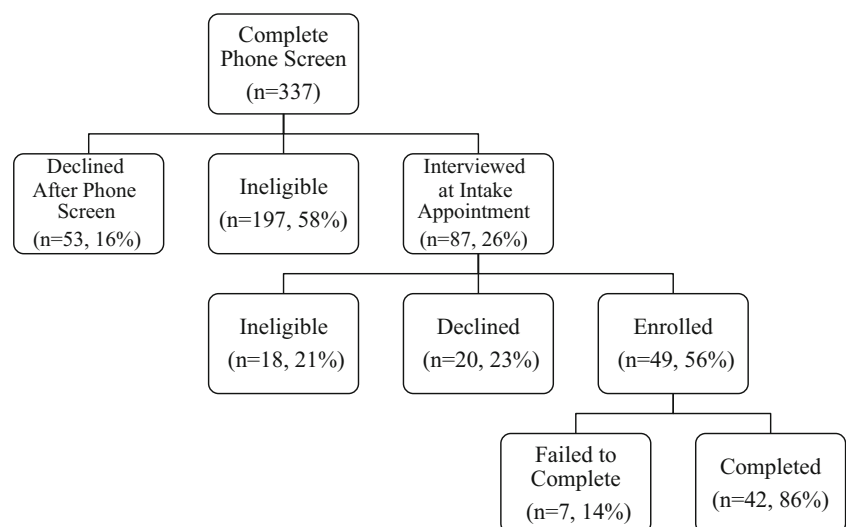
(45 %), unavailable for the scheduled group time (26 %), not interested (19 %), or did not show up for the intake appointment or were unresponsive (4 %).

Among women who were interested and eligible after the phone screen and completed an intake appointment, a small percentage was ineligible, with the most frequent reason for exclusion being lack of history of MDD (33 %), followed by endorsement of current MDD (17 %). The remaining women were excluded for the following reasons: exclusionary diagnosis (33 %), too far along in pregnancy (11 %), or other reasons (6 %). Reasons women declined participation at the intake (23 %) were as follows: time commitment (55 %), no longer interested (10 %), did not complete the full intake (15 %), or other (20 %).

Of the 49 women who enrolled, six participants (12 %) failed to complete the intervention (as defined by attending at least four sessions) due to miscarriage ($n=1$), medical reasons ($n=2$), lack of interest ($n=2$), or marital conflict ($n=1$), and an additional participant ($n=1$) was withdrawn after completing the fifth class due to miscarriage.

During the course of the study, utilization data were available for 46 participants (94 % of the sample) between enrollment and 6 months postpartum. Among these women, 30 % ($n=14$) were dispensed psychotropic medication and 20 % ($n=9$) had two or more psychotherapy visits.

Participant engagement and satisfaction

MBCT-PD was associated with high retention, completion of daily practice assignments, and satisfaction. We observed a completion rate of 88 %, with an average of 6.10 ($SD=1.99$) sessions completed. Women engaged in frequent at-home practices, reporting some practice on 33 ($SD=10.97$) out of the 42 assigned days. Women reported a higher total frequency of informal mindfulness practices ($M=78.68$, $SD=48.93$) than formal practices ($M=21.96$, $SD=15.56$). Specifically, formal practices included the body scan, yoga, and sitting meditation, and informal practices included the 3-min breathing space, mindfulness of routine activities (e.g., driving), noticing automatic pilot, and mindfulness practices related of the experience of being pregnant (e.g., bringing attention to the sensations of fetal movements).

Women reported a high degree of satisfaction on the CSQ-8, $M=29.26$, $SD=3.82$, and on responses to the Exit Interview items and thematic coding. Overall, women reported that the course had been helpful to them (78 %) and that it had changed how they coped with intense emotions (83 %) and with times when they may start to become depressed again (78 %). Additionally, thematic coding indicated that the majority of women reported benefits of MBCT-PD, including learning to relate differently to depressive phenomena (depression objectified; 67 %), learning to recognize their individual triggers and warning signs (discerning depressive

relapse/recurrence; 72 %), responding to early warning signs by intentionally engaging in positive activities (taking action; 89 %), and using the activities taught in the course (e.g., 3-min breathing space) to disengage from negative thoughts and improve mood (impact of activities; 94 %).

Depressive severity and relapse/recurrence

Analysis of depression symptom levels over the course of the intervention indicated a large and significant decrease in depressive symptom levels, $F(1,49)=8.55$, $p=0.0037$, $d=0.84$ (see Fig. 2). EPDS scores from intake, across the eight sessions of MBCT-PD, to post-intervention assessment at the end of MBCT-PD corresponded to an on-average reduction of 2.67 ($SE=0.91$). The decrease in depressive symptom levels observed during MBCT-PD was sustained throughout the perinatal period, with on-average reduction in EPDS scores, relative to baseline, of 2.02 ($SE=0.813$) during pregnancy and postpartum, $t(48)=2.48$, $p=0.013$, $d=0.71$. With respect to rates of relapse/recurrence, we observed an 18.37 % relapse/recurrence rate following the first MBCT-PD class across pregnancy and the 6-month postpartum follow-up period.

Discussion

Responding to the need for evidence-based psychotherapy interventions to prevent the relapse/recurrence of depression during the perinatal period, we modified MBCT to be specific to the perinatal period (MBCT-PD) and conducted an open trial. Results support the feasibility and clinical benefit of MBCT-PD for the prevention of depression relapse/recurrence during the perinatal period.
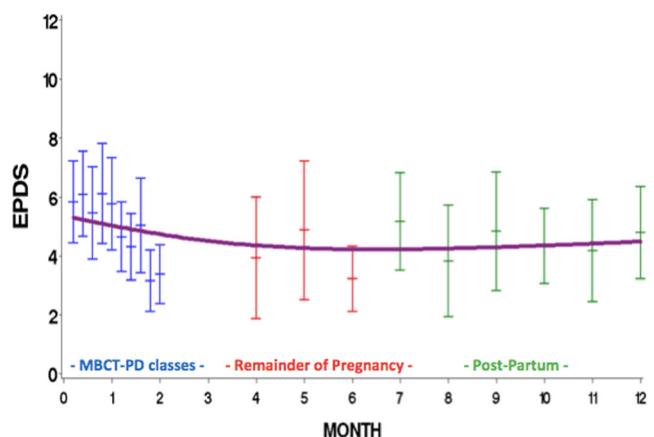

Fig. 2 EPDS means, standard errors, and estimated trajectory of depressive severity among MBCT-PD participants ($N=49$) with month based on the median observed days from intake for each of the respective assessment time points

Pregnant women with histories of depression reported high interest, engagement, and satisfaction with the MBCT-PD program. Retention rates were high, with 86 % of women completing the program. Completion of daily homework practices indicated that women used the skills in the context of daily life and, in fact, that they completed home practice at comparable or higher levels than non-pregnant individuals in other meditation-based intervention studies (Carmody and Baer 2008; Shapiro et al. 2008; Stanley et al. 2011). Moreover, women's subjective reports coded from the exit interviews also are consistent with an emphasis on the value of mindfulness practice. Specifically, MBCT is based on theory and empirical data that risk of relapse/recurrence is reduced when vulnerable individuals learn to become more aware of negative thoughts and feelings at times of potential relapse/recurrence and learn to respond to such states more skillfully by engaging a mindful mode of processing rather than an automatic, depressive ruminative mode . Consistent with such principles, over two thirds of women described their experience in MBCT-PD using themes suggesting an increased awareness of *triggers*, an ability to take skillful action during times of low mood, and an ability to step out of habitual modes of depressive, ruminative cognitive processing in order to improve mood. It will be important for future studies to test the degree to which such processes mediate any prophylactic benefit of MBCT-PD. In addition, it will be important for future studies to explore the relative emphasis on formal versus informal mindfulness practices. Women in this study reported more frequent use of informal practice. Although this pattern is consistent with reports from other studies of MBCT that indicate higher and more consistent use of informal practices over time (e.g., Bondolfi et al. 2010), it also may be the case that pregnant women require greater emphasis on brief and accessible forms of practice given the competing demands on energy and time during pregnancy and the postpartum.

Intent to treat analyses indicated significant improvement in depression symptom severity during the eight-session classes and maintenance of gains through 6-months postpartum. With respect to depression relapse/recurrence prevention, participation in MBCT-PD was associated with rates of relapse/recurrence of 18 %. This rate of relapse/recurrence is lower than the rates of approximately 30 % that have been reported in prospective naturalistic studies of similar samples of women, those who enter pregnancy with histories of depression (e.g., Goodman and Tully 2009). Although other studies of preventive interventions during pregnancy have not focused specifically on women with histories of depression, our findings of decreased depressive symptoms are in line with other published reports (Le et al. 2011; Tandon et al. 2011; Zlotnick et al. 2006). The focus on reduction in depression symptom levels is important given evidence that residual depressive symptoms are associated with functional impairment and

future depression risk, even when well below diagnostic thresholds among general populations (Judd 1997; Judd et al. 2000), and that they are associated with anxiety, perceived stress, functional impairment, and interpersonal problems among perinatal women specifically (Goodman and Tully 2009) and with negative outcomes among offspring (Goodman et al. 2011b). Thus, preventing depression relapse/recurrence and reducing even mild depressive symptoms among formerly depressed women may have important public health benefit.

Our findings suggest that mindfulness-based approaches may engage broad interest among pregnant women, consistent with our earlier work assessing preferences among pregnant women (Dimidjian and Goodman 2014; Goodman et al. 2013) and with recent work of another investigator group focused on the use of MBCT to treat anxiety during pregnancy (Goodman et al. 2014). In fact, although our study explicitly targeted women with a history of depression, there was substantial interest among women who did not have past depressive episodes, with over one third of women excluded at the initial contact for lack of prior MDD. Such patterns may reflect a growing interest in the value of mindfulness practice during pregnancy and the transition to parenthood (Bardacke 2012; Duncan et al. 2009; Dunn et al. 2012; Vieten and Astin 2008). In addition, women with current depressive symptoms also expressed interest in the study, with nearly one quarter of women excluded at the initial contact due to current depressive symptoms. Recent randomized control trials with general populations suggest that MBCT may have benefit for individuals with current depressive symptoms (Chiesa et al. 2012; Manicavasagar et al. 2012). It may be of interest for future studies to explore whether MBCT-PD has benefit for patients with elevated depressive symptoms as well as depression relapse/recurrence prevention.

Despite the broad interest, there also was a subgroup of eligible women who expressed initial interest but declined participation (16 % following the phone screen and 23 % following the intake interview). These rates may suggest that either the content or the format of the intervention may not be preferred for all at-risk perinatal women. Among women who declined participation, pragmatic barriers such as distance and time were the most common reasons for non-participation and suggest the importance of novel methods of increasing access to care for such populations, including web- and phone-based models. Pregnant women frequently access online resources for information (Fox 2011a; Lagan et al. 2006) and support (Fox 2011b), and a recent study indicated that approximately 85 % of pregnant women with depressive symptoms reported that they would have interest in an internet program that taught skills to cope with depression (Maloni et al. 2013). Telephone-based methods also have been used recently to increase the reach of MBCT interventions for patients with depression and epilepsy (Thompson et al. 2010). In this trial, 8-h-long

telephone sessions were delivered, with each session including skills practice, education, discussion, and assignment of weekly homework. Sessions were co-led by a layperson with epilepsy and a graduate student therapist.

Several limitations should be noted. First, given the open trial design, it is impossible to draw any causal inferences about the efficacy of MBCT-PD from these results. Benefits observed may be related to the MBCT-PD program; however, we cannot rule out other explanations such as spontaneous improvement, impact of non-study mental health intervention, and other unmeasured variables. Randomized controlled trials are essential. Second, it is not known the degree to which any benefits reported by women in this study conferred direct or indirect benefit to their offspring. An emerging body of work supports the association of perinatal depression and adverse effects on offspring (Goodman and Rouse 2010) and between treatment of postpartum depression and benefit to the infant (Goodman et al. 2008). In addition, a recent study reported that a pregnant woman's use of the type of depressive cognitive style targeted by MBCT-PD is associated with offspring vulnerability to depression 18 years later (Pearson et al. 2013). It will be important for future studies to investigate the effects of MBCT-PD on offspring development. Infants may benefit from their mothers' participation in MBCT-PD during pregnancy to the extent that (1) the depressive cognitive styles are altered (e.g., judgmental, self-referential, or ruminative), (2) infants are exposed to lower levels of stress hormones associated with infants' development of disrupted stress reactivity systems (O'Connor et al. 2013), (3) postnatal depression is less likely, and (4) women's newly acquired mindfulness skills transfer to their providing more of the sensitive responsive care that infants require (De Wolff and van Ijzendoorn 1997; Kersten-Alvarez et al. 2011; Thompson 1997). Third, although our adherence ratings also suggest that it is possible for behavioral health clinicians to deliver MBCT-PD with high fidelity, it should be noted that adherence was rated based on the behaviors of the pairs of expert instructors and behavioral health clinicians. Thus, it will be important for future studies to examine scalable methods of training clinicians. Finally, it will be important for future studies to examine the cost-effectiveness of MBCT in the long-term management of depression; such potential benefits may be multiplied in the case of perinatal women given that depression carries costs for both mother and child (Institute of Medicine 2009).

In summary, MBCT-PD for pregnant women at elevated risk of depressive relapse/recurrence is a feasible and acceptable approach, associated with high rates of engagement, satisfaction, and promising change on key depression outcomes through 6 months postpartum. These results suggest that MBCT-PD may be an important preventive option for pregnant women with histories of depression who want to learn skills to prevent depression through pregnancy and the early postpartum period and underscore the value of future investigation of MBCT-PD in a randomized controlled study.

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