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Potential for Prenatal Yoga to Serve as an Intervention to Treat Depression During Pregnancy

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A B S T R A C T

Background: When left untreated, antenatal depression can have a serious negative impact on maternal, and infant outcomes. Many affected women do not obtain treatment for depression owing to difficulties accessing care or because they do not find standard antidepressant treatments to be acceptable during pregnancy. This study examined the acceptability and feasibility of a gentle prenatal yoga intervention, as a strategy for treating depression during pregnancy.
Methods: We developed a 10-week prenatal yoga program for antenatal depression and an accompanying yoga instructors' manual, and enrolled 34 depressed pregnant women from the community into an open pilot trial. We measured change in maternal depression severity from before to after the intervention.
Results: Results suggested that the prenatal yoga intervention was feasible to administer and acceptable to the women enrolled. No study-related injuries or other safety issues were observed during the trial. On average, participants' depression severity decreased significantly by the end of the intervention based on both observed-rated and self-report depression assessment measures.
Conclusion: The current study suggests that prenatal yoga may be a viable approach to addressing antenatal depression, one that may have advantages in terms of greater acceptability than standard depression treatments. Research and policy implications are discussed.

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As many as 13% of women experience a major depressive episode during pregnancy, with an even greater proportion reporting clinically significant depressive symptom elevations (Gavin et al., 2005). Numerous studies have documented adverse outcomes associated with antenatal depression (Davalos, Yadon, & Tregellas, 2012; Grigoriadis et al., 2013). Compared with nondepressed women, depressed pregnant women experience higher rates of preeclampsia (Cripe, Frederick, Qiu, & Williams, 2011), spontaneous abortion (Sugiura-Ogasawara et al., 2002), and prebirth complications (Palladino et al., 2011), and infants of depressed mothers are at higher risk of preterm delivery and low birth weight (Grote et al., 2010). Antenatal depression often precedes postpartum depression, which is associated with cognitive and emotional problems in children (Beebe et al., 2008; Murray, Cooper, Wilson, & Romaniuk, 2003).

Lack of Acceptable Treatments for Antenatal Depression

Although pharmacological and nonpharmacologic interventions have been developed to treat depression in the general population, fewer clinical trials have examined the efficacy and safety of depression interventions during pregnancy. Pregnant women have unique concerns that influence their treatment decisions, and the most available depression treatment in the community, antidepressant medication, is viewed by

many women to be unacceptable during pregnancy (Battle, Salisbury, Schofield, & Ortiz-Hernandez, 2013). Fetal exposure concerns are common among both women and providers, and risk/benefit decision making can be complex owing to the large and at times conflicting literature addressing the safety of pre-natal antidepressant use (Chaudron, 2013). Psychotherapeutic approaches such as interpersonal psychotherapy and cognitive–behavioral psychotherapy have shown promise in the treatment of perinatal depression (Sockol, Epperson, & Barber, 2011), but engagement in psychotherapy is often hampered by logistical or attitudinal barriers (Kim et al., 2010; O'Mahen & Flynn, 2008). Some pregnant women may be reluctant to seek mental health care owing to stigma; others may be less available owing to increased medical appointments necessary for routine prenatal care, or other tasks related to preparing for a new baby.

New Treatments Are Needed

Although public awareness of perinatal mental health issues has increased, the majority of depressed pregnant and post-partum women do not receive mental health care (Flynn, Blow, & Marcus, 2006). Owing to the high public health cost of untreated antenatal depression, there is a need to develop more acceptable strategies to treat mood symptoms during pregnancy (Battle, Uebelacker, & Magee, 2012; Freeman, 2011).

Prenatal Yoga: A Promising Approach

Prenatal yoga, a form of yoga tailored to be safe, gentle, and particularly helpful for pregnant women, represents a promising strategy for the treatment of maternal depression. One of the ways in which prenatal yoga may have an impact on depression is by increasing mindfulness, or nonjudgmental attention to the present moment. Mindfulness is directly taught in many yoga classes. This skill may generalize beyond classes, thereby reducing (negative) self-judgment, and/or increasing focus on the present moment rather than ruminating about the past or future. Yoga has been increasingly studied in nonperinatal pop-ulations as a potential treatment for physical health conditions, including back pain, cardiovascular disease, and discomfort associated with cancer (Sherman, 2012). Although limited, some trials have examined yoga as a depression treatment. To date, randomized controlled trials (RCTs) evaluating yoga for depres-sion have been generally positive (Uebelacker et al., 2010); however, most have had significant methodological limitations, limiting firm conclusions that may be drawn.

Because prenatal yoga differs from yoga geared toward the general population in content, pace, and use of modifications, and because pregnant women have unique physiological needs, it is important to examine yoga specifically designed for the prenatal period. Although research has documented interest in prenatal yoga among pregnant women seeking depression treatment (Battle, Uebelacker, Howard, & Castaneda, 2010), little research has examined the efficacy of prenatal yoga in reducing symptoms among clinically depressed pregnant women. Most published prenatal yoga RCTs have focused on physical health outcomes rather than psychological well-being (Curtis, Weinrib, & Katz, 2012). One RCT with depressed women did find positive outcomes in the group receiving biweekly prenatal yoga classes for 12 weeks relative to a routine prenatal care group (Field et al., 2012). Another study of the same intervention (Field, Diego, Delgado, & Medina, 2013) found that improvements in depres-sion were similar to those in a brief social support condition over

a period of 12 weeks. However, generalizability of results for both trials are limited by reliance upon self-report scales, and use of a nonstandard, brief (20-minute) class format inconsistent with yoga classes offered in the community (Sherman, 2012). Further, although it is clear that the yoga intervention included a series of *asanas* (postures), there was no discussion of the style or tone of the classes (e.g., whether mindfulness was emphasized) and presence or absence of adverse events was not discussed. A recent, small, nonrandomized trial (n = 18) tested a 10-week mindfulness-based prenatal yoga intervention that utilized a more typical (90-minute) class format, finding that self-reported depression was significantly reduced after the intervention (Muzik, Hamilton, Rosenblum, Waxler, & Hadi, 2012). The intervention included a series of *asanas* and a clear focus on mindfulness. Although promising, a standard interviewer-rated depression scale was not used, and the mixed psychiatric sam-ple included only a small number of women with a current depression diagnosis. In sum, initial studies provide encourage-ment regarding prenatal yoga as a strategy to lower symptoms among depressed pregnant women, but are not definitive.

The Current Study

The goal of the current study was to develop a prenatal yoga intervention for clinically depressed women using a class structure and content that is consistent with prenatal yoga taught in the community, and to evaluate the acceptability, feasibility, and preliminary efficacy of the intervention in an open pilot trial. In addition to careful measurement of changes in depression, we examined pre–post changes in mindfulness, a possible mechanism by which yoga may potentially lower depressive symptoms (Uebelacker et al., 2010). In the current study, we expected that mindfulness would increase over time and depression would decrease over time.

Methods

This study was approved for human subjects protections by our institution's institutional review board.

Participants

Eligibility

Participants met the following criteria: 12 to 26 weeks gestation with a singleton pregnancy; absence of medical prob-lems for which prenatal yoga is contraindicated; 18 or older; English speaking; not a regular yoga practitioner; available to attend at least one class time; absence of significant alcohol or drug use during pregnancy; presence of a major or minor depressive episode during the pregnancy; absence of significant suicidality; absence of bipolar disorder, schizophrenia, or a chronic psychotic condition; absence of severe posttraumatic stress disorder, obsessive–compulsive disorder, or panic disor-der; and a Quick Inventory of Depressive Symptomatology (QIDS; Rush et al., 2006) score between 7 and 20. We judged 7 to be the minimum score for which we might see clinically important change; scores over 20 represent severe depression that merits more extensive treatment and oversight.

Demographic, pregnancy, and psychiatric characteristics

We enrolled 34 participants. Table 1 provides demographic, pregnancy, and psychiatric characteristics of the participants. The sample was diverse with respect to race and ethnicity. Many

Table 1
Characteristics of the Study Sample

	n (%) or Mean (SD) and Range
Demographics	
Age (y)	28 (5.4); range = 19–40
Marital status	
Married/living with partner	23 (68%)
Single/divorced	11 (32%)
Ethnicity	
Latina/Hispanic	14 (41%)
Not Latina/Hispanic	20 (59%)
Race	
Black/African American	5 (15%)
White	14 (41%)
Multiracial	2 (6%)
Other/race not specified	11 (32%)
Educational attainment	
High school not completed	3 (9%)
High school degree	5 (15%)
Some college	9 (26%)
Completed bachelor's degree	17 (50%)
Yearly combined family income ($)	
<25,000	11 (32%)
25,000–50,000	12 (35%)
≥50,000	9 (26%)
Declined to specify	2 (6%)
Employment status	
Full time	15 (44%)
Part time	5 (15%)
Full-time parent/homemaker	0
Student	6 (18%)
Unemployed	7 (21%)
Declined to specify	1 (3%)
Pregnancy characteristics at baseline	
Average weeks gestation	19.0 (4.7); range = 12–26.5
Pregnancy planning	
Pregnancy planned	16 (47%)
Pregnancy not planned	17 (50%)
Declined to specify	1 (3%)
Prior live births	
None	22 (65%)
One or more	12 (45%)
Psychiatric characteristics	
Diagnosis	
Current MDD	25 (74%)
MDD earlier in pregnancy	4 (12%)
Current minor depressive disorder	4 (12%)
Minor depressive disorder earlier in pregnancy	1 (3%)
Baseline QIDS score	12.6 (3.2); range = 7–18
Baseline EPDS score	13.0 (5.3); range = 2–23
Baseline depression treatment	
Taking an antidepressant	1 (3%)
Engaged in psychotherapy	4 (12%)

Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; MDD, major depressive disorder; QIDS, Quick Inventory of Depressive Symptomatology.

had a college education, yet were fairly low income. One-half of participants reported having an unplanned pregnancy; less than one-half had at least one child. The majority of women met criteria for current major depressive disorder. Baseline depression symptom severity ranged from mild to moderate. Four women were engaged in other depression treatment at baseline; the majority (n = 29; 85%) did not engage in any standard depression treatment at any time during the trial.

Procedures

Participants entered the study on a continual basis. We advertised at local OB/GYN practices and other locations serving perinatal women. Women who called expressing interest completed a screening interview that included the Patient Health Questionnaire – 9 (Kroenke, Spitzer, & Williams, 2001) to assess depressive symptoms. If participants did not at least have a low level of depressive symptoms (i.e., a Patient Health Questionnaire-9 total score of ≥5 and a "1" on the mood or anhedonia item), we judged that they would be unlikely to meet eligibility criteria. If judged potentially eligible, the caller was scheduled for an in-person assessment. At that interview, if she appeared eligible, we requested permission to contact her obstetric provider to gain medical clearance for participation. Once we received written clearance, participants could start attending prenatal yoga classes.

Participants completed assessments at baseline and endpoint (10 weeks). In addition, we conducted phone assessments throughout the 10-week period. The schedule for interim assessments shifted midway through the trial in response to participant feedback. Initially, these were scheduled at weeks 2, 4, 6, and 8; however, we moved to assessments to weeks 3.3 and 6.6 only. Fewer assessments enabled us to monitor participant safety and symptoms while minimizing burden.

Because this was a pilot treatment development study, we monitored participant adherence carefully. Initially, we did not question women about availability of transportation for class. We paid women for attendance at assessments but not classes; women could earn a total of $80 for assessments including $40 for the initial assessment. After the first 25 participants enrolled, we observed that some women enrolled, yet experienced difficulty getting to class. In response, we increased emphasis on the need for reliable transportation. To decrease the possibility that women attended the initial assessment simply to be paid, we decreased the amount paid for baseline and follow-up assessments (to $20 rather than $40). We added a small incentive ($10) each time a participant attended one class per week for 2 consecutive weeks. Thus, the total amount a woman could earn remained $80.

Measures

Demographics and pregnancy characteristics

We assessed the following via patient self-report: age, relationship status, race, ethnicity, education, family income, work status, pregnancy history, and gestation.

Depression diagnosis

The Structured Clinical Interview for DSM-IV Axis I Disorders-Patient Version, Mood Module and Psychotic Screen (SCID-IP; First, Spitzer, Gibbon, & Williams, 2001) was used at baseline to diagnose mood disorders. Interviews were administered by trained research assistants; questions about diagnosis were resolved by licensed psychologists (the first or second author).

Depression severity

We used the interviewer-rated QIDS (Rush et al., 2006) to determine presence of depressive symptoms for study eligibility and to assess change in depression severity over time. The QIDS is a psychometrically strong measure that is widely used in depression treatment trials. Scores of 0 to 5 represent no depression, 6 to 10 mild depression, and 11 to 15 moderate depression (Rush et al., 2003; Trivedi et al., 2004). We also administered the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) to assess change in depression severity over time. The EPDS is a widely used, 10-item,

self-report scale for perinatal populations with established validity and reliability. Both were administered at all assessment points.

Mental health treatment

The Treatment Response to Antidepressant Questionnaire (Posternak et al., 2004) was used to assess antidepressant usage. We used a brief structured interview to collect information about other mental health treatments. Measures were administered at baseline and 10 weeks.

Expectations and satisfaction with treatment

Treatment credibility and patient expectations for treatment success were measured at baseline with the Credibility Expectancy Questionnaire (Devilly & Borkovec, 2000). Scores on the two subscales, namely, credibility and expectancy, range from 1 (not at all) to 9 (very much). The Client Satisfaction Questionnaire-8 (CSQ-8; Larsen, Attkisson, Hargreaves, & Nguyen, 1979) is an 8-item scale that yields a score ranging from 8 to 32, with 32 indicating highest satisfaction. This scale has acceptable psychometric properties (Nguyen, Attkisson, & Stegner, 1983). The CSQ-8 was administered at endpoint.

Exercise/prenatal yoga

The International Physical Activity Questionnaire (Craig et al., 2003) is a self-report measure of physical activity that was administered at all timepoints. We added questions to assess number of prenatal yoga classes attended, amount of home yoga practice, and overall minutes per week spent practicing yoga. We also used data from class attendance sheets.

Mindfulness

The Five-Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) is a 39-item questionnaire measuring five aspects of mindfulness: nonreactivity to inner experience, observing, acting with awareness, describing with words, and nonjudging of experience. Higher scores reflect more mindfulness. The FFMQ was administered at baseline and endpoint.

Description of Prenatal Yoga Classes

Prenatal yoga classes occurred twice per week, with one daytime class and one evening class offered. Women were invited to attend twice per week; however, we understood that most women would only be able to attend once per week. We provided women with a yoga mat and a prenatal yoga DVD, and encouraged them to practice at home. Classes were 75 minutes long, gentle in nature, and designed to be safe for pregnant women, including frequent use of props and modifications of poses. Consultation with experts in prenatal yoga helped to ensure that class content and format was consistent with prenatal yoga classes typically offered in the community. Class content was documented in a detailed intervention manual, and included the following components: an opening greeting; *pranayama*, breath awareness or meditation; a warm-up that included gentle, breath-linked movement; standing poses; floor poses; a final resting pose; *pranayama* or meditation; and a brief class closing, including discussion of homework. Yoga teachers were Registered Yoga Teachers who had prenatal yoga training before the study, as well as further study-specific training. Consistent with common principles of yoga practice, instructors were asked to 1) demonstrate and

encourage a nonjudgmental focus on sensation experienced in the present moment (i.e., mindfulness), 2) emphasize breathing awareness, 3) have an open and nonjudgmental attitude toward pregnancy and birth-related choices, and 4) keep in mind that participants could potentially have both positive and negative reactions to their pregnancy, and that participants may vary in degree of attachment to the developing baby.

Data Analysis

We used descriptive statistics to characterize the sample. To examine change in depression over time, we employed multilevel linear models, with depression symptoms as the outcome variable and time (i.e., weeks) as the sole predictor variable. The intercept was specified as random. A multilevel modeling approach is advantageous in that, compared with a pre–post t test, the multilevel model results in increased power because it uses all available data at each timepoint when the outcome variable is measured. Further, the model can accommodate varying interim assessment timepoints. To understand the association between minutes per week of yoga and depression symptoms, we conducted a similar multilevel analysis in which we examined whether minutes of yoga in the previous week was associated with depression severity in the previous week. Again, only the intercept was specified as random. We did not include the baseline timepoint in the model, because inclusion of this timepoint could inflate artificially the association between the two variables of interest. Depression severity (i.e., QIDS) served as the outcome variable. Time and minutes per week of yoga were time-varying predictors. Finally, to examine changes in mindfulness over time, we conducted paired t tests.

Results

Acceptability and Feasibility of the Intervention

Recruitment

We recruited 34 participants over a 14-month period (Figure 1). Of 95 women who initially called, only 6 chose not to participate after hearing the study description. Ultimately onethird of women who called about the study were enrolled.

Retention

We collected at least partial follow-up assessment data from 31 of the 34 participants; 22 (65%) provided data specifically at endpoint. Overall, we were able to collect data at approximately 75% of all scheduled data collection timepoints. One woman did not provide follow-up data and did not attend classes because she terminated her pregnancy soon after enrollment.

Number of classes attended

Twenty-nine participants attended one or more classes; five did not attend any classes. The mean number of classes attended for those who attended classes was 5.2 (Table 2) over the 9 weeks they were eligible to attend. As discussed in Methods, we made protocol changes after the first 25 participants were enrolled. We examined adherence before and after these protocol changes and found that the number of classes attended increased from a mean of 3.8 classes in the initial group of participants (n = 25) to a mean of 6.4 classes among the final group of enrolled participants (n = 9; t = −1.82; df = 32; $p < .10$).
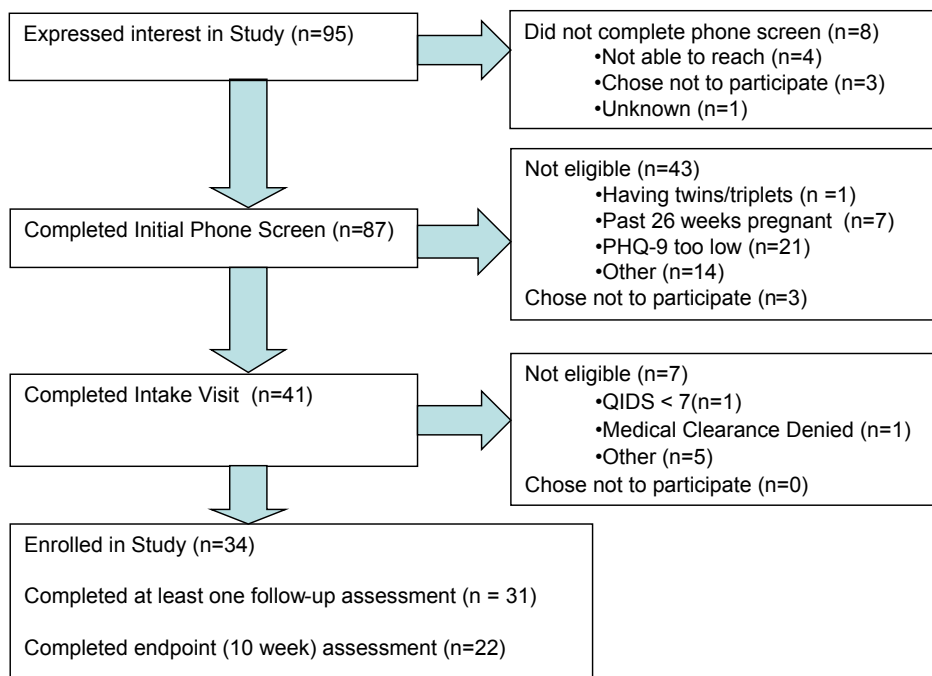
Figure 1. Flow chart of participants in prenatal yoga open trial.

Class and home practice

Table 2 provides descriptive statistics with regard to amount of yoga practiced. Number of classes attended as assessed by attendance records showed a large correlation with self-report minutes per week in class ($r = 0.85$; $p < .01$).

Other mental health treatment

Very few treatment changes were observed. Of the four women in psychotherapy at baseline, three continued during the trial. Another woman started therapy while in the trial. The one participant taking antidepressants at baseline continued on a consistent dose throughout the trial.

Expectancy, credibility, and participant satisfaction

Overall, participants expected that prenatal yoga would improve their symptoms, and believed that prenatal yoga was a credible intervention for depression (Table 2). After taking classes, participants, on average, rated their satisfaction with classes as high.

Injuries owing to yoga

At all interim and endpoint assessments, we asked participants if they had experienced any injuries owing to participation

in yoga classes, or during home yoga practice. No injuries were reported.

Change in Depression Severity

We conducted multilevel models to examine changes in depression symptoms over time (Table 3). Participants experienced significant decreases in depression symptoms over time on both the QIDS and the EPDS. Over 10 weeks, women's symptoms decreased, on average, 4.4 points on the QIDS (1.4 standard deviations) and 5.5 points on the EPDS (1.0 standard deviation), a clinically meaningful reduction (Figure 2). This degree of change is similar to that seen in more established treatments for antenatal depression (Spinelli & Endicott, 2003), and represents a large effect size (Cohen, 1988).

We examined the association between minutes per week of yoga and depression symptoms in the previous week. As reported in Table 3, we found that more time spent practicing

Table 2
Indices of Acceptability and Feasibility

	N	Mean (SD)	Range
Number of classes attended	34	5.2 (3.7)	1–16
Average minutes per week practicing yoga in class	30	51.3 (41.6)	0–182
Average minutes per week practicing yoga at home	30	32.7 (55.2)	0–260
Average minutes per week practicing yoga at home and in class	30	83.9 (75.3)	0–345
Expectancy (CEQ) before beginning classes	34	7.0 (1.1)	5–9
Credibility (CEQ) before beginning classes	34	7.7 (0.9)	5.3–9
Satisfaction (CSQ-8) at endpoint	23	29.3 (2.9)	23–32

Abbreviations: CEQ, Credibility Expectancy Questionnaire; CSQ-8, Client Satisfaction Questionnaire-8; SD, standard deviation.

Table 3
Multilevel Models Predicting Change in Depression Severity Over Time

Parameter	Estimate (SE)	95% CI	t (df)
Outcome = QIDS			
Intercept	11.34 (0.52)	10.31, 12.37	21.82 (89.4)[*]
Time	−0.44 (0.08)	−0.60, −0.28	−5.45 (107.7)[*]
Outcome = EPDS			
Intercept	11.57 (0.86)	9.84, 13.31	13.42 (48.2)[*]
Time	−0.55 (0.97)	−0.75, −0.36	−5.69 (97.2)[*]
Outcome = QIDS (not including baseline timepoint)			
Intercept	10.07 (0.90)	8.29, 11.85	11.25 (85.9)[*]
Time	−0.16 (0.11)	−3.67, 0.05	−1.49 (72.1)
Minutes per week in class	−0.010 (.004)	−.0187, −0.001	−2.22 (74.9)[*]

Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; QIDS, Quick Inventory of Depressive Symptomatology; SE, standard error.
  [*] $p < .05$.
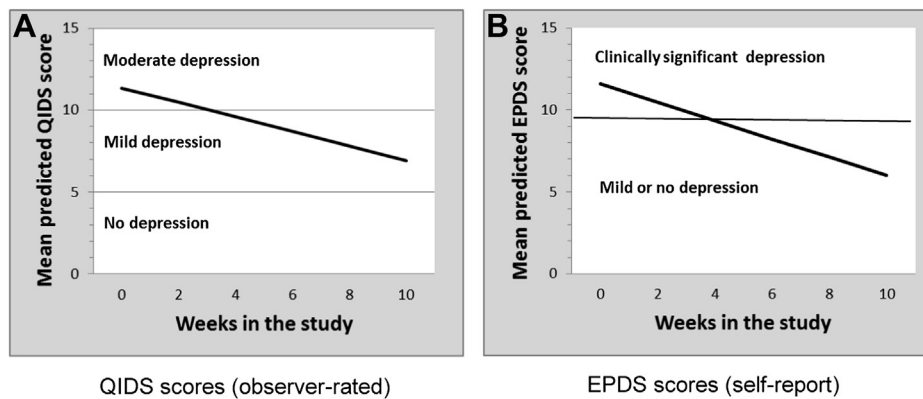
Figure 2. Change in depression severity over time on the Quick Inventory of Depressive Symptomatology (QIDS) and Edinburgh Postnatal Depression Scale (EPDS). (*A*) QIDS scores (observer rated). (*B*) EPDS scores (self-report).

yoga during a given week was associated significantly with lower levels of depression during that week.

Mindfulness

In Table 4, we present correlations between baseline depression and baseline mindfulness. As we expected, higher levels of mindfulness were generally associated with lower levels of depression. Next, we used paired *t* tests to assess pre–post changes in aspects of mindfulness. All changes were in the expected direction, and improvements in two aspects of mindfulness (increased awareness, increased nonjudgment) reached statistical significance. Effect sizes were in the moderate range (Cohen, 1988).

Discussion

This treatment development study sought to evaluate whether prenatal yoga could represent a viable treatment option for antenatal depression. We developed a 10-week prenatal yoga program for depressed women with no prior yoga experience, and tested the intervention in an open pilot trial with 34 women. We found that the intervention was feasible to administer and acceptable to patients, who voiced high levels of satisfaction, and to prenatal care providers, who welcomed study recruitment and provided medical clearance for appropriate patients. We designed the program to be consistent with prenatal yoga classes offered in the community. Women engaged in the program by attending classes and practicing yoga at home. Classes were gentle in nature and no injuries or safety concerns were

reported. Significant reductions in depression severity were observed from before to after the treatment. We also collected data on a potential mechanism of change, mindfulness. We observed that mindfulness was correlated with depression at baseline, and that there were increases in mindfulness over time as women participated in the trial.

These findings contribute to the small but growing literature suggesting that prenatal yoga may be useful as a treatment for antenatal depression. Consistent with findings of Muzik et al., we showed that a standard length (i.e., 75- to 90-minute) prenatal yoga class may be acceptable to women with elevated depression, and that mindfulness increases over the course of a prenatal yoga intervention. Also like Muzik et al., we observe no adverse events owing to prenatal yoga practice. Because the present study utilized a rigorous assessment strategy, including diagnostic assessment at baseline as well as repeated administration of a standard, interview-based measure of depression severity as the outcome—and because the majority of our sample had a current major depressive episode—our findings extend previous research by indicating that standard prenatal yoga classes may be effective in reducing depressive symptoms, even among women experiencing a current major depressive episode. Further, this is the first study to demonstrate that amount of yoga practice (i.e., number of minutes practicing prenatal yoga each week) was associated significantly with women's depressive severity that week.

This study was intended to develop and evaluate the content and format of the prenatal yoga program so that the intervention could be evaluated in a subsequent, well-powered RCT. Although the design was ideal for assessing the feasibility, acceptability,

Table 4
Change in Mindfulness Over Time on the Five-Facet Mindfulness Questionnaire

Characteristic	Pretreatment, Mean (SD)	Posttreatment, Mean (SD)	Paired *t* Test (df)	Cohen's *d*	Correlation Between Baseline Mindfulness and Depression[§]
Observe	22.2 (7.1)[†]	24.0 (6.1)[†]	−1.21 (19)	0.27	−0.05
Describe	26.5 (6.9)[‡]	27.6 (6.5)[‡]	−1.06 (20)	0.16	−0.36[*]
Awareness	25.8 (5.5)[‡]	28.8 (6.2)[‡]	−2.84[*] (20)	0.51	−0.42[*]
Nonjudge	26.2 (7.9)[†]	29.9 (5.7)[†]	−3.71[*] (19)	0.54	−0.44[*]
Nonreact	20.3 (4.8)[‡]	22.5 (4.4)[‡]	−1.88 (20)	0.48	−0.36[*]

[*] $p < .05$.
[†] n = 20.
[‡] n = 21.
[§] n = 33.

and safety of the program, the current trial did not have the design necessary to evaluate definitively the efficacy of prenatal yoga in reducing depression. Without randomization to a prenatal yoga condition versus a comparison condition, we cannot be certain that observed reductions in depression were attributable to prenatal yoga practice. Another limitation includes the small number of women enrolled after procedural changes were made to help increase attendance rates. Because we employed several protocol changes to increase attendance, including small financial incentives, we do not know if increased attendance rates would have occurred without financial incentives. Finally, the sample size prohibited examination of differences in outcomes by demographic or clinical subgroup.

Future Research

Several studies now suggest that prenatal yoga may be a viable treatment for antenatal depression, likely to be safe, feasible to administer, and acceptable to women and providers. However, critical questions remain. In addition to a well-designed, fully powered RCT to evaluate efficacy, future studies should examine potential mechanisms of action. Mechanisms may be conceptualized on the biologic level (e.g., decreased sympathetic nervous system arousal) or on the psychological level (e.g., increased mindfulness/nonjudgment).

In addition, future studies should include longitudinal designs, and evaluate not only maternal outcomes, but also associated pregnancy and infant outcomes. Prior studies with healthy, nondepressed samples suggest that yoga may improve overall maternal health and well-being, because it is associated with lower lumbopelvic pain (Martins & Pinto e Silva, 2014), better quality of life (Rakhshani, Maharana, Raghuram, Nagendra, & Venkatram, 2010), lower stress (Satyapriya, Nagendra, Nagarathna, & Padmalatha, 2009), and decreased delivery pain (Chuntharapat, Petpichetchian, & Hatthakit, 2008). Further, women with high-risk pregnancies who practiced yoga are less likely to develop pregnancy-induced hypertension or preeclampsia (Jayashree et al., 2013), and had fewer preterm births (Rakhshani et al., 2012). However, no studies to date have evaluated pregnancy and birth outcomes among depressed women practicing yoga.

Although our data provide some indication that prenatal yoga may be acceptable to women across a range of racial/ethnic subgroups, future research with larger and more diverse samples will be important to examine this question more carefully.

Implementation Challenges

Pregnant women have unique concerns in accessing depression treatment, and often face barriers to care (Goodman, 2009). Although prenatal yoga may represent a more acceptable option for many women, logistical issues may still limit access. For example, although prenatal yoga is increasingly popular (Wang et al., 2005), not all communities offer it. Even when available, some women may have difficulty attending classes at times offered. Prenatal yoga DVDs may increase access, yet relying on home practice alone may be challenging for depressed women who experience lower levels of motivation and energy. Should future research demonstrate efficacy of prenatal yoga for depression, greater efforts should be made to minimize barriers for pregnant women. This may include making prenatal yoga available onsite at OB/GYN clinics, establishing yoga programs reimbursable by insurance policies, and providing childcare. In the current study, we found that increasing the emphasis on adherence and providing small incentives for regular adherence increased number of classes attended. Although provision of financial incentives may not always be feasible, use of such incentives has been built in to "real-world" wellness programs offered by some employers and insurers.

Implications for Policy and/or Practice

In light of the high cost to women, families, and society of not treating antenatal depression, more resources should be devoted to testing novel interventions that may have broader reach than current depression treatment options. Prenatal yoga is particularly promising because the current results, and the burgeoning literature, suggest prenatal yoga may lead to improvements in depression and also bring about a wider range of health benefits.

Further, emerging data suggest that pregnant women are interested in trying alternative treatment approaches. As findings support new approaches to care, insurers and policymakers must consider making nontraditional treatments with demonstrated efficacy eligible for insurance payment. This will ensure that these therapies are available to groups likely to experience the greatest health disparities, such as low-income and racial minority women (Segre, Losch, & O'Hara, 2006; Shankardass et al., 2014).

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