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Efficacy of Yoga for Depressed Postpartum Women: a Randomized Controlled Trial

Melissa Mercedes Buttner
University of Iowa

EFFICACY OF YOGA FOR DEPRESSED POSTPARTUM WOMEN: A RANDOMIZED CONTROLLED TRIAL

by

Melissa Mercedes Buttner

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Thesis Supervisor: Professor Michael W. O'Hara

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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

Melissa Mercedes Buttner

has been approved by the Examining Committee
for the thesis requirement for the Doctor of Philosophy
degree in Psychology at the August 2013 graduation.

Thesis Committee: _____
Michael W. O'Hara, Thesis Supervisor

_____
Lilian Dindo

_____
Susan Lutgendorf

_____
James Marchman

_____
Scott Stuart

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ABSTRACT

Postpartum depression (PPD) is a significant public health issue. Up to 20% of women are affected by depression following childbirth. PPD is associated with anxiety, poor adjustment and health-related quality of life (HRQOL), and may lead to a woman's personal suffering, conflict with family members (especially in the relationship with partner) and developmental delays in children. Given the high prevalence of PPD and deleterious effects on both women and their families, adequate treatment is critical. While existing PPD treatments have strong efficacy data, the treatment literature suggests that many depressed postpartum women either do not receive treatment or receive suboptimal care. Further, barriers to care including medication side effects for breastfeeding women, stigma, and treatment preferences influence treatment decision-making. Thus, it may be worthwhile to examine the efficacy of a complementary and alternative medicine (CAM) treatment option for PPD that is associated with minimal risk and consistent with maternal preferences.

The current investigation examined the efficacy of a Gentle Vinyasa Flow yoga intervention for PPD. Fifty-seven postpartum women with a score of ≥ 12 on the Hamilton Depression Rating Scale (HDRS) were randomly assigned to 1 of 2 groups − yoga ($n = 28$) or wait-list control (WLC) ($n = 29$). The yoga intervention lasted 8 weeks, and consisted of 16 classes taught by a certified yoga instructor in a studio and the recommendation to practice once a week at home with the use of a DVD that included a 30 minute yoga sequence. The primary outcome, depression, was assessed using the clinician-rated HDRS and self-report measures. The HDRS was administered over the telephone by blinded raters at baseline and after 2, 4, 6, and 8 weeks of treatment.

Secondary outcomes were anxiety, postpartum adjustment, and HRQOL, with exploratory outcomes including mindfulness and physical activity. These outcomes were assessed using self-report measures completed on the same schedule as that for the HDRS. Growth curve modeling was used to test the hypotheses that women in the yoga group would experience a significantly greater rate of change over the course of the 8-week intervention on primary and secondary outcome measures, relative to the WLC group. As predicted, controlling for age and social anxiety at baseline, women in the yoga group experienced a greater rate of change in depression and well-being scores over the course of the 8-week intervention. The yoga group also experienced a significantly greater rate of improvement on scores of anxiety, postpartum adjustment, HRQOL, and mindfulness over the 8-week intervention, relative to the control group.

These findings support yoga as a promising CAM intervention for PPD; large-scale replication studies are warranted. The findings also shed light on potential mediator and intervention-relevant variables for future research. Yoga is an acceptable and low-risk treatment option that may have broader clinical implications for the PPD treatment literature, and the field of CAM more generally.

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CHAPTER I
INTRODUCTION

Approximately 1 in 5 women will experience depression in the postpartum period (Gavin, Gaynes, Lohr, Meltzer-Brody, Gartlehner, & Swinson, 2005). Postpartum depression (PPD) has been shown to have detrimental effects on women's psychological functioning (Cooper, Murray, Wilson, & Romaniuk, 2003), social functioning (O'Hara, Stuart, Gorman, & Wenzel, 2000), and quality of life (DaCosta, Dritsa, Rippen, Lowensteyn, & Khalife, 2006). The deleterious effects of PPD also are evidenced in the negative effects on marital relationships (Burke, 2003) and exposed children (Grace, Evindar, & Stewart, 2003). Given the high prevalence rate, depression in postpartum women is a pervasive mental health issue. Nonetheless, a small percentage of women are diagnosed, and those who are diagnosed are undertreated (Dennis, 2004), despite numerous randomized controlled trials (RCT) investigating the efficacy of pharmacological and nonpharmacological interventions (Fitelson, Kim, Baker, & Leight, 2011; O'Hara & McCabe, 2013). Existing first-line treatments are associated with barriers, including medication side effects from antidepressants and stigma (Dennis & Chung-Lee, 2006; Goodman, 2009; O'Mahony, Donnelly, Bouchal, & Este, 2013). Complementary and alternative medicine (CAM) therapies have gained attention in the depression literature as an alternative treatment option with an expanding empirical base (Freeman, 2009). To date, no published empirical studies have tested the efficacy of yoga for PPD.

To support expansion of empirical research into CAM therapies for PPD, I conducted an RCT examining the efficacy of yoga for PPD. The primary aim of this study was to test the efficacy of an 8-week yoga intervention for reducing symptoms of

depression, relative to a wait-list control group. Secondary aims included testing the efficacy of a yoga intervention for reducing symptoms of anxiety, and improving postpartum adjustment and health-related quality of life, relative to a wait-list control. It was hypothesized that individuals receiving the yoga intervention would experience a significantly greater rate of improvement in depression, anxiety, adjustment, and health-related quality of life over the course of the 8-week intervention, relative to the control group.

Postpartum Depression

Epidemiological studies suggest that Major Depressive Disorder (MDD) is twice as common in women as in men, with a peak age of onset during the reproductive years (Kessler, McGonagle, Nelson, Hughes, Swartz, & Blazer, 1994). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association [APA], 2000), MDD is defined as having five or more of the following eight symptoms (at least one of the symptoms must be low mood/depression or anhedonia): low mood/depression; anhedonia; increase/decrease in appetite; sleep disturbance; psychomotor agitation/retardation; fatigue; feelings of worthlessness/guilt; poor concentration/decision-making; and suicidal ideation (APA, 2000). Depression in women is significant, affecting more women than any other condition with the exception of heart disease (Murray & Lopez, 1996). In 2000, depression was the second leading cause of hospitalization after obstetric care, with 205,000 women discharged from the hospital with a diagnosis of depression (Jiang, Elixhauser, Nicholas, Steiner, Reyes, & Bierman, 2002).

Subclinical Depression

Depression may be best conceptualized in research and clinical work on a continuum rather than using discrete categories (Cuijpers, Graaf, & van Dorsselaer, 2004). The depression continuum is characterized as the absence of symptoms at one end, major depression at the opposite end, and subthreshold (or subclinical) depression in the middle (Angst, Sellaro, & Merikangas, 2000). Subclinical depression is defined as clinically relevant depressive symptoms, without meeting full criteria for a major depressive disorder (MDD) (Cuijpers, Smit, & van Straten, 2007), and is operationalized in the following ways: (1) scoring above a cut-off score on a self-report depression scale (e.g., Beck Depression Inventory); (2) having depressed mood with one or more additional symptoms of a mood disorder (e.g., loss of pleasure, sleep disturbance); or (3) meeting criteria for minor depression (Cuijpers et al., 2004).

Subclinical depression is associated with deleterious effects on quality of life (Wells et al., 1989), and contributes to a significant increase in health-care utilization (Cuijpers et al., 2004) and economic costs associated with lost days of work (Cuijpers et al., 2004). Psychological interventions targeting subclinical depression have a significant impact on depressive symptomatology, with long-term improvements evidenced in decreased incidence of major depression (Cuijpers et al., 2007). Importantly, subclinical depression is associated with psychological suffering similar to that in clinical depression (Cuijpers et al., 2007), but has broader effects as a public health issue (Morgan & Jorm, 2008). Therefore, research into treatment of subclinical depression is critical and should be considered in treatment outcome studies.

Specific to the postpartum period, close to 20% of women meet criteria for major or minor depression within the first three months of childbirth (Gavin et al., 2005). In fact, there is some research to suggest that there are subgroups of women at particular risk for worsening of mood in the postpartum (O'Hara, 1997). This increase in mood disturbance following childbirth may be driven by biological factors (e.g., personal and family psychiatric history; O'Hara Zekoski, Philipps, & Wright, 1990), or unique factors that are characteristic of the postpartum period (e.g., sleep deprivation, role transition to motherhood; Beck, 2001). Because of these differences, depressed postpartum women may respond differently to treatments designed for general depression compared to a non-puerperal depressed population (Hendrick, Altshuler, Strouse, & Grosser, 2000). Further, depression in the postpartum is often comorbid with anxiety and obsessional symptoms, with women presenting with generalized anxiety disorder and panic disorder (Wenzel, Haugen, Jackson, & Brendle, 2005).

Postpartum Morbidity and Disability

Depressed postpartum women are at a high risk for recurrent episodes of depression (Philipps & O'Hara, 1991), with untreated depression during this time potentially contributing to chronic depression (Nonacs & Cohen, 1998). Additionally, a wealth of empirical evidence highlights the negative impact of PPD on infants and children (Goodman, Rouse, Connell, Broth, Hall, & Heyward, 2011), evidenced by impaired maternal-infant interactions (Beck, 2001), and poor cognitive (Whiffen & Gotlib, 1989) and emotional functioning in infants (Murray, Cooper, Wilson, & Romaniuk, 2003). Because depression in the postpartum may be chronic and recurring, children continuously exposed to the effects of depression may become vulnerable to the

onset of externalizing disorders (e.g. conduct disorders), and major depression later in life (Weissman & Jensen, 2002). The personal suffering of women, coupled with the potential deleterious effects on infants, children, and partner, are just some of the more compelling reasons for pursuing the development and empirical validation of efficacious treatments for postpartum depression.

Anxiety Comorbidity

In contrast to the vast amount of research dedicated to the examination of PPD, postpartum anxiety disorders have garnered little research attention. It is well-documented in the mood and anxiety disorders literature that depression and anxiety are comorbid (Watson, 2005). A framework for understanding the relationship between depression and anxiety put forth by Clark and Watson (1991) in their tripartite model posits that depression and anxiety have key symptoms distinguishing the two conditions. However, both conditions share a common underlying dimension of general distress referred to as Negative Affect. Structurally defining the concepts of depression and anxiety remains a fundamental issue that requires further investigation (Watson, 2005). Nevertheless, there are several reasons to consider anxiety within the context of the postpartum period.

First, the occurrence of obsessive-compulsive disorder and generalized anxiety disorder are higher in postpartum women, relative to the general population (Ross & McLean, 2006). Second, the peak age of onset for anxiety disorders in the female population is in the mid-to late-20s (Heron, O'Connor, Evans, Golding, & Glover, 2004), a time during which women may be contemplating about or starting a family. Third, there is an inherent level of stress associated with the postpartum period because recently

delivered mothers are adapting to a new set of expectations for themselves that come with the adjustment to motherhood (O'Hara, Hoffman, Philipps, & Wright, 1992). Thus, stressors linked to the postpartum period may lead to increased anxiety in women following childbirth, more so than at other times during their lives (Ross, Gilbert Evans, Sellers, & Romach, 2003; Wenzel et al., 2005).

The existing body of literature suggests that symptoms of anxiety are in fact common during the postpartum period (Heron et al., 2004; Stuart, Couser, Schilder, O'Hara, & Gorman, 1998; Wenzel, Gorman, O'Hara, & Stuart, 2001; Wenzel, Haugen, Jackson, & Robinson, 2003; Wenzel et al., 2005). For example, Stuart et al. (1998) showed that the incidence of anxiety between 14 and 30 weeks postpartum was higher than the rate of depression during the same time period. Higher prevalence rates of anxiety, relative to depression, in the postpartum period have been reported in subsequent studies. Postpartum prevalence rates of anxiety range from 1.3% for panic disorder (Wenzel et al., 2005) to 8.2% for generalized anxiety disorder (Wenzel et al., 2003; Wenzel et al., 2005). Importantly, Wenzel et al. (2003) showed that over 30% of women who were eight weeks postpartum reported symptoms of worry and generalized anxiety, relative to 12% of the sample endorsing symptoms of depression.

Symptoms of anxiety are an important feature of depression in the postpartum, even more so than in women experiencing depression during nonchildbearing times (Misri, Kim, Riggs, & Kostaras, 2000; Stuart et al., 1998). Empirical data to help guide clinical interventions for comorbid anxiety in PPD are limited. Empirically-supported treatments for anxiety in the general population have been applied to the postpartum population with some success, including the use of medications (SSRIs) and

psychotherapy (Cognitive Behavioral Therapy) (Ross & McLean, 2006). Taken together, it is important to consider comorbid anxiety when evaluating treatment options for postpartum depression.

Postpartum Adjustment

The transition to motherhood comes with new expectations and demands of the mother. Depressed postpartum women report lower levels of postpartum adjustment, with negative effects on interpersonal relationships (O'Hara et al., 2000). Maternal role functioning (e.g., self-efficacy specific to parenting, social functioning) is important to consider during this time (Logsdon, Wisner, & Hanusa, 2009), especially because the presence of depression can lead to its deterioration (DaCosta et al., 2006; Logsdon et al., 2009; O'Hara et al., 2000). The influence of depression on postpartum adjustment is evidenced in a number of studies. In one study, depressed postpartum women meeting Research Diagnostic Criteria (RDC) for major or minor depression reported poorer social functioning in dimensions reflecting close relationships (e.g., spouse, new baby) compared to a nondepressed group (O'Hara et al., 1992). In this study, social role functioning was assessed using the Postpartum Adjustment Questionnaire (PPAQ), a measure designed to assess adjustment in childbearing women (O'Hara et al., 1992). In a subsequent study, Boyce et al. (2000) showed that overall social functioning, as assessed using the SF-36 social functioning subscale, was significantly impaired in depressed women at 24 weeks postpartum, compared to a nondepressed postpartum group.

While significant impairments are typically found in depressed postpartum women across all eight dimensions of the SF-36 (Boyce et al., 2000; Brown & Lumley, 2003; DaCosta et al., 2006), studies examining the impact of depression on role

functioning in postpartum women suggest that even nondepressed postpartum women show impairments in the vitality dimension of the SF-36 (e.g., energy to complete tasks), relative to normative samples (Boyce et al., 2000; Brown & Lumley, 2003). Further, there are data to suggest differences in the effects of depression on role functioning in postpartum women, relative to depression unrelated to the postpartum period (Boyce et al., 2000). Taken together, emphasis should be placed on identifying measures that adequately assess adjustment specific to the postpartum woman, which will inform the development of treatments for PPD.

Health-related Quality of Life

Health-related quality of life (HRQOL; DaCosta et al., 2006) is an important outcome to consider when evaluating the impact of PPD on women's emotional and physical well-being (DaCosta et al., 2006). Because HRQOL is a construct tapping various domains (e.g., mental and physical health, role functioning, vitality, etc.), reliable assessment requires the use of a multi-dimensional measure. The most commonly used measure to asses HRQOL in treatment outcomes studies is the Medical Outcomes Study 36-item short form (SF-36; Ware & Sherbourne, 1992), which covers dimensions such as role limitations due to physical and emotional functioning, social functioning, and vitality.

In the general depression literature, studies have shown that compared to healthy individuals, those with depression report poorer HRQOL, including poorer physical and social functioning, perceived health, and more days in bed (Wells et al., 1989). Specific to postpartum depression, Boyce et al. (2000) examined the impact of depressed mood assessed at 8 weeks postpartum on functioning and well-being at 24 weeks postpartum.

Depressed women (*n* = 54; 12.7%) scoring greater than or equal to 12 on the Edinburgh Postnatal Depression Scale (EPDS) were significantly more impaired in five of the eight dimensions on the SF-36, including Role Limitations due to Physical and Emotional functioning, Social Functioning, Mental Health, and Vitality. Nondepressed women (scoring < 12 on the EPDS) reported impairment in only two of the eight SF-36 dimensions (Vitality and Role Limitations due to Emotional Problems), but better Mental and General Health compared to age-appropriate normative means. Further, Dennis (2004) showed that women depressed at 4 and 8 weeks postpartum based on a score of 12 or greater on the EPDS reported poorer Physical and Mental Health status compared to nondepressed women (< 12 on the EPDS).

When considering health outcomes, perceived satisfaction with life also should be assessed as a potential contributing factor. In the *Positive Psychology* literature, the construct of satisfaction with one's life is receiving growing empirical support for its role in improved psychological outcomes (Pavot & Diener, 2008). The scale often used to measure the construct, the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), taps subjective well-being. For example, in the area of health psychology, the SWLS has been implemented to assess subjective health-related quality of life in individuals with chronic illness, as well as to examine adjustment to chronic medical conditions such as spinal cord injury and traumatic brain injury (Pavot & Diener, 2008). To date, the PPD treatment literature has yet to examine quality of life indicators such as perceived satisfaction with life in treatment outcome studies. A comprehensive assessment of quality of life in treatment efficacy research for PPD may yield valuable information above and beyond symptom reduction.

Postpartum Depression Treatment

Despite the high prevalence of postpartum depression (PPD) (both clinical and subclinical) and the numerous studies that have systematically examined the efficacy of pharmacological and nonpharmacological treatments for PPD, depression in the postpartum period is still undertreated. Current gold standard treatments include pharmacological (e.g., antidepressant medication) and nonpharmacological (e.g., psychotherapy) therapies. Pharmacological treatments are often recommended for women with severe postpartum depression (e.g., presence of active suicidal ideation, intent or psychosis), either as a standalone or in conjunction with a nonpharmacological treatment (Cohen, Wang, Nonacs, Viguera, Lemon, & Freeman, 2010). Despite limited research in this area, empirical evidence suggests that nonpharmacological treatment strategies are as efficacious for women with PPD (Appleby et al., 1997; Misri et al., 2004; O'Hara & McCabe, 2013). Further, postpartum women may desire nonpharmacological treatment options, especially if concerned about the potential side effects of medication on breastfeeding, dependency/withdrawal (Boath, Bradley, & Henshaw, 2004; Chabrol, Teissedre, Armitage, Danel, & Walburg, 2004), as well as stigma and shame (Dennis & Chung-Lee, 2006; O'Mahony et al., 2013). Barriers associated with medication side effects and social stigma may be addressed through the implementation of alternative treatment options that are associated with low risk and do not require the vulnerability associated with discussing emotions and feelings inherent in psychotherapeutic interventions.

Pharmacological Treatments

It is argued that efficacy and acceptability of antidepressant medication during nonchildbearing times is equivalent to that during the postpartum period. To date, gold standard antidepressant medications for treating general depression (e.g., fluoxetine) have demonstrated efficacy in the treatment of PPD (e.g., Appleby, Warner, Whitton, & Faragher, 1997). In fact, depressed postpartum women may respond differently to antidepressant medications compared to those experiencing a non-puerperal depressive episode. For example, in a study comparing 26 depressed postpartum women to 25 non-puerperal depressed women, the depressed group required more antidepressant medication and had a delayed response to treatment (Hendrick et al., 2000).

In the one placebo-controlled antidepressant treatment trial for PPD, fluoxetine was compared to supportive counseling for 87 women with RDC-defined major or minor depression in the postpartum (Appleby et al., 1997). Postpartum women were randomized to receive 20 mg of fluoxetine daily and 1 counseling session, fluoxetine and 6 counseling sessions, placebo and 1 counseling session, or placebo and 6 counseling sessions. Among the 61 women who completed the 3-month study, fluoxetine outperformed placebo on depression outcome measures, Hamilton Depression Rating Scale (HDRS) and Edinburgh Postnatal Depression Scale (EPDS). Six sessions of counseling were significantly superior to a single session, and no advantage was associated with combined fluoxetine and counseling over either treatment alone. Notably, both the HDRS and EPDS baseline scores were indicative of mild depression. Thus, results cannot be generalized to more severe PPD.

In a controlled trial examining the effectiveness of medication relative to cognitive-behavioral therapy (CBT), paroxetine was compared to paroxetine plus CBT in a sample of 35 postpartum women with DSM-IV diagnosis of depression comorbid with anxiety disorder (Misri, Reebye, Corral, & Milis, 2004). Women were randomly assigned to 1 of 2 treatment groups: (1) paroxetine only (n = 16), or (2) paroxetine plus 12 sessions of CBT combination therapy (n = 19). Both groups showed significant improvement in mood and anxiety symptoms from pre-to post-treatment ($p < .01$) on the 21-item HDRS (paroxetine: 22.06 vs. 4.5; paroxetine plus CBT: 21.06 vs. 6.0), Hamilton Rating Scale for Anxiety (paroxetine: 20.31 vs. 6.06; paroxetine plus CBT: 21.32 vs. 6.68), and the Yale-Brown Obsessive Compulsive Scale (paroxetine: 7.12 vs. 2.13; paroxetine plus CBT: 12.37 vs. 3.26). However, there were no significant differences between groups on these outcome measures at post-treatment (Misri et al., 2004). A more recent combined treatment trial was conducted with sertraline added to brief psychodynamic therapy (Bloch, Meiboom, Lorberblatt, Bluvstein, Aharonov, & Schreiber, 2012). While participants experienced symptom improvement, the add-on component of psychotherapy did not yield significant effects over and above the sertraline, a finding that is consistent with the earlier combined treatment trial (Misri et al., 2004).

In addition, four small open trial designs (both the researchers and participants know which treatment is being administered) examining antidepressants for PPD have been published. The most recent trial investigated the use of buproprion in eight postpartum women meeting DSM-IV diagnostic criteria for major depression and scoring 17 or greater on the HDRS (Nonacs, Soares, Viguera, Pearson, Poitras, & Cohen, 2005).

Women experienced a significant decrease in scores from baseline (20.5) to endpoint (10.0; $p < .05$), with three participants achieving remission (score < 7 on the HDRS) at week 8. A second open trial examined the use of venlafaxine for 15 women with PPD (Cohen et al., 2001). Ten women (67%) completed the 8 week study with significant improvement detected in scores from baseline to endpoint as assessed using the HDRS (26.13 vs. 7, $p < .01$). Notably, 12 participants (80%) had scores of 7 or less on the HDRS (indicative of remission). In a third open trial examining the role of sertraline as a treatment for PPD, sertraline was administered to 26 postpartum women for 8 weeks (Stowe, Casarella, Landry, & Nemeroff, 1995). At 8 weeks, women showed a significant reduction in symptoms of depression on the $HDRS_{21}$ from baseline to the end of the 8-week period (22 vs. 7; $p < .001$). In addition, 20 of the 21 completers showed greater than 50% reduction in $HDRS_{21}$ scores, and 14 had $HDRS_{21}$ scores ≤ 7 (a score of ≤ 7 on the HDRS is defined as remission). Lastly, a case series described six women with PPD and scores of ≥ 17 on the HDRS who were treated for 8 weeks with fluvoxamine (Suri, Burt, Altshuler, Zuckerbrow-Miller, & Fairbanks, 2001). Of the six women, five completed the study with 67% ($n = 4$) scoring ≤ 7 on the HDRS, thus achieving remission.

Pharmacological treatment data also suggests that selective serotonin reuptake inhibitors (SSRIs) may be superior to treatment with tricyclic antidepressants (TCAs) for women in the postpartum period. One 8-week randomized clinical trial with sertraline (SSRI) was conducted to determine its efficacy in preventing recurrence of PPD (Wisner, Perel, Peindl, Hanusa, Piontek, & Findling, 2004). Twenty-two women with a history of PPD based on DSM-IV criteria were randomized to either sertraline or placebo

immediately following childbirth (sertraline: $n = 14$; placebo: $n = 8$). In the 8-week preventive treatment period, recurrence of PPD occurred in four (50%) women taking placebo and in one woman (7%) taking sertraline. Further, the time to recurrence was significantly longer in the sertraline versus the placebo-treated group. In a second study conducted by Wisner et al. (2006), a double-blind randomized 8-week clinical trial comparing the efficacy of nortriptyline (TCA) with sertraline (SSRI) was completed in a group of postpartum depressed women. Findings revealed no significant differences in time-to-response to treatment and remission of depressive symptoms between the two medication groups (sertraline, $n = 36$; nortriptyline, $n = 47$) (Wisner et al., 2006). In sum, these findings suggest that women may preferentially respond to SSRIs, relative to TCAs, during the childbearing years.

Breastfeeding Considerations

In response to the well-documented advantages of breastfeeding, the American Academy of Pediatrics (2005) recommends breastfeeding for the first 6 months of an infant's life. The potential effects of antidepressant medication on breastfeeding are of concern to most mothers (Goodman, 2009), and may contribute to their hesitancy to use antidepressant medications. For example, in one study the acceptability of psychotherapy (by consultation and by home visits) and antidepressants for PPD was evaluated before and after drug safety information was provided to breastfeeding and bottlefeeding mothers (Chabrol et al., 2004). Information made reference to the effectiveness of antidepressants, relative to psychotherapy, and that antidepressant drugs pass into the mother's milk and into the baby's blood in small quantities in the case of breastfeeding. Findings from the study showed that acceptability of antidepressants was significantly

lower than psychotherapy before information was presented to mothers (regardless of infant feeding method) about the potential side effects of antidepressants ($p < .001$). Notably, the acceptability of antidepressants significantly decreased after information on breastfeeding and antidepressants was presented to breastfeeding mothers compared with bottlefeeding mothers ($p = .04$).

Given the dearth of evidence on the effects of antidepressants in breast milk, treatment providers turn to nonpharmacologic treatments, especially when symptom presentation is mild or moderate (Goodman, 2009). The decision to use antidepressant medication while breastfeeding involves various factors including: severity of depressive symptoms, risks of medication use, and maternal treatment preferences (Goodman, 2009).

Maternal Role Functioning

Maternal role functioning (e.g., social, work) is important in the transition to motherhood (Beck, 2001; DaCosta et al., 2006), especially in light of the many demands placed on the new mother. Depression in postpartum women is associated with poor adjustment following childbirth (O'Hara et al., 1992; O'Hara et al., 2000) and reduced quality of life (e.g., vitality, energy, and physical health) (DaCosta et al., 2006). Antidepressant medications have been shown to have significant positive effects maternal role functioning, specifically with overall functioning and gratification with maternal role (Logsdon et al., 2009). A pilot study was conducted investigating the impact of antidepressant medications (sertraline and nortriptyline) on maternal role functioning in a subset of women ($N = 27$) who participated in an 8-week double blind trial of nortriptyline compared with sertraline for PPD (Wisner et al., 2006). Outcome measures

included depression, overall level of functioning, and maternal role functioning (self-efficacy and gratification in the maternal role). Findings showed that both antidepressants were equally efficacious in reducing depressive symptoms and improving overall level of functioning and gratification in the maternal role (e.g., enjoyment in new parent role). However, no improvements were detected in self-efficacy (self-perceived knowledge and skill in infant's diet, health, and safety) (Logsdon et al., 2009).

In sum, the unique characteristics associated with the postpartum period, including risk/benefits associated with medications and breastfeeding concerns, maternal role transition, and comorbid anxiety, add a layer of complexity in developing efficacious treatments for PPD. The potential side effects of medication are of significant concern for breastfeeding mothers, and serve as a barrier to seeking antidepressant treatment. Additionally, the pharmacological treatment trials present with methodological limitations, including: (1) small sample sizes, (2) absence of adequate control or comparison group; (3) failure to evaluate the effects of antidepressant medication on symptoms of comorbid anxiety, with the exception of one study (Misri et al., 2004); and (4) failure to evaluate the effects of antidepressant treatment on maternal role functioning, with few exceptions (e.g., Logsdon, Wisner, Hanusa, & Phillips, 2003). In sum, studies investigating pharmacological treatments for PPD provide little efficacy data and present with methodological limitations, making it difficult to provide informed treatment recommendations for depressed postpartum women.

Nonpharmacological Treatments

Interpersonal Psychotherapy

Interpersonal Psychotherapy (IPT) is one of the most well-established psychological interventions for postpartum depression (PPD) (Fitelson et al., 2011;

O'Hara et al., 2000). Interpersonal Psychotherapy is a manual-based treatment designed to improve psychological symptoms and social functioning by focusing on modifying interpersonal relationships, including expectations about those relationships (Stuart, 2005). Because of this emphasis on interpersonal relationships, IPT is appropriately suited for PPD as it addresses unique factors specific to the postpartum period, such as the relationship with partner, role transition to motherhood, and social support (O'Hara et al., 2000; Stuart, 2005).

The efficacy of IPT for major depression more generally has been examined in several studies, notably the National Institute of Mental Health's Treatment of Depression Collaborative Research Program (TDCRP) (Elkin et al., 1985). Results from this study showed that IPT was equal to both imipramine (antidepressant medication) and Cognitive Behavioral Therapy (CBT) in the treatment of mild to moderate depression, and outperformed placebo for severe major depression. Specific to postpartum depression, O'Hara et al. (2000) examined the efficacy of IPT for PPD in 120 postpartum women meeting diagnostic criteria for major depression. These women were randomly assigned to either 12 weeks of IPT or a wait-list control (WLC) group. Postpartum women receiving IPT performed significantly better, relative to the WLC group, on measures of depression and postpartum adjustment assessed using the 17-item HDRS and Postpartum Adjustment Questionnaire (PPAQ), respectively. Depression scores for women receiving IPT significantly decreased from pre- to post-treatment (19.4 to 8.3), relative to the WLC group (19.8 to 16.8) ($p = .003$). Additionally, a significantly larger percentage of women receiving IPT recovered from their depressive episode based on a HDRS score ≤ 6 (37.5%), relative to the women in the WLC group (13.7%; $p = .007$).

Taken together, this randomized study suggests that IPT as an efficacious psychological treatment for PPD and improved social functioning (O'Hara et al., 2000).

In less rigorously designed studies, a single group design was used with six depressed postpartum women based on DSM-III criteria. These women were provided 12 weeks of IPT with modifications to include assistance with marital disputes and major role transitions--specific characteristics associated with PPD. Findings revealed a significant reduction in depression scores at post-treatment based on the HDRS, BDI, and EPDS (Stuart & O'Hara, 1995). A quasi-experimental study was conducted with 39 women screened using DSM-IV criteria. The intervention consisted of two groups: (1) IPT that included 12 weekly 1-hour therapy sessions, and (2) mother-infant therapy that consisted of 12 weekly, 1.5-hour sessions. A significant reduction in depression scores was detected within the treatment groups at post-treatment on the CES-D, but not the BDI (Clark, Tluczek, & Wenzel, 2003). Finally, in an open study of group IPT for PPD in 17 Austrian women, findings showed a significant improvement at the 3-month endpoint and at the 6-month follow-up compared to baseline scores on the HDRS and EPDS (Klier, Muzik, Rosenblum, & Lenz, 2001). In sum, there is clear support for the efficacy of IPT for perinatal mood disorders. However, there are some limitations associated with these studies, including: 1) small sample size (Clark et al., 2003; Klier et al., 2001; Stuart & O'Hara, 1995), 2) lack of a control group (Klier et al., 2001; Stuart & O'Hara, 1995), and 3) investigator-based assessment of treatment outcome (Klier et al., 2001).

Cognitive Behavioral Therapy

Cognitive Behavioral Therapy (CBT) is a well-researched and effective treatment for mood and anxiety disorders (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). According to Beck's model of cognitive therapy, negative and maladaptive thoughts are linked to psychological distress and behaviors (Beck, Rush, Shaw, & Emery, 1979). These thoughts include beliefs about the self, the world, and the future and lead to automatic negative thought patterns. Therefore, the focus in CBT is to help individuals modify patterns of negative thinking through various techniques, including cognitive restructuring, challenging faulty thought patterns, and exposure, with the aim of reducing emotional and physical distress (Beck et al., 1979; Dimidjian et al., 2006).

Several trials have been conducted to evaluate CBT for PPD either alone or in combination with other treatments (Fitelson et al., 2011). The most notable of these studies was a randomized controlled trial in which 87 women with PPD were randomized to one of 4 treatment conditions: (1) fluoxetine and 1 CBT session, (2) fluoxetine and 6 CBT sessions, (3) placebo and 1 CBT session, or (4) placebo and 6 sessions of CBT conducted by Appleby et al. (1997). Of the 87 women who met RDC for major and minor depression at 6 to 8 weeks postpartum, 61 (70%) completed the 12 weeks of treatment. All four treatment groups showed significant improvement in depressive symptoms. Six sessions of CBT with placebo pill was as effective as the treatment condition with fluoxetine and one session of CBT; however, there was no additional benefit in receiving 6 CBT sessions in combination with fluoxetine. Notably, the counseling sessions were delivered by nonspecialists with minimal training in CBT, and

6 sessions of CBT may not adequately represent a standard course of treatment (Appleby et al., 1997).

In a second combination medication-CBT study, 35 women with PPD and comorbid anxiety were randomized either to paroxetine alone or paroxetine and 12 weekly manualized CBT sessions with a therapist (Misri et al., 2004). Significant decreases in depressive symptoms were detected in both groups. However, there were no significant differences between the groups in response rates or time to remission. This finding suggests that there was no detectable added benefit to receiving CBT in combination with the antidepressant over the 12-week treatment period, consistent with Appleby et al.'s (1997) findings.

In a third randomized controlled trial, 37 Australian women identified using the EPDS (score > 12) and clinical interview were assigned to either a usual care control group (n = 20) comprising 6 weekly clinic visits with an early childhood nurse (ECN), or an intervention group (n = 17) with 6 weekly home-based sessions delivered by the ECNs, who received training in CBT (Prendergast & Austin, 2001). Although both groups showed a significant improvement in mood, there were no group differences at post-treatment or the 24-week follow-up. A high recovery rate at the initial follow-up also was detected with close to 80% of participants scoring < 10 on the EPDS. Findings suggest that perceived support from a nurse is as effective as modified CBT. Limitations associated with this study include the delivery of the intervention in that the ECNs were not licensed psychologists, though the nurses received CBT training prior to study and received supervision throughout the treatment trial. Moreover, because the control group

made weekly visits to a clinic and met with an ECN, the control group seemed to resemble a supportive psychotherapy group rather than a true control.

In a study conducted by French researchers, 258 women at risk for PPD (EPDS score > 8) were alternately assigned to either an intervention or control group (Chabrol et al., 2004). At 4 to 6 weeks postpartum, women with a score of greater than 10 on the EPDS were assessed for depression using the HDRS and BDI; those with major depression remained in the control group (n = 30) or the intervention group (n = 18). The intervention consisted of a CBT program of 5 to 8 home visits. Findings revealed that a significantly greater number of women in the intervention group recovered, relative to the control group, based on the HDRS, EPDS, and BDI scores. Recovery rates using the HDRS (score < 7) were 67% for the intervention and 7% for the control group. An RCT conducted in the United Kingdom recruited 193 women with PPD to examine the long-term effect of three psychological treatments on women's mood (Cooper et al., 2003). Women were randomly assigned to either treatment as usual (n = 52), or to 1 of 3 interventions: CBT (n = 43), psychodynamic therapy (n = 50), or nondirective counseling (n = 48). The intervention was conducted in-home with all participants assessed at 4.5 months postpartum, and at 9, 18, and 60 months. All three interventions significantly decreased EPDS scores at 4.5 months, relative to the control group; notably, only psychodynamic therapy produced a reduction in depression rates based on DSM-III-R, compared to controls. However, treatment gains were not maintained at 9 months.

Using a group format, CBT was examined in a pilot trial consisting of 20 Australian women who were within 6 months postpartum and scored > 12 on the EPDS (Meager & Milgrom, 1996). Women were randomly assigned to either a wait-list control

group (n = 10) or the intervention group (n = 10). The intervention consisted of a 10-week program based on CBT principles that targeted PPD risk factors. Six of the women in the intervention completed the study, with participants in the intervention showing a statistically significant improvement in depression; notably, however, these women were still moderately depressed. Significant differences in depression scores were not detected in the control group during the 10-week program.

Taken together, these studies lend support for the role of CBT interventions in the treatment of PPD. However, they do not support the additional benefit to CBT in combination with medication, and do not support CBT as distinctly beneficial for PPD when compared to other treatments (e.g., antidepressants). These studies also suffer from methodological limitations such as: small sample sizes (Chabrol et al., 2004; Prendergast & Austin, 2001; Meager & Milgrom, 1996), poor randomization method (Prendergast & Austin, 2001; Chabrol et al., 2004; Cooper, et al., 2003), and lack of an adequate control group (Appleby et al., 1997).

Psychosocial Interventions

In comparison to CBT and IPT, the psychosocial interventions are unstructured and nonmanualized, and include peer (Dennis, 2003) and partner (Misri et al., 2000) support, and nondirective counseling (Cooper et al., 2003; Holden, Sagovsky, & Cox, 1989; Wickberg & Hwang, 1996). Supportive and nondirective counseling, as well as peer support interventions, have yielded beneficial effects for postpartum women presenting with mild to moderate depression. Importantly, epidemiologic data and findings from prospective studies have consistently identified disruptions in social support as a PPD risk factor (Beck, 2001; Xie, He, Koszycki, Walker, & Wen, 2009).

For example, in a prospective study of a cohort of Chinese pregnant women, low social support during pregnancy and postpartum was associated with an increased risk for postpartum depression, with the highest risk for those women who had low practical support, such as assistance with caring for the newborn (Xie et al., 2009). Despite the limitations of this study affecting generalizability (e.g., married Chinese primiparous women with no obstetric complications and use of a rating scale validated in Chinese population), findings suggest that social support may be important and serve as a protective factor in the treatment of depressed postpartum women.

In a pilot study, a novel intervention using a telephone-based peer support group was used to evaluate the effect of mother-to-mother support on depressive symptomatology in a postpartum population identified as high risk with a score > 9 on the EPDS (Dennis, 2003). The intervention significantly outperformed a care as usual group in reducing depressive symptoms at endpoint (8 weeks). In a larger multisite trial conducted more recently, investigators showed that postpartum women at high risk for developing PPD who received telephone-based peer support over the course of 12 weeks were at lower risk for developing PPD (defined by a score > 12 on the EPDS), relative to a care as usual control group (Dennis et al., 2009). In a study conducted in Sweden, researchers showed that six sessions of nondirective counseling with child health nurses significantly outperformed routine primary care for depressed postpartum women (N = 31) (Wickberg & Hwang, 1996). Similar results were found in depressed postpartum women receiving 8-weekly sessions of nondirective therapy by trained nurses in the United Kingdom (Holden et al., 1989).

Despite the findings to support lack of partner support as an important risk factor for PPD (see Fitelson et al., 2011), few studies have examined the role of partner or other family support in the treatment of PPD. In one survey-based study, shared activities, problem-solving, and positive feedback from the partner was associated with lower depression scores at 8 weeks postpartum (Dennis & Ross, 2006). In a qualitative study, women recovering from PPD identified the following factors to be most important in their improvement: emotional and practical, improved communication with partner, and emotional support from friends (DiMascio, Kent, Fiander, & Lawrence, 2008). Further, in a small nonblinded study examining the role of partner support in the treatment of PPD, 29 depressed postpartum women were randomized to receive 7 sessions of psychoeducation with their partners (support group), or without (control group) (Misri et al., 2000). Women in the active treatment group showed significant reductions in depressive symptoms, relative to those women in the control group. While these studies do not yield sufficient data to support the efficacy of a partner-based intervention for PPD, there is some evidence to suggest that including the partner in the treatment process may be beneficial for depressed postpartum women.

In conclusion, a review of psychological and psychosocial treatments suggest that most studies found strong and significant effects for psychological treatments (e.g., Chabrol et al., 2004; Meager & Milgrom, 1996; O'Hara et al., 2000), while other studies yielded weak or nonsignificant effects (e.g., Prendergrast & Austin, 2001). Among these treatments for PPD showing the most promise are CBT and IPT, the most effective and well-researched psychological therapies for PPD to date. As seen with pharmacological treatments, however, nonpharmacological treatments also present with methodological

weaknesses, including: 1) small sample sizes (Meager & Milgrom, 1996; Misri et al., 2000; Wickberg & Hwang, 1996); 2) poorly defined treatment interventions (Appleby et al., 1997), and 3) weak efficacy (Holden et al., 1989).

Treatment Barriers and Preferences

Barriers

It is important to understand barriers to receiving adequate care, and ways to promote help-seeking behaviors in depressed postpartum women. Maternal barriers to seeking care from a mental health provider include disclosing emotional problems to an unknown treatment provider, shame, stigma, and culturally-relevant factors such as the fear of being characterized as "mentally ill" (Dennis & Chung-Lee, 2006; O'Mahen & Flynn, 2008; O'Mahony et al., 2013). Structural barriers include access to health care and the tendency for treatment providers to "normalize" the mother's depressive symptoms (Dennis & Chung-Lee, 2006).

Preferences

Regarding maternal treatment preferences for PPD, women are reluctant to take antidepressant medication (Boath et al., 2004; Chabrol et al., 2004). In addition to concerns with antidepressant use, women often report a fear of addiction to medication and apprehension about potential side effects or harm relating to long-term medication use as significant concerns (Boath et al., 2004). Notably, negative perceptions regarding medication use are maintained even after symptom remission (Boath et al., 2004). Finally, in addition to factors such as peer support in a group setting and positive interactions with partner and family, relaxation techniques, self-care, and physical activity were among the most commonly identified treatment preferences by depressed postpartum women (Dennis & Chung-Lee, 2006). Taken together, the PPD treatment

literature suggests that postpartum women prefer nonpharmacological versus pharmacological treatment options for PPD.

In sum, most of the research to date supports the use of IPT as the first-line treatment for PPD (O'Hara et al., 2000). Antidepressant medication use also is supported to a lesser degree by one randomized controlled trial (Appleby et al., 1997), and 4 uncontrolled trials (Misri et al., 2004; Stowe et al., 1995; Cohen et al., 2001; Suri et al., 2001), with mixed findings surrounding the role of medication in preventing recurrent PPD (Wisner et al., 2004; Wisner et al., 2006). Psychotherapy is often preferred over antidepressant medications by breastfeeding depressed mothers, and to a lesser extent by non-breastfeeding depressed mothers (Chabrol et al., 2004). Nonetheless, women suffering from PPD may seek alternatives to conventional forms of treatment because of medication safety concerns, stigma issues in the treatment of mental illness, limited efficacy, or personal beliefs.

Complementary and Alternative Medicine (CAM)

The U.S. National Institutes of Health, National Center for Complementary and Alternative Medicine (NCCAM) defines *complementary and alternative medicine* (CAM) as a 'form of medicine consisting of systems, practices, and consumer products that are outside the realm of traditional or conventional forms of medicine' (NCCAM, 2008). Alternative medicine is often used as a replacement for conventional and complementary is incorporated as an adjunct to conventional medicine. According to NCCAM (2008), CAM therapies are categorized as follows: 1) whole medical systems, 2) mind-body medicine, 3) biologically-based therapies, 4) manipulative and body-based methods, and 5) energy therapies. CAM therapies include: acupuncture, exercise, diet,

light therapy, fish oil, herbal remedies (e.g., St. John's Wort), meditation, relaxation, and yoga (Freeman, 2009; Wu et al., 2007). Evidence for the efficacy for these alternative forms of therapy is growing, with several studies on yoga and exercise demonstrating therapeutic effectiveness superior to no-active controls for depression and anxiety (Ross & Thomas, 2010).

The 2007 United States National Health Interview Survey (NHIS) indicated that close to 40% of adults used at least one CAM therapy in the past 12 months (Barnes, Bloom, & Nahin, 2008). According to the NHIS in 2002, correlates of CAM use included gender (higher prevalence in women), higher levels of education, engaged in leisure-time activity, and had medical comorbidities. Regarding influence of ethnic differences on CAM use, mind-body interventions were used most often for prevention across all ethnic groups (Grzywacz, Lang, Suerken, Quandt, Bell, & Arcury, 2005). Notably, African-Americans used biologically-based therapies (51.1%) and mind-body therapies (relaxation, yoga: 92%) more often than other ethnic groups for the prevention of illness (Brown, Barner, Richards, & Bohman, 2007). In a national survey conducted in the late 90s on the use of 24 complementary and alternative therapies for the treatment of chronic conditions, 9.4% of the respondents reported suffering from anxiety, and 7.2% reported severe depression in the past 12 months (N = 2,055) (Kessler et al., 2001). Of the total respondents, over 50% with self-diagnosed depression and 60% with self-diagnosed anxiety reported using CAM therapies to treat these conditions within the past 12 months. Another study examining the patterns of and reasons for use of CAM therapies in a depressed, female population showed that 54% (n = 220) reported past year use of a CAM therapies (e.g., massage, yoga, herbal remedies) (Wu et al., 2007).

Notably, participants' most frequently cited reasons for use of these therapies included: (a) wanting the therapies to be based on a "natural" approach, (b) wanting a treatment that was congruent with their own values/beliefs, and (c) previous negative experiences with conventional forms of treatment (e.g., adverse side effects) (Wu et al., 2007). Additionally, individuals who are already practicing self-care strategies (e.g., regular exercise, consume healthy foods) are attracted to the holistic nature and focus of deriving benefit from the body's natural ability to heal that is fundamental to CAM practices (Schuster, Dobson, Jauregui, & Blanks, 2004; Hsu, Cherkin, Hoffmeyer, Sherman, & Phillips, 2011).

Qualitative research suggests that the typical profile of a CAM user is associated with characteristics such as *perceived control* and *active participation* in treatment (Bishop, Yardley, & Lewith, 2007). For example, CAM therapies may be perceived as a form of treatment that facilitates the process of taking an active role in the management of illness (Bishop et al., 2007). Additionally, coping strategies have been identified as factors related to preference for CAM therapies given their hypothesized link to constructs such as *perceived control* and *active participation* in treatment (Bishop et al., 2007). In particular, one study showed that active coping and expressing emotions were associated with CAM use in a population of gay HIV-positive men, while no associations were detected between maladaptive coping (e.g., avoiding) and turning to emotions (Knippels & Weiss, 2000). In general, there is some evidence to suggest an association between CAM use, active coping strategies, and participation, with evidence primarily from cancer and HIV populations (Bishop et al., 2007).

CAM Therapies for Postpartum Depression

Because of the high prevalence of postpartum depression (PPD) and the risks associated with conventional forms of treatment, it is important to further examine the role of alternative treatments in PPD. Women are increasing their use of CAM therapies to treat depression (Wu et al., 2007) and perinatal depression more specifically (Freeman, 2009). To date, CAM therapies yielding the greatest empirical support for PPD are acupuncture, exercise, omega-3 fatty acids (fish oil), and to a lesser extent bright light therapy and massage (Freeman, 2009).

A recent randomized controlled trial (RCT) examined the effects of acupuncture on depression during pregnancy (Manber et al., 2010). According to traditional Chinese medicine, acupuncture addresses the imbalance of energy in the body stemming from trauma that is associated with the development of mental and physical illnesses (Manber et al., 2010). Depressed pregnant women meeting DSM-IV criteria for major depression were randomized to receive either acupuncture specific for depression ($n = 52$), or one of two active controls: control acupuncture ($n = 49$) or massage ($n = 49$). The treatments lasted 8 weeks, with 12 sessions total. A significant difference in decreased symptom severity was detected in the acupuncture group, relative to the combined controls, Cohen's $d = .39$, and the control acupuncture alone, Cohen's $d = .46$, $p < .05$. Moreover, the acupuncture group also showed a significantly greater response rate (63%), relative to the combined controls (44.3%; $p < .05$) and control acupuncture alone (37.5%; $p < .05$). Together, these findings suggest that acupuncture may serve as a viable treatment option for depressed pregnant women, and may extend to the perinatal population more generally.

Within the broader context of the depression treatment literature, exercise has been found to promote mental and physical well-being (e.g., Brosse, Sheets, Lett, & Blumenthal, 2002). Thus, the role of maternal exercise for PPD has been examined in several studies. The health benefits of postpartum exercise are well-documented in the exercise literature, including improved cardiovascular fitness, energy (Sampselle, Seng, Yeo, Killion, & Oakley, 1999), and psychosocial functioning (Mottola, 2002). Several studies have investigated the role of exercise in reducing symptoms of postpartum depression, including both randomized controlled trials and observational studies (Daley, MacArthur, & Winter, 2007).

In one randomized controlled trial, 20 Australian depressed women (EPDS score ≥ 12) who had given birth within the past 12 months were randomly assigned to either an exercise intervention (12-week exercise and social support program; $n = 10$) or control (2 sessions of exercise over a 6-week period and phone support at week 6; $n = 10$) group (Armstrong & Edwards, 2003). Mothers receiving the intervention reported significantly lower EPDS scores, relative to those in the control group at post-intervention, pram walking = 4.6; control = 14.8; $p < .01$. It is notable that at baseline, many participants were receiving medication or psychological therapy to treat their postpartum depression.

A second trial was conducted by the same researchers to examine the effects of a twice-weekly pram walking intervention compared with the effects of a social support intervention (Armstrong & Edwards, 2004). Postpartum women ($N = 19$) scoring 12 or greater on the EPDS were randomized to either the exercise intervention ($n = 9$) or social support group ($n = 10$). The exercise intervention showed significantly greater reductions in EPDS scores, relative to the social support group, at the end of the 12-week

intervention period, exercise = 6.3; social support = 13.3, $p < .05$. Both RCTs reported substantial reductions in depressive symptoms in participants receiving an exercise intervention with pram walking, compared to a control group. However, the validity of these studies is affected by small sample sizes and short-term follow-up.

Omega-3 fatty acids have stimulated the most epidemiological and clinical research for perinatal depression. This attention seems to be driven by the well-known health benefits of Omega-3 fatty acids for the perinatal population, and the data to suggest its role in improving mood (Freeman, 2009). For example, two randomized placebo-controlled trials have been conducted in which omega-3 fatty acids were compared to placebo for perinatal depression. In both studies, no significant differences were detected between omega-3 fatty acids and placebo (Freeman, Davis, Sinha, Wisner, Hibbeln, & Gelenberg, 2008; see also Freeman, 2009). In contrast to the positive findings in the general depression literature, studies examining the use of omega-3 fatty acids for PPD have yielded mixed results.

The role of infant and maternal massage in the treatment of PPD also has been examined, with mixed findings. Results from studies examining the effects of maternal massage on symptoms of depression and anxiety show positive outcomes on psychological functioning and infant interactions (Coelho, Boddy, & Ernst, 2008). In contrast, results from studies on the role of infant massage on maternal depression have been mixed with one study suggesting substantial improvements in depression outcomes occurring between initial intake and the first class only, calling into question the specific effects of the massage intervention and the high rate of attrition occurring for those assigned to the infant massage class (Field, Grizzle, Scafidi, & Schanberg, 1996). A

second study in this area also yielded conflicting findings, showing modest support for infant massage with depressed postpartum women (O'Higgins, Roberts, & Glover, 2008). In this study, depressed postpartum women were randomly assigned to 6 sessions of infant massage or to a support group at 4 weeks postpartum. A nondepressed control group did not receive the intervention, but was followed longitudinally along with the depressed group. Women in the infant massage class and support group improved over time; however, there were no significant differences in depression scores between conditions at post-treatment and the one-year follow-up. Further, both groups maintained significantly higher levels of depression, relative to the nondepressed control group (O'Higgins et al., 2008). In summary, the use of massage as a treatment for PPD is associated with little risk and may have some benefit for both mother and baby. However, similar to the other forms of CAM treatments for PPD, its efficacy remains unclear.

Similar to massage, the use of bright light therapy for PPD is an attractive treatment option because there are no documented risks for breastfeeding mothers. Nonetheless, the findings for light therapy for PPD are somewhat discouraging, despite promising results showing a significantly greater antidepressant response with bright light therapy, relative to placebo, in an antenatal depressed population (Epperson et al., 2004). Currently, there is inadequate data to support the efficacy of bright light therapy for PPD. In the singular study examining the effects of bright light therapy on symptoms of postpartum depression, 15 outpatient women with PPD were randomly assigned to receive either bright light therapy (n = 10) or a dim light placebo (n = 5) daily for six weeks (Corral, Wardrop, Zhang, Grewal, & Patton, 2007). At six weeks, significant

reductions in depressive symptoms from pre- to post-treatment were detected in both groups; however, significant between group differences were not found.

In sum, CAM treatments address barriers to care and maternal treatment preferences identified in the context of pharmacological and nonpharmacological treatment strategies (e.g., safety issues with antidepressants and discomfort with sharing personal feelings). In particular, CAM treatments offer general health benefits (e.g., Omega-3 fatty acids and exercise) and are associated with little to no risk. Nonetheless, at this time there are limited efficacy data to support these alternative treatments as a first-line treatment for postpartum depression. Further, similar methodological limitations associated with conventional forms of treatment are present in CAM treatment studies as well (e.g., small sample size, lack of adequate comparison group). Taken together, additional treatment trials are necessary to better understand the role of CAM therapies in the treatment of postpartum depression.

The prevalence of CAM therapies is substantial, and growing, with a higher percentage of females reporting use of CAM treatments (Barnes et al., 2008). Further, *yoga* was identified as a top 10 CAM option, with improving overall mental and physical well-being as a commonly reported reason for practicing yoga (Barnes et al., 2008). The lack of efficacy data, methodological weaknesses of treatment studies, and barriers to care identified in the treatment literature for PPD support the need for additional treatment trials. This, coupled with the empirical support and acceptability of yoga in treating various mental and health-related conditions, suggests that an efficacy trial examining the effects of yoga for depressed postpartum women may be worthwhile.

Yoga

History of Yoga

Yoga is an ancient holistic practice that originated in India, and is derived from the Sanskrit word meaning "to yoke, or to unite" (Desikachar, 1999). The practice of yoga traces back to 3000 BCE, and has evolved over four periods known as Vedic (2000 BCE-600 BCE), Pre-Classical (600-200 BCE), Classical (200 BCE), and Post-Classical (Feuerstein, 2001). The Pre-Classical period is associated with the emergence of the *Upanishads*, 200 texts that have a strong influence on Hindu philosophy, as well as the the *Bhagavad Gita*, considered one of the oldest written texts in the history of yoga (Feuerstein, 2001). The foundations of meditation and the concept of a path to enlightenment *(samadhi*) begin to emerge during the Pre-Classical period as well (Feuerstein, 2001; Grilley, 2012; Powers, 2008). Subsequently, the Classical period witnessed the emergence of Patanjali's *Yoga Sutras*, which outlines the *eight-limbed path* of yoga, a philosophy that underlies most of yogic principles in modern culture (Iyengar, 1993). This philosophy of yoga comprises eight parts, or limbs: *yama* (ethical guidelines), *niyama* (spiritual observances), *asana* (physical poses), *pranayama* (breathing exercises), *pratyahara* (control of the senses), *dharana* (concentration), *dhyana* (meditation), and *samadhi* (state of bliss) (Iyengar, 1993). The *Yoga Sutras* is considered to be the leading text on yoga, offering theoretical frameworks in which to approach calming the mind and responding to "mental chatter" (Iyengar, 2001).

Prevalence of Yoga

A National Health Interview Survey on Americans' use of CAM in the year 2007, published by the National Center for Complementary and Alternative Medicine

(NCCAM, 2008), showed that among adults surveyed in the United States (*N* = 23,393), the use of mind-body therapies increased from 2002 to 2007. In particular, yoga was reported as one of the 10 most commonly used CAM therapies among adults, with 6.1% reporting the use of yoga in the past 12 months (Barnes et al., 2008). Additionally, a recent national survey of yoga practitioners (*N* = 1,045) showed that individuals practicing yoga believed that their health improved as a result of their practice. Specifically, participants indicated that the yoga practice improved their energy (84.5%), mood (86.5%) and their social relationships (67%) (Ross, Friedmann, Bevans, & Thomas, 2013). *Hatha*, a more physical form of yoga, is the most commonly practiced style of yoga in Western culture today (Feuerstein, 2001). In its full expression, this system of yoga integrates three basic components: breath (*pranayama*), physical poses (*asanas*), and meditation (*dhyana*) (Feuerstein, 2001; Stephens, 2010).

In an open trial investigating the feasibility and acceptability of Hatha (specifically Vinyasa Flow) yoga in a population of depressed women, the acceptability of yoga was supported as evidenced in a high retention rate of 10 out of 11 people recruited for the trial (dropout rate = 9%) (Uebelacker et al., 2010b). Several themes emerged from this feasibility study, including emotional (e.g., feeling calm and relaxed), physical (e.g., improved sleep and weight loss), and social (e.g., feeling connected to others in class) benefits (Uebelacker et al., 2010b). More recent feasibility and acceptability data from a yoga study on 27 depressed women suggested that work and personal responsibilities were key barriers to participating and completing the study. Yoga's acceptability was supported by improved mood and a feeling of connectedness amongst the participants and with other participants in the class (Kinser, Bourguignon,

Whaley, Hauenstein, & Taylor, 2013). Taken together, investigation into yoga as a CAM therapy for improving and maintaining emotional and physical health is gaining momentum in the empirical literature (Field, 2011; Li & Goldsmith, 2012; Lin, Hu, Chang, Lin, & Tsauo, 2011; Ross et al., 2013).

Active Components of Yoga

Yoga is a holistic system that integrates mindfulness, breath, and movement (poses) (Feuerstein, 2001; Stephens, 2010); thus, emphasis is placed on treating the whole person rather than on symptom reduction alone (Bishop et al., 2007). This holistic view may appeal to individuals who prefer treatments that focus on the mind-body connection. In the small number of studies examining the efficacy of yoga, researchers have yet to examine the influence of specific elements of yoga (e.g., poses, mindfulness) to inform understanding into how one style of yoga (e.g., Vinyasa Flow, Iyengar, Yin) may be more efficacious for a targeted population (e.g., postpartum women), relative to another style.

In one study, researchers examined the effects of an Iyengar-based yoga intervention (a form of Hatha yoga) on reducing symptoms of depression (Shapiro & Cline, 2004). Findings suggested that backbends and inversions may be associated with mood enhancement, which is consistent with yogic principles (Feuerstein, 2001; McCall, 2007). However, the empirical support for this relationship is equivocal at best due to the lack of an adequate control group and small sample size to reliably examine the specific effects of poses on mood.

There is a small body of literature to support the therapeutic application of Iyengar yoga (e.g., Shapiro & Cline, 2004; Shapiro, Cook, Davydov, Ottaviani, Leuchter,

& Abrams, 2007), developed by B.K.S. Iyengar, primarily due to its emphasis on precision and alignment (Iyengar, 2001). This particular style of yoga incorporates the use of props (e.g., bolsters, blankets, blocks) to make yoga accessible to beginners, despite limited experience and flexibility (Iyengar, 2001). Other styles of yoga theorized to have therapeutic benefit include Anusara, Ashtanga, Bikram, and Vinyasa Flow (Stephens, 2010). Because the empirical support on yoga is in its early stages, and requires further research into its efficacy, the field has yet to examine potential mediators of change. Thus, it is difficult at this point to identify important elements of a yoga sequence that are associated with a desired therapeutic benefit (e.g., reduced symptoms of depression, improved quality of life).

Mindfulness

The emphasis in most styles of yoga is on the physical aspect through the practice of the poses. Another important component of yoga is mindfulness (Feuerstein, 2001). Some styles of yoga integrate mindfulness meditation that is practiced at the beginning of a class with the introduction of the breath, and at the close of a class with the resting pose (*savasana*). In addition, mindfulness may be practiced during a class with the intentional linking of breath with movement from one pose to another, which is generally referred to as vinyasa flow (Stephens, 2010).

According to ancient Buddhist traditions, mindfulness is broadly defined as the ability to maintain attention on a chosen meditative object (e.g., the breath), with an emphasis on returning to beneficial (versus negative) thoughts (Bishop et al., 2004). The most commonly used definition of mindfulness is that of Jon Kabat-Zinn's, who defined it as "paying attention in a particular way: on purpose, in the present moment and

nonjudgmentally" (Kabat-Zinn, 1994, p. 4). Mindfulness is operationalized in psychological models as a multifaceted construct assessed by self-report measures tapping abilities to carefully observe and label internal or external experiences in a "non-reactive, non-judgmental manner" (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The practice of mindfulness facilitates increased awareness of present-moment experiences and attentional focus, rather than focusing on clearing the mind of thoughts (Bishop et al., 2004). Thus, a mindfulness practice can support the experience of disengaging from evaluative thinking through cultivating an attitude of curiosity and attention to ongoing reactions to emotions, thoughts, and feelings (Shapiro, Oman, Thoresen, Plante, & Flinders, 2008). In the mindfulness-based therapy literature, disengaging from evaluative thinking serves to disrupt the processes by which negative mood and rumination are sustained (Teasdale, Segal, Williams, Ridgeway, Soulsby, & Lau, 2000).

Mindfulness-based therapy (MBT)—which encompasses mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR)—is becoming increasingly popular as a form of treatment for promoting psychological and physical well-being. Mindfulness-based stress reduction (MBSR) is an 8-week program in which participants attend weekly classes and learn to practice mindfulness meditation (MM) with the goal to increase mindfulness in daily life (Kabat-Zinn, 2003). Mindfulness-based cognitive therapy (MBCT), recognized as the primary area of research investigating the impact of mindfulness on depression, is also an 8-week group treatment that integrates MBSR and cognitive therapy to target negative thought patterns associated with the vulnerability to experience depression. Here, participants practice

mindfulness with an emphasis on noticing shifts in mood and learning coping strategies that encourage observing, rather than judging, the shifts (Teasdale et al., 2000). In a recent meta-analytic review of the effects of MBT on symptoms of depression and anxiety, 39 studies were analyzed yielding a moderate effect size for improving anxiety (Hedges' g = .63) and mood symptoms (Hedges' g = .59) from pre- to post-treatment (Hofmann, Sawyer, Witt, & Oh, 2010). To this end, mindfulness as a component of yoga may help to generate beneficial effects on psychological functioning and quality of life.

More recent empirical research into the benefits of mindfulness lends support for its role in targeting rumination and dysfunctional attitudes (e.g., Jain et al., 2007; Ramel, Goldin, Carmona, & McQuaid, 2004; Shapiro et al., 2008). Importantly, rumination and distraction as coping styles have been associated with negative affect, higher levels of depressive symptoms, and are strong predictors of depression and anxiety (Nolen-Hoeksema, 2000). Theoretical models suggest that MM interventions may prevent depression relapse by counteracting the vulnerability to engage in negative ruminative thought patterns (Teasdale, Moore, Hayhurst, Pope, Williams, & Segal 2002). Notably, a study examining the effects of MM on changes in affect showed that MM practice may reduce rumination (negative cognitions) in individuals with a history of depression, independent of changes in affect (Ramel et al., 2004). Through a regular yoga practice that promotes mindfulness skills, such as when a yoga instructor reminds students to bring their awareness back to their breath during class, or asks students to notice physical sensations in the body while holding a certain pose, one can practice mindfulness and may experience an increase in mindfulness skills.

Physical Activity

Postpartum women often experience weight gain and decreased fitness levels following childbirth, with weight gain an important predictor of poor psychological functioning during this time (LaCoursiere, Baksh, Bloebaum, & Varner, 2006). Moreover, studies show that postpartum women are susceptible to inactivity immediately following childbirth, and report reduced levels of activity relative to pre-pregnancy (Sampselle et al., 1999). Taken together, promoting physical activity in depressed postpartum women may be beneficial.

Most forms of Hatha yoga include physical activity by way of practicing the physical poses. The physical aspect of yoga may help to support improved psychological and physical functioning by counteracting inactivity and agitation associated with depression and anxiety (McCall, 2007). Further, given that mindfulness may have specific antidepressant effects (e.g., Teasdale et al., 2002; Jain et al., 2007), learning mindful movement in the context of a yoga class may potentially support its effectiveness, outweighing the benefits of exercise alone in reducing symptoms of depression (Ross & Thomas, 2010). The physical component of yoga also may function to promote a sense of self-mastery and/or self-efficacy through regular practice of the poses. For example, a yoga class that emphasizes alignment of poses, and the use of breath to link poses, may instill a sense of accomplishment as a student learns to hold the poses while staying with potential distractions such as losing balance or focus, and continue to maintain a connection with the breath. Through this process, it is hypothesized that yoga may cultivate a sense of mastery and self-efficacy, which may serve as a form of *positive reinforcement*. In fact, behavioral theories of depression

suggest that decreases in positive reinforcement are associated with onset or relapse of depression, and that a primary aim in treating depression should be to support access to environmental "antidepressant reinforcers" (Longmore & Worrell, 2007).

Empirical Evidence of Yoga

Over the past few decades, research into CAM therapies has witnessed a confluence of Western medicine and psychological theories with ancient Eastern practices such as yoga and mindfulness meditation for working with psychological and physical distress. This marriage of ideas is being expressed through the growing empirical base for yoga as a CAM therapy for improving psychological and physical health. The existing body of literature on yoga's efficacy spans a wide range of chronic medical conditions, including stress (Ross & Thomas, 2010), pain (Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005), and cancer (Carson, Carson, Porter, Keefe, Shaw, & Miller, 2007; Lin et al., 2011), as well as pregnancy-related conditions such as labor pain (Chuntharapat, Petpichetchian, & Hatthakit, 2008) and sleep disturbance (Beddoe, Lee, Weiss, Kennedy, & Yang, 2010). Further, empirical studies have focused on psychological functioning including depression and anxiety (Field, 2011; Kirkwood, Rampes, Tuffrey, Richardson, & Pilkington, 2005; Uebelacker, Epstein-Lubow, Gaudiano, Tremont, Battle, & Miller, 2010a). The following review of empirical support for yoga will highlight evidence for depression and anxiety, and quality of life (including role functioning), as these areas inform the current investigation into yoga as a CAM therapy for PPD.

Depression

As previously discussed, management of self-diagnosed depression and anxiety is a commonly reported reason for using a CAM treatment option (e.g., Kessler et al., 2001). Individuals may prefer an alternative therapy such as yoga due to a lack of response with previous therapy, adverse side effects of medication, and/or a preference for CAM treatments in general. To date, eight trials of yoga as an efficacious treatment for depression have been conducted (Uebelacker et al., 2010a).

In a sample of 30 depressed outpatients, active components of yoga including *pranayama* (breath) and *asanas* (physical postures) were offered for 20 minutes each day for a total of 3 days (Broota & Dhir, 1990). For the purpose of this study, the intervention was named the "Broota technique," and was compared to a progressive relaxation technique and a control intervention, which consisted of the participant narrating current complaints and state of mind. Results of the study suggested that the Broota technique showed significantly greater effects on a depression symptom checklist after the 3-day intervention, relative to the control group ($p < .05$). The Broota technique was described as being favorable to the relaxation technique; however, there were no data supporting this finding. Further, methodological weaknesses of this study include use of a symptom checklist developed specifically for the study (i.e., no established psychometric properties) to measure change in depressive symptoms, lack of data on baseline comparison of groups, and no description of randomization method.

In another treatment trial, 30 individuals who met DSM-IV diagnostic criteria for major depression were randomized to a yoga combined with antidepressant medication group, or to an attention control combined with antidepressant medication group

(Sharma, Das, Mondal, Goswampi, & Gandhi, 2005). The intervention was based on *Sahaj* yoga, a style of yoga emphasizing meditation, and consisted of 3 30-minute classes on a weekly basis for 8 consecutive weeks. The yoga group showed significantly greater reduction in depression as assessed via the HDRS, relative to the control group, at 2 months post-treatment, Cohen's $d = .76$. Further, the number of remitters was significantly higher in the yoga group at 2 months post-treatment, relative to the control group ($p = .02$). Although study findings were significant for the yoga group, it is notable that the yoga intervention focused on meditation and did not incorporate two (breath and physical poses) of the three components posited as essential for a comprehensive yoga class. In a randomized pilot trial, the effects of meditation with Hatha yoga plus psychoeducation and group therapy with hypnosis plus psychoeducation were compared to psychoeducation alone (control group) in 46 participants presenting with either dysthymia or major depression (Butler et al., 2008). Significant differences were not detected between groups in depression scores (assessed using the HDRS) over time (HDRS was administered at baseline, 6, and 9 months). However, the meditation plus yoga group showed a significantly greater remission rate ($n = 10$), relative to the control group ($n = 5$) at the 9-month follow-up assessment, χ^2 (1, 27) = 4.64, $p < .031$, Cramer's $V = -.41$. It is noteworthy that 17.4% ($n = 8/46$) of the participants were taking antidepressants and/or receiving psychotherapy at baseline, with 40% (n = 16/40) of the participants engaging in one or both of these forms of treatment at the 9-month follow-up. Of the 23 remitters, 9 (39%) were in psychotherapy and/or taking antidepressant medication at time of follow-up. Therefore, the findings from this study should be

interpreted with caution when considering the interventions as efficacious treatment options for long-term clinical depression.

In contrast to these studies, two studies examining the effects of Sudarshan Kriya Yoga (SKY) on depressive symptoms showed mixed results. Sudarshan Kriya Yoga is a style of yoga that involves rhythmic hyperventilation at different rates of breathing, and has demonstrated efficacy based on an open clinical trial for dysthymia (Janakiramaiah et al., 1998). In a subsequent triple arm RCT assessing the effects of the SKY breathing technique, 45 participants with DSM-IV defined melancholic depression and a score of ≥ 17 on the HDRS were randomized into three equal groups to receive SKY, or two depression treatments—Electroconvulsive Therapy (ECT) or imipramine—for 4 weeks (Janakiramaiah, Gangadhar, Murthya, Harish, Subbakrishnab, & Vedamurthachar, 2000). The intervention consisted of at least 4 45-minute sessions each day (the intervention protocol was to practice daily for six days a week) of SKY yoga, over the course of the 4-week intervention. Findings suggested that ECT outperformed SKY yoga, Cohen's d = 0.91 favoring ECT, and that SKY and imipramine were not significantly different in depression scores at post-treatment (4 weeks after randomization), Cohen's d = 0.24, favoring imipramine. The null findings associated with the yoga intervention may be related to the type of yoga performed in the intervention, with its emphasis on breath and minimal focus on mindfulness and/or physical activation associated with the integration of yoga poses.

In a study with a similar design, 30 individuals diagnosed with DSM-IV major depression (including > 18 on HDRS) were randomized to either a "full" SKY or a "partial" SKY group (full SKY without rhythmic breathing), with both groups receiving

the intervention daily for 4 weeks (Rohini, Pandey, Janakiramaiah, Gangadhar, & Vedamurthachar, 2000). Both groups yielded positive but non-significant effects as evidenced in reduced depression scores on the BDI for both groups, Cohen's $d = 0.68$ favoring full SKY.

In contrast to these studies, empirical investigations into the effects of Iyengar yoga on psychological functioning have generally yielded positive and consistent results. In one trial, college students ($N = 28$) presenting with mild depressive symptoms (a score of 10-15 on the BDI) were randomized to either an Iyengar yoga intervention or a wait-list control group (Woolery et al., 2004). The intervention consisted of 2 1-hour yoga classes on a weekly basis for 5 consecutive weeks. Participants in the yoga group experienced significantly greater reductions in scores on the BDI at post-treatment, relative to the wait-list control group, yoga = 3.90; control = 11.00, $p < .01$, with a similar pattern emerging for symptoms of anxiety as assessed using the State Trait Anxiety Inventory (STAI) ($p < .001$) (Woolery et al., 2004). In a single-group study, the effects of an 8-week Iyengar yoga intervention (20 yoga classes total) on participants with major depression in partial remission were examined (Shapiro et al., 2007). In the 17 completers, significant differences were detected on measures of depression (HDRS: 12.4 vs. 6.2, $p < .001$) and anxiety (STAI: 53.0 vs. 47.4, $p < .005$) at post-treatment, with more than 50% ($n = 11/17$) achieving remission at treatment termination.

In one study examining subclinical depression, 50 female college students were randomized to either a Savasana group that practiced rhythmic breathing and relaxation for 30 minutes daily over the course of one month or a control group (Khumar, Kaur, & Kaur, 1993). The Amritstar Depression Inventory and Zung Depression Rating Scale

(ZDRS) were used to assess initial diagnosis, with the ZDRS used as the depression outcome measure. Notably, the investigators reported that participants randomized into the study were identified as cases of "severe depression"; however, no baseline scores were provided for either of the depression measures. Findings revealed a significant difference in depression scores at mid- and post-treatment in the yoga group, but not in the control group. Further, participants in the yoga group showed a significantly greater reduction in symptoms of depression at post-treatment, relative to the control group (p = .01).

To conclude, all randomized controlled trials yielded evidence to suggest that yoga is efficacious for treating depression, with the exception of one study that did not directly compare the two groups (Khumar et al., 1993). Nonetheless, due to methodological inadequacies associated with some (and in some cases all) of these studies, findings should be interpreted with caution. These limitations include: (1) use of non-standard depression outcome measures (Broota & Dhir, 1990); (2) clinical interviewer not blinded to treatment assignment (e.g., Khumar et al., 1993; Sharma et al., 2005; Woolery et al., 2004), with the exception of one study (Butler et al., 2008); (3) length of intervention (e.g., 3 or 5 day interventions, Broota & Dhir, 1990; Khumar et al., 1993); and (4) absence of a treatment manual and/or any measure of adherence or competence to ensure that the person leading the yoga class was compliant with the yoga intervention set forth by the investigators (all studies). Finally, studies varied in the style of yoga being practiced. For example, some studies used a style of yoga that focused on breath only (e.g., SKY yoga; Janakiramaiah et al., 2000; Rohini et al., 2000), or a class

that consisted of one pose (savasana) with breath incorporated into the entire class (Khumar et al., 1993).

Anxiety

There is an expanding literature on the beneficial effects of yoga for anxiety disorders. A more recent meta-analysis identified 35 studies examining the effects of yoga and meditation on anxiety and stress (Li & Goldsmith, 2012). The following review of the literature highlights randomized controlled trials that involved yoga as an intervention, and participants with symptoms of anxiety or anxiety disorders.

Few studies have involved samples meeting diagnostic criteria for anxiety disorders. In one study examining the efficacy of yoga for obsessive-compulsive disorder (OCD), eligible participants met diagnostic criteria for OCD based on the DSM-III-R and a score of ≥ 15 on the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) (Shannahoff-Khalsa et al., 1999). Twelve participants were randomized to a Kundalini yoga group and 10 participants to a relaxation combined with mindfulness meditation group and were asked to attend a one-hour class on a weekly basis with an instructor, in addition to participating in a daily practice, for 3 months. The Kundalini yoga intervention included mantra meditation as well as an OCD specific technique involving breathing through only the left nostril. Participants in the relaxation plus meditation group (relaxation group) received Herbert Benson's *Relaxation Response* plus mindfulness meditation. The primary outcome measure was the Y-BOCS, assessed at baseline and at post-treatment (3 months). The yoga group showed significantly greater reduction in obsessive-compulsive symptoms as assessed via the Y-BOCS, relative to the relaxation group, Standard Mean Difference (SMD) = 1.10, 95% CI [-0.02, 2.22].

Further, a reduction of 20% to 35% on the Y-BOCS was identified as a clinically significant change. Participants in the yoga group experienced a 38.4% reduction in obsessive-compulsive symptoms, while those in the relaxation group experienced a 13.9% reduction in symptoms at post-treatment (Shannahoff-Khalsa et al., 1999).

Yoga as a viable treatment option for anxiety in cancer patients has garnered increasing attention in the scientific literature. The effects of an integrated yoga program on symptoms of anxiety, depression, and perceived stress were examined in 58 cancer patients (yoga $n = 35$; supportive counseling (control) $n = 23$) undergoing radiotherapy (Banerjee et al., 2007). The yoga intervention consisted of 1 90-minute session on a weekly basis for 6 weeks, and incorporated yoga poses, meditation techniques designed specifically for cancer patients (e.g., guided imagery of cancer cells, training in positive thoughts), and breathing techniques (pranayama). The Hospital Anxiety and Depression Scale (HADS) and Perceived Stress Scale (PSS) were used as psychological outcome measures. There were significant differences in levels of anxiety and depression assessed using the HADS in the yoga group, relative to the control group, at post-treatment (6 weeks) ($p < .001$). Of note, the control group experienced a significant increase in symptoms of anxiety and depression from pre- to post-treatment. Finally, the yoga group experienced a significant decrease in stress levels assessed using the PSS, relative to the control group, at post-treatment. Together, these findings lend support for the role of yoga in reducing anxiety, depression, and stress in a cancer population. Other studies with cancer patients have been conducted with a focus on quality of life as the primary outcome measure, and effects on mood and anxiety symptoms as secondary outcome measures. In general, these studies show significant reduction in symptoms of anxiety

for participants randomized to yoga interventions, relative to comparison groups (e.g., wait-list control) (Field, 2011; Li & Goldsmith, 2012).

There are a number of studies of the effects of yoga on anxiety levels in subclinical samples. For example, Berger and Owen (1988) compared the effects of swimming, fencing, body conditioning, and yoga classes and showed that only the yoga treatment group reported a significant reduction in state anxiety, as assessed using the State Trait Anxiety Inventory. Similarly, Netz and Lidor (2003) showed that participants in a yoga and swimming group and those participating in the Feldenkrais method (a somatic intervention designed to improve movement and use of self through awareness to reduce pain or limitations in movement and promote general well-being) showed lower anxiety levels relative to a control group. However, in a study conducted with an elderly population, Blumenthal et al. (1991) found that yoga participants performed worse than those in an aerobic exercise group and no better than the other treatment groups on anxiety measures.

Additional studies relying on self-report of anxiety symptoms have yielded mixed results. In a 3 month RCT comparing yoga to diazepam (an anxiolytic), the yoga group reported significantly lower scores on the Institute for Personality and Ability Testing scale at endpoint, whereas the diazepam group did not (Sahasi, Mohan, & Kacker, 1989). These investigators also showed that overall improvement (assessed by a consultant psychiatrist to the study) was greater for the yoga group (76.7%) than for the diazepam group (50%); notably, no statistical significance was associated with this finding (Sahasi et al., 1989). In sum, as with yoga trials for depression, studies investigating yoga for anxiety (subclinical and clinical) yield mixed results. These inconclusive findings may

be a result of methodological limitations including small sample sizes with inadequate power and non-randomization of participants.

Quality of Life

In addition to depression and anxiety, there also is a growing body of literature on yoga as a CAM therapy for improving quality of life (including social functioning) in cancer patients (Carlson & Bultz, 2008; Lin et al., 2011). In one randomized controlled trial, 128 breast cancer patients were assigned to either a 12-week yoga intervention (n = 84), or a 12-week wait-list control (n = 44) (Moadel et al., 2007). The yoga intervention consisted of the 3 basic components of a yoga class (breath, poses, and meditation). At 3 months post-treatment, the yoga group showed significant improvements in overall quality of life ($p < .008$), and emotional ($p < .015$) and social well-being ($p < .004$), as assessed using the Functional Assessment of Cancer Therapy. In a non-randomized study, 20 women undergoing treatment for breast cancer were referred to a yoga program as part of preventative rehabilitation (Ulger & Vardar Yagli, 2010), which consisted of 8 sessions of yoga that included breathing exercises, physical poses, relaxation, and meditation. Significant differences in quality of life scores (assessed using the Nottingham Health Profile) were detected between pre- and post-treatment (8 sessions) ($p < .05$).

Studies investigating the health benefits of yoga, relative to aerobic exercise, suggest that yoga may be as effective as or superior to exercise in improving health-related outcomes. One group of investigators compared the efficacy of a 6-month Iyengar yoga intervention to stationary cycling and a wait-list control on measures of fatigue, alertness, and health-related quality of life among other outcomes in 69 adults

(female: $n = 53$) with multiple sclerosis (Oken et al., 2004). The participants in the yoga and stationary cycling interventions showed significant improvements in fatigue, including the vitality dimension (measures energy and tiredness) of the SF-36, relative to the wait-list control ($p < .01$). However, no significant group differences were detected between the yoga and exercise group. In contrast to these findings, in a study comparing the effects of walking with Iyengar yoga in 135 healthy seniors, the yoga group significantly outperformed the exercise group on levels of fatigue ($p = .006$), and SF-36 quality of life domains: bodily pain (assesses limitations due to the experience of pain) ($p = .006$) and social functioning (assesses the effect of physical and emotional health on social activities) ($p = .006$) (Oken et al., 2006).

Yoga for Postpartum Depression

In general, the results of efficacy studies examining yoga's role in improving emotional and physical well-being are promising despite the methodological weaknesses associated with these studies. Thus, there are several reasons to examine the potential value of yoga for PPD. First, there are data to suggest that yoga is beneficial in reducing symptoms of depression and anxiety, and improving quality of life and social functioning, across diverse populations including cancer patients, psychiatric in-patients, and college students. The treatment literature has identified these as important factors in the context of postpartum depression. Second, drawing from the psychotherapy literature, there may be a theoretical link between yoga and already existing empirically-supported treatments such as Behavioral Activation and MBCT (e.g., Dimidjian et al., 2006; Teasdale et al., 2002) in that certain aspects of yoga (i.e., mindfulness and physical activity) are already active components of these treatments. For example, the ability to

learn difficult poses while staying mindful and connected to the breath during a yoga class may help to foster mindfulness skills. As demonstrated in the MBT literature, mindfulness skills are positively associated with improved psychological functioning (e.g., Jain et al., 2007; Shapiro et al., 2008). In addition, women concerned about drug safety issues associated with medication use, stigma linked to conventional forms of treatment, or prefer a mind-body intervention that emphasizes a holistic approach to understanding illness, may find value in a yoga intervention for PPD.

Limitations of Existing Treatments for Postpartum Depression

The methodological limitations of studies on existing treatment modalities for PPD make it difficult to draw substantive conclusions regarding efficacy and appropriate treatment recommendations. Additionally, barriers to care associated with existing treatments for PPD impact a mother's desire to seek and receive adequate postpartum care, especially when depressed. For example, the effects of antidepressant medications on breastfeeding are a primary concern for many postpartum women (Dennis & Chung-Lee, 2006; Goodman, 2009). Postpartum women, especially those from ethnically and culturally diverse backgrounds, also may find it difficult to discuss personal issues with a therapist (O'Mahony et al., 2013). Maternal treatment preferences suggest that nonpharmacological interventions, including CAM treatment options, may have wider acceptability than nonpharmacological strategies (Dimidjian & Goodman, 2009; Freeman, 2009). Specific to yoga as an efficacious CAM therapy, methodological limitations associated with existing research are similar to those described for well-established PPD treatments (e.g., lack of appropriate control group, small sample size). Further, in accordance with CONSORT guidelines (Moher et al., 2010) for rigorously

controlled randomized trials to support efficacy of a new intervention, there are notable issues including intervention length (e.g., 3 day intervention; Broota & Dhir, 1990), inadequate randomization process, and lack of details regarding the yoga intervention (e.g., style of yoga, type of poses, sequence of poses). Taken together, these design limitations compromise the internal validity of empirical studies, making it difficult to draw substantive conclusions from the research as well as the ability to conduct future research and replication studies.

Importance and Significance of the Current Investigation

There are clear data to support the efficacy of pharmacological and nonpharmacological treatment strategies for postpartum depression (PPD). Nevertheless, barriers to care associated with existing treatment options for PPD (Dimidjian & Goodman, 2009; Fitelson et al., 2011), along with the number of women who are either untreated or receive suboptimal treatment, warrant additional randomized controlled treatment trials for PPD. Complementary and alternative medicine (CAM) treatments for PPD are attractive as evidenced in the growing empirical base and acceptability of these treatments, particularly with respect to the perinatal population (Freeman, 2009). Taken together, the primary aim of the current investigation was to conduct a randomized controlled trial to examine the efficacy of an 8-week Gentle Vinyasa Flow yoga intervention for reducing symptoms of depression in postpartum women. Further, given that the existing PPD treatment literature suggests that comorbid anxiety symptoms (Ross & McLean, 2006), postpartum adjustment (O'Hara et al., 2000), and health-related quality of life (DaCosta et al., 2006) are important factors to consider in the recovery of depressed postpartum women, these factors were included in the current investigation.

There is a growing body of literature highlighting comorbid depression and anxiety in depressed postpartum women (Wenzel et al., 2003, 2005), with data to suggest that anxiety is more prevalent in depressed postpartum women, relative to non-postpartum depressed women (Hendrick et al., 2000). Because efficacy studies have yet to investigate yoga as an alternative treatment option for PPD, it is difficult to formulate hypotheses based on empirical evidence. Nonetheless, existing data from yoga efficacy studies for mood and anxiety symptoms in non-postpartum depressed populations are compelling (e.g., Field, 2011; Uebelacker et al., 2010a). Taken together, Aim 2 was developed to shed light on the effects of yoga in reducing symptoms of anxiety, relative to a WLC group, in depressed postpartum women. As already evidenced in the CAM therapy literature for the cancer populations (Field, 2011), by targeting depression yoga can also reduce symptoms of anxiety. This comorbid relationship can have significant clinical implications and inform the development of yoga interventions for PPD.

Significance of the current investigation can also be found in its focus on postpartum adjustment and maternal role functioning in particular. Research shows that the transition to motherhood can have a significant impact on functioning in the areas of relationships (e.g., partner, family, friends) and work (Beck, 2001; DaCosta et al., 2006; O'Hara et al., 2000). Regarding the potential for yoga to effect change in these areas, previous studies have detected significant improvements in vitality, energy, and social functioning assessed via the SF-36 in a sample of elderly men and women participating in a 6-month Hatha yoga intervention, relative to exercise alone or a wait-list control group (Oken et al., 2006). The significance of Aim 3 is derived from the lack of empirical research into the effects of yoga on postpartum adjustment (e.g., role functioning in the

areas of work, and relationships with family/friends). Second, because the literature on yoga for PPD is non-existent, the current investigation is the first to examine postpartum adjustment as an outcome using the Postpartum Adjustment Questionnaire. Therefore, it is expected that the findings from the current study will inform future research investigating treatments for PPD and its effects on maternal role functioning more broadly.

Finally, there is strong evidence for the negative effects of PPD on quality of life, in particular health-related quality of life (Boyce et al., 2003; Brown & Lumley, 2003; DaCosta et al., 2006; Dennis, 2004). As discussed previously, a yoga intervention outperformed exercise alone and a wait-list control group on certain health-related outcomes assessed using the SF-36 (e.g., vitality, energy, social functioning) in a healthy elderly population (Oken et al., 2006). Additionally, the Satisfaction with Life Scale (SWLS; Diener et al., 1985) was used to assess subjective perception of well-being as another facet of quality of life (QOL). It was predicted that findings regarding QOL generated from Aim 4 would support future research in clarifying the importance of examining QOL variables in a yoga study for PPD.

A Gentle Vinyasa Flow yoga intervention was developed to examine the efficacy of yoga as a CAM therapy for depressed postpartum women. The present investigation was developed based on existing empirical evidence supporting yoga as an efficacious treatment for reducing mood and anxiety symptoms (e.g., Li & Goldsmith, 2012; Uebelacker et al., 2010b), and improving HRQOL and social functioning (e.g., Oken et al., 2004, 2006) in various populations. Finally, in accordance with CONSORT guidelines, the current treatment trial includes elements of a rigorously controlled

randomized trial for evaluating the efficacy of a new treatment: (1) an appropriate randomization process; (2) inclusion of an adherence checklist; (3) adequate comparison group; and (5) a treatment manual outlining the intervention specifically designed for the postpartum population. Empirical data on the efficacy of yoga as a CAM therapy for depressed postpartum women is critical. The present investigation will not only provide the foundation for future research studies, but also improve understanding into the role of hypothesized *process variables* (e.g., mindfulness and physical activity) as potential mediators by which yoga is efficacious in improving psychological and physical well-being.

Introduction to Dissertation Project

The existing literature on yoga as a CAM therapy for improving psychological and physical functioning across various populations shows promising results for yoga as an alternative treatment option. Thus, the primary objective of the current investigation was to examine the efficacy of a yoga intervention for reducing symptoms of depression, and improving well-being, in postpartum women. Secondary objectives were to examine the efficacy of yoga for reducing symptoms of anxiety and postpartum maladjustment, and improving quality of life (both health-related quality of life and satisfaction with life) in the target population. To meet these objectives, I pursued the following aims:

Hypotheses

Aim #1: *To examine the efficacy of a yoga intervention, compared to a wait-list control (WLC) group, for reducing symptoms of depression and improving well-being in depressed postpartum women.* My hypothesis was that the yoga group would experience a greater rate of change (improvement) in depression and well-being scores over the 8-week intervention relative to the WLC group.

Aim #2: *To examine the efficacy of a yoga intervention, compared to a WLC group, for reducing symptoms of anxiety in depressed postpartum women.* My hypothesis was that

the yoga group would experience a greater rate of change (improvement) in anxiety scores over the 8-week intervention, relative to the WLC group.

Aim #3: *To examine the efficacy of a yoga intervention, compared to a WLC group, for improving postpartum adjustment in depressed postpartum women.* My hypothesis was that the yoga group would experience a greater rate of change (improvement) in adjustment scores over the 8-week intervention, relative to the WLC group.

Aim #4: *To examine the efficacy of a yoga intervention, compared to a WLC group, for improving quality of life (QOL) in depressed postpartum women.* My hypothesis was that the yoga group would experience a greater rate of change (improvement) in QOL variables over the 8-week intervention, relative to the WLC group.

Aim #5: *To examine whether treatment outcomes for depression were maintained during the 2-month follow-up period.* I predicted that the yoga group would maintain treatment gains on primary outcome measures of depression through the 2-month follow-up period.

CHAPTER II
METHODS

Participants and Procedure

Participants

Participants were asked to report basic sociodemographic information, including age, gender, ethnicity, education level and family income. The final sample included 53 Whites (94%), 2 Asian Americans (4%), and 1 African American (2%). The average age at baseline was 31.18 (*SD* = 5.10), and women on average were 4.68 months postpartum (*SD* = 3.16) with 16.47 years of education (*SD* = 2.49). Forty-four women were married at time of randomization (79%), 42 were currently breastfeeding (75%), 37 were currently employed or on maternity leave (66%), and 35 had an income of $50,000 or greater (63%).

Procedure

Postpartum women between the ages of 18 to 50 who gave birth within the past 12 months, were able to speak and read English, and who were experiencing symptoms of depression were recruited to participate in the study. To meet eligibility criteria for the yoga study, women had to: (1) score 12 or greater on the 17-item Hamilton Depressing Rating Scale (HDRS; Hamilton, 1967) (the 17-item HDRS will be referred to as HDRS throughout the remainder of this document); (2) reside within a 30 mile radius of Iowa City, including Cedar Rapids, Coralville, Marion, and North Liberty; and (3) $\geq$ 6 weeks postpartum if method of delivery was by cesarean section (C-section). Women having a vaginal delivery were eligible to participate immediately following childbirth assuming they were medically cleared. Recommendations for postpartum exercise are often derived from clinical rather than empirical evidence; thus, guidelines from the American

College of Obstetricians and Gynecologists (ACOG; Artal & O'Toole, 2003) were used to determine appropriate standards for the practice of yoga. According to ACOG, if pregnancy and childbirth were uncomplicated, immediate resumption of mild exercises (e.g., walking, pelvic floor exercises, stretching; Mottola, 2002) may occur in the postpartum period. In contrast, if the delivery was complicated and/or involved a C-section, consultation from a medical provider during the first postpartum check-up (6 weeks postpartum) is recommended prior to resuming exercise (Mottola, 2002).[1]

Study exclusion criteria were as follows: (1) a current or past diagnosis of bipolar disorder, schizophrenia or other psychotic disorder, alcohol or drug abuse/dependence (except nicotine) and anorexia in the past year; (2) acute suicidal or homicidal risk; (3) ongoing mental health treatment, including antidepressant or other psychotropic medications (e.g., benzodiazepines, buspirone), or psychotherapy with a certified therapist in the past month; (4) currently taking St. John's Wort or Fish oil; (5) practicing yoga at a studio with a certified yoga instructor within the past month; and (6) a significant medical disorder contra-indicated with yoga for postpartum women, including unevaluated maternal cardiac arrhythmia, marked respiratory compromise, and poorly controlled Type I diabetes, hypertension, or seizure disorder (Mottola, 2002).[1] Once eligibility was confirmed, interested women were asked to participate in the yoga study understanding that there was a 50/50 chance of being randomized to either the yoga or wait-list control (WLC) group.

Upon receiving approval from the University of Iowa's Institutional Review Board (IRB), women were recruited through several mechanisms as outlined below (see Figures A1 and A2 for Recruitment Flowcharts).

Recruitment

Birth Record Recruitment

Research staff from the Iowa Depression and Clinical Research Center (IDCRC) and yoga study identified potential research participants using birth records obtained from the Iowa Department of Public Health, and participants' information were entered into an Access database by a research assistant. Consent letters explaining the study's screening process, including the initial phone (or on-line) screen and subsequent telephone interview to determine eligibility, were sent to women who were 12 to 20 weeks postpartum in Linn and Johnson Counties in the state of Iowa. Women interested in participating responded in one of two ways: 1) returned the enclosed postcard indicating their interest in participating along with their name, address, phone number, e-mail address, and best times to contact so that research staff would be able to follow-up to complete the eligibility screen, or 2) completed the eligibility screen on-line. Women who were not interested in participating were asked to return the enclosed postcard indicating that they were not interested in participating and were no longer contacted moving forward.

Poster and Electronic Mail Recruitment

Participants also were recruited through the use of posters located in UIHC's maternity ward, neonatal intensive care unit (NICU), pediatrics, OB/GYN, and family medicine clinics. Posters provided basic information about participation in the study, along with contact information for the IDCRC. Women interested in participating were encouraged to contact the IDCRC to determine eligibility. Flyers and posters were also posted in private OB/GYN clinics, community mental health agencies in the Iowa City

and Coralville areas, local grocery stores and daycare centers. Finally, advertisements about the study were sent via the University-wide research e-mail system and postings on ResearchMatch.org (i.e., National Recruitment Registry Project) and Craigslist. The University-wide e-mail system was the most successful recruitment strategy, yielding approximately 90% of referrals to the yoga study.

Screening and Enrollment

During the initial screening phase of the yoga study, consenting participants provided demographic information, responded to screening questions (e.g., age, ability to speak and read English), and completed the 9-item Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2002). Documentation of consent was waived for all participants for this telephone interview, with verbal consent obtained prior to beginning the interview. If the participant was eligible based on responses to the screening questions (e.g., within 12 months postpartum, previous prior yoga experience, location of residence, currently receiving mental-health treatment), and her PHQ-9 composite score was 10 or greater, the potential participant was asked to complete the initial telephone interview using the Structured Clinical Interview for DSM-IV Axis-I Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1995) and the HDRS. If the participant received a score ≥ 12 on the HDRS and met inclusion criteria, she was informed of the yoga study. Interested participants were provided with basic information about the study, including the nature of the study and randomization process. If the participant remained interested in participating in the yoga study, the Principal Investigator (PI) scheduled an in-home visit with the participant over the telephone.

The in-home visit consisted of a review of study protocol, including randomization procedures. Documentation of signed consent was obtained at this time, and the participant was given a packet of self-report questionnaires to complete with a self-addressed return envelope to use for mailing back the questionnaire packet. The questionnaire packet included the following: 1) Sociodemographic questionnaire, 2) Five- Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), 3) Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007), 4) Postpartum Adjustment Questionnaire (PPAQ; O'Hara, Hoffman, Philipps, & Wright, 1992), 5) Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), 6) Short Form 36-item health survey (SF-36; Ware & Sherbourne, 1992), and 7) Stanford Brief Activity Survey (SBAS; Taylor-Piliae et al., 2006) (see Table B1 for measures). Participants enrolled in the study received payment for each interview and questionnaire packet as they completed each assessment. Participants received up to $70 for participation in the study ($20 for intake assessment, $10 for each assessment during treatment phase (up to $40), and $10 for the follow-up assessment at 2 months post-treatment).

Randomization

Eligible participants randomized into the yoga intervention were asked to attend 2 1-hour yoga classes on a weekly basis over the course of 8 weeks. These participants were provided with 6 different class times from which to choose, and were not required to attend the same classes every week. If participants were randomized into the WLC group, instructions for participation in this group were provided during the in-home visit (see Table B2 for instructions provided to women randomized to the WLC group).

A randomized list was prepared by the Clinical Trials Data Management Center at the University of Iowa using a computer generated random number table based on the method of blocked randomization and a predetermined ratio of 1:1. Block size varied to ensure that the PI did not have the ability to predict group assignment for the next participant, and to address potential imbalance with group assignment over the course of the trial (see Moher et al., 2010 regarding Consolidated Standards of Reporting Trials (CONSORT) guidelines for randomized controlled trials). For example, with a block of eight participants randomized according to a predetermined ratio of 1:1, four would be allocated to the yoga intervention and four to the WLC group. After generating the random number table, a research assistant in the IDCRC prepared separate envelopes with the group assignment for each randomization number to ensure concealed allocation of assignments. To enter a woman into the study, a research assistant opened a sequentially numbered, opaque, sealed envelope containing the group assignment for that participant. At this point, the participant is considered part of the *intent-to-treat* population. Sequence generation and allocation concealment were handled by a research assistant in the IDCRC. This randomization process ensured complete separation of people involved with the generation and allocation concealment from those involved in the implementation of the yoga intervention and/or clinical assessments.

Measures

All measures used in the current investigation are summarized in Table B3. All outcome and exploratory measures were assessed at several time points over the course of the study: at baseline, 2 weeks, 4 weeks, 6 weeks, 8 weeks, and at 2 months post-treatment (see Figure A3 for Assessment Timeline).

Screening Measures

Patient Health Questionnaire-9

The nine-item Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2002) is a depression scale that includes the 9 criteria for diagnosing DSM-IV major depression. The PHQ-9 has been found to have high sensitivity (73% - 88%) and specificity (88% - 98%) in large population-based studies, and has been recommended and used as an effective tool for diagnosing depression (Huang, Chung, Kroenke, Delucchi, & Spitzer, 2006), monitoring treatment response (Huang et al., 2006), and evaluating depression outcomes (Löwe, Kroenke, Herzog, & Gräfe, 2004).

Structured Clinical Interview for DSM-IV Axis-I Disorders

The Structured Clinical Interview for DSM-IV Axis-I Disorders (SCID; First et al., 1995) was developed to assess major Axis I and II psychiatric disorders using the DSM-IV, and was administered to participants with PHQ-9 scores ≥ 10, a cut-off score that is predictive of Major Depressive Disorder (Huang et al., 2006; Löwe et al., 2004).

Hamilton Depression Rating Scale

The Hamilton Depression Rating Scale (HDRS; Hamilton, 1967) is a validated and reliable measure of the severity of current depressive symptoms, and is used extensively in depression treatment studies. The 17-item HDRS was selected as the primary outcome measure of depression because it is sensitive to treatment change in the postpartum population (O'Hara et al., 2000), and is a valid indicator of depression severity in PPD despite the overlap between somatic HDRS items and typical experiences of postpartum women (Ross, Evans, Sellers, & Romach, 2003). In previous research conducted by the IDCRC using the HDRS, adjustments were made to differentiate

between normal postpartum experiences and depressive symptoms to avoid biased ratings. Clinical interviewers for the current study used specific interview instructions to prevent such biases from occurring.

The SCID and HDRS were administered over the telephone by Masters-level clinicians with experience in psychiatric interviewing. Dr. O'Hara has extensive experience conducting psychotherapy trials using the SCID and HDRS to evaluate depression in the postpartum period, and was available to train and supervise the interviewers. Such training has led to high inter-rater reliability in previous studies (O'Hara et al., 2000). All interviews were audiotaped to calculate reliability ratings. Using intraclass correlation (ICC) to account for consistency and absolute level differences, we obtained an ICC of 0.98, 95% CI [0.94, 0.99] for the 17-item HDRS total score based on 18 interviews and three separate raters. In the current study, the HDRS was used as both a screening and outcome measure for depression.

Outcome Measures

Inventory of Depression and Anxiety Symptoms

The Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007) is a 64-item factor analytically derived, multidimensional inventory that uses a 5-point Likert scale to assess symptoms of depression and anxiety over the past 2 weeks (1 = *not at all* to 5 = *extremely*). The IDAS has strong internal consistency reliability, with median coefficient alphas greater than .80 (Watson et al., 2007). It has good convergent and discriminant validity with diagnoses and self-report measures, as well as good short-term retest reliability in a psychiatric patient sample (Watson et al., 2007, 2008), and has been validated for use in a postpartum sample (Watson et al., 2007). In Watson et al.'s

(2007) postpartum sample, the IDAS scale of General Depression was strongly correlated to the Beck Depression Inventory II (BDI-II) (r = .83), whereas Panic was strongly correlated with the Beck Anxiety Inventory (BAI) (r = .78). Further, discriminant validity findings showed that the General Depression and Well-Being scales had significantly stronger correlations with the BDI-II than with the BAI. Conversely, the Panic and Traumatic Intrusions scales were the only two that correlated more strongly with the BAI (z scores = 15.31 and 3.16, respectively) (Watson et al., 2007). In the present study, the General Depression and Well Being scales were used to assess the nature and course of depression over time, in addition to the HDRS. The Panic, Social Anxiety, and Traumatic Intrusions (which assesses traumatic intrusions related to PTSD) scales were used to assess symptoms of anxiety.

Postpartum Adjustment Questionnaire

The Postpartum Adjustment Questionnaire (PPAQ; O'Hara, Hoffman, Philipps, & Wright, 1992) is a 61-item questionnaire that assesses the social adjustment of postpartum women. It includes 16 social role domains including: a) the amount of time spent in the activity; b) the woman's self-evaluation of her performance; c) the woman's perception of others' evaluation of her performance; and d) the change in performance since the birth of the newborn. Subscales are stable over time and are internally consistent. The PPAQ reliably distinguishes depressed from non-depressed postpartum women (O'Hara et al., 1992), and is sensitive to change in postpartum women treated for depression (O'Hara et al., 2000).

Medical Outcomes Study 36-Item Short-Form Health Survey

The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36; Ware, Kosinski, & Keller, 1994) is a well-validated measure of Health-related Quality of Life (HRQOL) and consists of 36 items reflecting 8 domains of health: 1) role-limiting physical, 2) role-limiting emotional, 3) physical functioning, 4) social functioning, 5) mental health, 6) energy and vitality, 7) pain, and 8) general health perceptions. The physical functioning domain (10 items) assesses limitations in physical activities, such as walking and climbing stairs. The role physical (4 items) and role emotional (3 items) domains measure limitations with work or other daily activities due to poor emotional or physical health. Bodily pain (2 items) measures limitations due to pain, and vitality (4 items) measures energy and tiredness. The social functioning domain (2 items) measures the effect of physical and emotional health on normal social activities, and mental health (5 items) assesses happiness, nervousness, and depression. General health perceptions (5 items) assess personal health and the expectation of health changes. Three of these scales (physical functioning, role-physical, and bodily pain) correlate highly with the physical component and contribute the most to the scoring of the Physical Component Summary (PCS) scale, whereas the mental health, role-emotional, and social functioning scales contribute most to the scoring of the Mental Component Summary (MCS) scale (Ware et al., 1994). All domains are scored on a scale from 0 to 100, with higher scores reflecting better health (Ware & Sherbourne, 1992). The measure has strong psychometric properties (Ware et al., 1994), and has been validated in PPD samples (e.g., Boyce et al., 2000; Dennis, 2004). Additionally, the SF-36 has performed equally well or better in detecting average group differences and changes over time (Ware et al., 1994). The SF-

36 is a well-established measure for assessing levels of HRQOL, and is an important outcome in treatment efficacy research for PPD (DaCosta et al., 2006).

Satisfaction with Life Scale

The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) is a 5-item self-report measure of general life satisfaction. Items are rated on a seven-point scale ranging from "*strongly disagree*" to "*strongly agree*." The SWLS has demonstrated adequate internal consistency, with coefficient alphas ranging from .79 to .89 (Pavot & Diener, 1993). This measure demonstrates good convergence with other measures of self-reported satisfaction (r = .58 - .68; Diener et al., 1985) as well as with informant reports (r = .58; see Pavot & Diener, 1993). In this study, the SWLS was used along with the SF-36 to assess health-related quality of life.

Exploratory Measures

Five Facet Mindfulness Questionnaire

The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-item self-report questionnaire. Scale developers conducted exploratory and confirmatory analyses in different samples to create subscales that assess five components of mindfulness: 1) nonreactivity to inner experience, 2) observing, 3) acting with awareness, 4) describing with words, and 5) nonjudging of experience. Participants respond to items by selecting the response choice that is "most generally true" of their experience using a 5-point Likert scale ranging from 1 ("never or very rarely true") to 5 ("very often or always true"). Higher scores indicate greater levels of mindfulness. The FFMQ has strong psychometric properties as evidenced by adequate to good internal consistencies for all domains (Cronbach's alpha range from .75 to .91) (Baer et al., 2006). The facets

also correspond to different components of mindfulness and correlate with psychological functioning. For example, the "describing" facet correlates positively with emotional intelligence, "nonreactivity" with self-compassion, and "observing" with the openness facet (Baer et al., 2008).

Stanford Brief Activity Survey

The Stanford Brief Activity Survey (SBAS; Taylor-Piliae et al., 2006) is a two-item questionnaire that takes less than 5 minutes to complete. The questionnaire is designed to obtain a quick assessment of the amount and intensity of physical activity that an individual performs during the day. The first item describes different kinds of on-the-job activity and the second item describes leisure-time activities. Each item has five response choices. Participants selected one response that best described on-the-job activity and one that described leisure-time activity. Each response choice included a global statement pertaining to the activity and the dimensions of frequency, intensity, time and type of activity performed. The SBAS has been shown to detect recommended national physical activity recommendations of 150 or more minutes/week at moderate or greater intensity levels with a sensitivity of .73 and specificity of .61 (Taylor-Piliae et al., 2006). Research supports its construct validity and reliability in a population of older adults, with higher self-reported mental and physical well-being significantly associated with higher levels of physical activity ($p < .01$), and statistically significant retest reliability ($r = .62$, $p < .001$) (Taylor-Piliae et al., 2010).

Treatment Conditions

Yoga Group

The yoga intervention consisted of 16 1-hour yoga classes over the course of 8 weeks. A Gentle Vinyasa Flow class was developed for the current study by the PI and certified yoga instructors having expertise in postnatal yoga instruction.[2] Importantly, consideration was given to yoga poses used in previous yoga interventions to address depression (see Design Considerations for a detailed explanation). The 1-hour yoga class consisted of sun salutations, balancing and relaxation poses (see Table B4 for the yoga sequence implemented in the current study), as well as mindfulness exercises such as reminding students to return to their breath if the mind has wandered and noticing physical sensations in the body while holding a pose. The classes were primarily taught by the PI, with assistance from a second certified instructor when the PI was unavailable to teach classes. Classes were held at yoga studios located in Coralville and Cedar Rapids, Iowa. There were no differences between the studios other than location.

Participants randomized to the yoga group were also asked to practice at home at least 1 day a week using a postnatal yoga DVD that was developed by the PI in collaboration with two certified yoga instructors. The video was approximately 30 minutes in length and the sequence of yoga poses was modeled after the yoga class taught in the studio. The DVD also included instructions on how to modify and advance the poses. Student Video Productions (SVP) at the University of Iowa was contracted to produce the video after receiving approval from the University of Iowa's Institutional Review Board. Upon randomization, participants received a document containing

frequently asked questions (FAQs) on yoga, including what to expect when beginning a yoga practice and proper class etiquette (see Table B5 for the FAQ document).

Wait-list Control Group

Participants randomized to the wait-list control (WLC) group were asked to wait 8 weeks before receiving the yoga classes. These participants were asked to maintain their regular activities, but to refrain from practicing yoga with an instructor (practicing at home with a DVD was acceptable), and from seeking conventional or alternative treatments during the 8-week waiting period. An instruction sheet with these guidelines was provided to participants randomized to the WLC group (see Table B2).

Clinical interviewers administered the HDRS over the telephone to all study participants, and self-report questionnaire packets were mailed to participants with a self-addressed return envelope for each assessment (e.g., baseline, week 2, week 4, etc.). The yoga instructors were blinded from participant's research data, and did not participate in interview assessments after completion of baseline assessments. The interviewer also assessed compliance in the WLC group at each time point. During this time, the participant's suicide risk and clinical deterioration, if any, was assessed as necessary.

If participants in the yoga group missed a class, a research assistant or the PI contacted the participant by phone and sent an e-mail reminder with a list of days and times for ongoing yoga classes. Participants failing to complete assessments by the due date were contacted by phone and e-mail for at least one week after the 2, 4, 6, and 8 week scheduled interviews and for up to 4 weeks after the scheduled 2-month follow-up assessment to ensure sufficient attempts to collect study data.

Yoga Instruction and Adherence

All classes were taught by certified yoga instructors, each with at least 10 years of experience in yoga instruction. The yoga instructors have participated in various workshops on yoga anatomy, sequencing, and yoga philosophy. The instructors are certified to teach Bikram and Vinyasa Flow yoga, two forms of Hatha yoga upon which the proposed yoga intervention was modeled, and are certified by Yoga Alliance.[3] Class sizes varied from 1 to 8 participants at any given time throughout the study period. The instructors followed the yoga intervention protocol (see Table B4) and the instruction manual (see Table B6) developed specifically for this study to guide delivery of the intervention.

Two randomly selected yoga classes were video recorded and independently reviewed by a certified yoga instructor in the Iowa City area with expertise in teaching postnatal yoga. Randomly selected videos were reviewed to determine adherence to the yoga protocol. Because there are no adherence measures for yoga interventions, an adherence checklist was developed specifically for this study to correspond with the yoga intervention (see Table B7 for Adherence Checklist). The yoga classes were reviewed and coded for any discrepancies using the adherence checklist. Although instructions for guiding the participants through each class are outlined in the manual, there was some flexibility in delivery of the instructions from class to class.[4] As such, these slight variations in delivery of instructions were not considered deviations from the protocol. For example, instructions such as “press down through your feet” and “draw your hip back” may be presented in a slightly different order. However, these variations did not affect overall alignment and did not jeopardize the safety of the students.

Design Considerations

There were several considerations that guided the design of the current research study. The issues identified in each case reflect design concerns that are difficult to address with an adequate solution. The following section highlights these concerns along with a rationale used to reach solutions in the study's design.

Wait-list Control Group

The Introduction section describes the scientific rationale for the wait-list control (WLC) group. The comparison group in an efficacy trial is an important element; thus, the CONSORT guidelines (Moher et al., 2010) were used to obtain information on acceptable comparison groups. These guidelines consider wait-list controls and treatment as usual as adequate comparison groups to conduct randomized clinical trials. The use of a WLC group allows for rigorous examination, is becoming increasingly prevalent in psychological research (Cisler, Barnes, Farnsworth, & Sifers, 2007), and was sufficient for the overall objectives of the current research study.

Yoga Intervention

The following factors were considered in developing the Gentle Vinyasa Flow yoga intervention: (1) the minimum effective dose of yoga, (2) the style of yoga, (3) the level of complexity, and (4) type and sequencing of poses, consistent with guidelines set forth in recent yoga treatment efficacy research (Haaz & Bartlett, 2012). There is some empirical evidence to suggest that factors such as specific poses or level of complexity may play a role in the therapeutic effects of yoga (e.g., Michalsen et al., 2005; Woolery et al., 2004). Yoga philosophy highlights the role of back bends and other chest opening exercises as counter to the slumped posture associated with depression (Weintraub, 2004;

Iyengar, 2001). Regarding minimum effective dosage, conventional guidelines recommend that beginner yoga students take ≥ 3 classes (60 or 90 minute class) a week for ≥ 4 consecutive weeks at a yoga studio with a certified instructor (versus at home using a DVD) to begin to experience the hypothesized benefits of yoga (e.g., reduced stress, improved mood, weight loss). Physically healthy students are encouraged to start with a beginner's class and transition to a more rigorous style of yoga (e.g., Power Vinyasa Flow) after 4 weeks of a consistent practice (McCall, 2007). Given the lack of empirical evidence on the dose-response relationship in the yoga literature, these elements of a yoga class require further investigation.

HDRS Entrance Criterion

Psychotherapy trials for depression have relied on various HDRS thresholds for eligibility. In the current study, a baseline HDRS score ≥ 12 was used as entrance criterion for identifying postpartum women with depression. Previous yoga trials have relied on baseline HDRS entrance criterion ranging from a score ≥ 17 (Janakiramaiah et al., 2000) to ≥ 18 (Rohini et al., 2000), with one trial on acupuncture using a baseline HDRS score ≥ 14 to operationalize moderate to severe symptoms of depression (Manber et al., 2010). Further, previous RCTs examining psychotherapy for PPD utilized a HDRS score ≥ 12 as entrance criterion (O'Hara et al., 2000). While a low HDRS entrance score (e.g., ≥ 10) may be uninformative for severe depression, a high HDRS score (e.g., ≥ 17) may affect feasibility. The results of the O'Hara et al. (2000) IPT study, with a mean baseline score on the HDRS of 19.6, supported the feasibility of recruiting my target population using the HDRS score ≥ 12 entrance criterion.

The current research study also examined depressive symptoms on a continuum, rather than categorically. This decision was driven by research to suggest that subclinical depression is clinically meaningful, showing strong associations with increased disability and health care utilization (specifically in postpartum women; e.g., Dennis, 2004), and later onset of major depression (e.g., Cuijpers et al., 2004, 2007). Thus, inclusion criteria for the present study did not require a DSM-IV diagnosis of MDD.

Recruitment and Retention Feasibility

Using previous treatment trials of IPT for PPD conducted through the IDCRC as proxies, it was anticipated that of the pool of women who met HDRS entrance criterion (score $\geq$ 12), 15% would be ineligible because of disqualifying current or past psychiatric disorder. Approximately 50% of the women (5 participants) meeting criteria would either decline to participate or meet other exclusion criteria beyond presence/history of psychiatric disorder. Based on the IDCRC's experience in recruiting the target population, recruiting 60 participants was expected to take approximately 12 months. Consistent with these projections, it took approximately 12 months for the current study to recruit 57 women.

The yoga intervention also was tested for retention feasibility. Female undergraduate students (N = 20) enrolled in psychology courses at the University of Iowa in the fall 2010 and spring 2011 semesters responded to an e-mail seeking volunteers to participate in a dissertation research study on yoga. The primary reason for declining participation was class/work conflicts. Twelve female beginner yoga (practiced yoga less than 3 times a week for less than one month) students committed to participating in the pilot study. The pilot test consisted of a 4-week intervention, with 2 1-hour classes each

week held on Fridays and Saturdays at 2 p.m. The rate of attrition was approximately 8.3% (n = 11 participants were retained). One participant dropped from the pilot test due to anxiety over mild heat in the yoga room from a previous yoga class in the studio. There was no difficulty in recruiting participants for the pilot test. However, there are obvious and notable differences between a population of female undergraduate students and depressed postpartum women. In a depressed postpartum population, logistical issues such as childcare and transportation have been identified as significant treatment barriers (Dennis & Chung-Lee, 2006). These issues were not a concern for the undergraduate students.

The yoga intervention tested in the pilot study was refined on the basis of qualitative feedback collected over the course of the 4-week pilot study. The feedback included information obtained from self-report questionnaires administered at the end of each yoga class, and through a focus group held at the end of the 4-week pilot study. Specific information received over the course of the pilot included: (1) participant's feedback on which components of yoga (e.g., meditation, breathing) they liked/disliked the most; (2) poses that were the most/least difficult to perform; (3) importance of personalized instruction; and (4) clarity of instructions provided during each class. Feedback was reviewed after each class and potential revisions to the yoga intervention and instruction manual were summarized by the PI. A complete summary of all revisions to the yoga intervention and instructions was presented to the yoga consultants[2] on the project. For example, a pose identified by multiple participants as being difficult to perform due to level of complexity and that did not improve for participants over the course of the 4-week intervention were included in the summary of revisions. In contrast,

those poses identified by multiple participants as being difficult to perform but that improved by the end of the 4-week intervention were not included in the summary of changes. Moreover, the PI emphasized mindfulness skills during each class; for example, the PI would offer the breath as a point of focus to return to when the participant noticed her mind wandering or drifting outside the yoga room. In addition, participants were asked to notice physical sensations in their bodies while holding difficult poses (e.g., Warrior II pose). Feedback obtained at the end of the intervention was a preference for being reminded of the breath and to notice what arises (e.g., thoughts, feelings) while holding difficult poses. After a review of the proposed changes with the yoga consultants on the study, the changes were integrated with the yoga protocol and instruction manual. In sum, results from the pilot study suggested that (a) the PI would be able to retain participants randomized into the yoga group, and (b) conducting the yoga intervention was feasible.

Statistical Methodology

The majority of analyses were conducted using growth curve modeling techniques (GCM; Raudenbush & Bryk, 2001) and the HLM 7 software (Raudenbush, Bryk, & Congdon, 2011). All other analyses (e.g., baseline comparisons, t-tests) were conducted with SPSS version 21.0 (IBM Corp. Released 2012). Advantages to using GCM with multiwave data include the ability to retain cases despite missing data and account for varying time intervals between data collection points across participants. GCM allows for a 2-stage process of data analysis. The first stage (Level 1), estimates the trajectory of change (growth curve) for a variable described by two parameters: the *intercept* which represents the level of the dependent variable at a given point in time (e.g., depression at

treatment termination) and the *slope* which represents the rate of change over time (e.g., change in depression from pre- to post-treatment). At Level 2, relationships between Level 1 parameters and between-participants factors (e.g., group assignment) can be examined. Five repeated measurements of a given dependent variable were nested within participants including: pre-treatment, week 2, week 4, week 6, and week 8 (post-treatment). Time was measured as weeks since wave 5 of data collection (i.e., at 8 weeks of treatment) and entered uncentered in all analyses so that the intercept represents scores of depression (and other dependent variables) at post-treatment. Treatment group (*yoga* = 1 and *wait-list control group* = 0) was entered as a predictor of Level 1 intercept (post-treatment levels) and time (change from pre- to post-treatment) parameters at Level 2.

Power and Sample Size

To achieve adequate power for the primary analyses with depression, sample size was estimated using PASS 11 software (Hintze, 2011) and procedures outlined by Cohen (1992) on the basis of 0.8 power to detect significant differences (p = .05, 2-sided). Previous research examining the effects of yoga on depression has revealed between group effect sizes ranging from .15-1.59 (e.g., Veale, Le Fevre, Pantelis, de Souza, Mann, & Sargeant, 1992; Woolery et al., 2004). Thus, an approximate average effect size of 0.8 at endpoint on the HDRS was estimated using these data. This also represents a clinically significant change in depressive symptoms, and is associated with a "large" effect (Cohen, 1992). The analysis indicated that a minimum of 30 participants per treatment group would be needed to detect an effect of this magnitude for my primary hypothesis.

CHAPTER III
RESULTS

Descriptives and Preliminary Analyses

The total sample size randomized was 57 (Yoga group: n = 28; Wait-list Control group: n = 29). Please see Figure A4 for the participant flow diagram. On average, the sample at baseline had substantial levels of depressive symptoms as evidenced by scores on the IDAS depression scales (General Depression and Well-Being). Scores on the IDAS General Depression scale, on average, were higher at baseline (M = 57.68, SD = 9.23) relative to a *postpartum sample* (M = 38.92, SD = 12.40) presented in Watson et al.'s (2007) work on the development of the IDAS measure. Further, on average, women in the yoga study started with lower scores on the IDAS Well-Being scale (M = 16.80, SD = 4.12) compared to the IDAS postpartum sample (M = 22.72, SD = 6.88). T-tests suggest significantly higher mean levels at baseline for all three IDAS scales (compared to the normative group), $p < .001$. Regarding intervention-related variables, 44% of the yoga group (n = 12/27) and 34% of the control group (n = 10/29) had prior yoga experience (defined as practicing yoga for at least one month in a yoga studio with a certified instructor), a nonsignificant difference (p = .378). On average, women in the yoga group attended 12 (out of 16) classes (SD = 4.54, range: 0 - 16) and 67% (n = 18/27) attended nine or more classes over the course of the 8-week intervention. Class sizes ranged from 1 to 8 participants, with 1 participant representing the modal number (see Table B8). Seventy-eight percent (n = 21/27) of the women in the yoga group practiced at home using the postnatal yoga DVD developed for this study (30 minute sequence) at least once every two weeks during the 8-week intervention (see Table B9 for a summary of sociodemographic and intervention-related characteristics between

groups). Means and standard deviations for the yoga and control groups' HDRS, IDAS (relevant subscales), PPAQ, SF-36 (total composite score and relevant subscales), SWLS, FFMQ, and SBAS are presented in Table B10.

Baseline comparisons between groups were conducted for dependent variables and sociodemographic factors including: race and ethnicity, education, age, parity, income, and marital and breastfeeding status. Comparisons were conducted using chi-square analysis (or Fisher's exact test where appropriate) for categorical variables and t-tests for continuous variables. These analyses indicated that the yoga and wait-list control groups were similar in their racial and ethnic backgrounds, history of depression, education, parity, income level, and breastfeeding status. There was a significant difference between groups at baseline for age, t (54) = 2.63, $p < .05$ and the IDAS Social Anxiety scale, t (54) = -1.93, $p < .05$. Thus, these variables were included as covariates in the primary analyses.

Baseline Models of Dependent Variables

A linear model of change was tested for each dependent variable (e.g., depression). Parameter estimates of this model were examined to determine whether there was (a) significant change in depression over time, on average, and the nature of this change (e.g., if depression decreases across the treatment period) and (b) significant between-subject variability in intercept and time parameters (such that they can be examined as outcomes of treatment group assignment). See Table B3 for a list of measures used to operationalize each construct tested under each aim. For each dependent variable, the following model was tested:

$$Y_{tij} = \pi_{0ij} + \pi_{1ij} (\text{time}) + e_{tjj}$$

where Y_{tij} is the level of the dependent variable at time *t* for subject *i,* π_{0ij} is the intercept for subject *i* (e.g., levels of the dependent variable at 8 weeks after randomization), π_{1ij} is the rate of linear change in the dependent variable over time for subject *i*, and e_{tjj} is the residual variance in repeated measures for individual *i,* which is assumed to be independent and normally distributed.

On average, depression (assessed via the HDRS) decreased systematically over time for the entire sample, t (55) = -10.17, $p < .001$. Additionally, there was significant between-subject variability in Level 1 intercept, χ^2 (54) = 296.76, $p < .001$, and slope parameters, χ^2 (54) = 114.16, $p < .001$. Thus, it was appropriate to examine Level 2 predictors of these parameters. A comparison of the deviance statistics of the linear model to a more parsimonious mean-and-variance model (modeling symptoms as fluctuating over time with no systematic change) revealed that adding the linear parameter significantly improved the fit of the model, χ^2 (2) = 143.10, $p < .001$.

The same pattern of results emerged for the other dependent variables under investigation. Scores of general depression (IDAS General Depression scale), anxiety (IDAS anxiety scales: Panic, Social Anxiety, and Traumatic Intrusions), and postpartum maladjustment (PPAQ) decreased (improved) significantly from pre- to post-treatment (*t*s ranged from -2.97 to -8.24, $p < .05$). Scores of well-being (IDAS Well-Being scale), health-related quality of life (SF-36, SFMCS, and SFPCS), satisfaction with life (SWLS), mindfulness (FFMQ), and physical activity (SBAS) increased (improved) significantly from pre- to post-treatment (*t*s ranged from 3.85 to 7.18, $p < .05$). There was also significant between subject variability in intercept (χ^2s ranged from 106.78 to 1090.13, *p*

< .05), and slope (χ^2s ranged from 74.19 to 229.93, $p < .05$) parameters for these dependent variables.

Primary Analyses

Guided by empirical evidence supporting the role of yoga for reducing symptoms of depression in adult, college, and cancer populations (e.g., Bower, Woolery, Sternlieb, & Garet, 2005; Jain et al., 2008; Woolery et al., 2004), we expected a steeper linear decline in symptoms of depression over the course of the 8-week intervention for the yoga group, relative to the wait-list control group. That is, we expected that treatment group assignment would significantly predict rates of change in depressive symptoms (i.e., a significant treatment x time interaction). We also expected the groups to differ significantly in levels of depression by post-treatment.

Aim 1: Do treatment groups differ with regard to changes in depression and general well-being from pre- to post-treatment?

Analyses: Treatment group was entered uncentered as a dichotomous predictor of intercept and slope parameters (along with continuous covariates social anxiety and age which were entered grand centered) at Level 2 to determine whether significant differences existed between groups with regard to changes in depressive symptoms over the course of the 8-week intervention (γ_{11}):

Level 1: Y_{ij} (Depression) = β_{0j} (Intercept) + β_{1j} (Time) + r_{ij}
Level 2: β_{0j} (Depression at post-treatment) = γ_{00} + γ_{01} (Treatment Group) + γ_{02} (Social Anxiety) +γ_{03} (Age) +u_{0j}
β_{1j} (Linear change in Depression) = γ_{10} + γ_{11} (Treatment Group) + γ_{12} (Social Anxiety) + γ_{13} (Age) + u_{1j}

Controlling for age and social anxiety at baseline, treatment group significantly predicted rates of change in depression (assessed using the HDRS) over the 8-week intervention, t (52) = -2.94, p = .005, and levels of depression at post-treatment, t (52) = -

3.02, $p = .004$ (see Figure A5). Individuals in the yoga group experienced a steeper linear decline in depression over the course of the 8-week intervention, relative to the wait-list control group, and had lower levels of depression at post-treatment. A Reliable Change Index score (RCI; Jacobson & Truax, 1991) was calculated to determine clinical significance for the primary outcome measure (HDRS). Roughly 78% of the women in the yoga group ($n = 18/23$; 78.2%) and 59% ($n = 16/27$) in the control group experienced clinically significant change (change scores ≥ 5.30) for the HDRS scores from pre- to post-treatment. One participant in the yoga group (who dropped out of the intervention during week 6, but continued to complete interview-based assessments) and three in the control group experienced an *increase* in levels of depression from pre- to post-treatment; however, these changes were not clinically significant.

Examinations of additional dependent variables also demonstrated greater rates of improvement over time for the treatment group relative to the control group, along with lower levels at post-treatment. Treatment group significantly predicted rates of change in depression (assessed using the IDAS General Depression scale) over the 8 week intervention, t (52) = -3.26, $p = .002$, and levels of depression at post-treatment, t (52) = -4.27, $p < .001$ (see Figure A6). Treatment group significantly predicted rates of change in well-being (assessed using the IDAS Well-Being scale) over the 8 week intervention, t (52) = 2.94, $p = .005$, and levels of well-being at post-treatment, t (52) = 4.04, $p < .001$ (see Figure A7).

In sum, hypotheses were supported by results of the present study: individuals in the yoga group experienced a steeper linear decline in depression and greater linear

increase in well-being over the course of the 8-week intervention. Please see Table B11 for coefficients, *SE*s, confidence intervals, and effect sizes.

Attrition

For all hypotheses, an *intent-to-treat analysis* was conducted such that all enrolled participants were included in all analyses unless the participant did not provide complete data for the baseline assessment (n = 1). To address missing data due to attrition/drop-out, pattern-mixture models for non-ignorable missing data were conducted (Atkins, 2005; Hedecker & Gibbons, 1997) on the primary dependent variable (HDRS) such that drop-out status was entered as a covariate and moderator of treatment effect. Results of these analyses were nonsignificant for scores at post-treatment, t (51) = -.44, p = .663, as well as for rate of change in depression scores over the 8-week intervention, t (51) = -1.16, p = .252, suggesting that the effect of treatment group on depression did not significantly vary as a function of missing data due to attrition.

Secondary Analyses

Aim 2: Do treatment groups differ with regard to changes in anxiety (assessed using multiple scales of the IDAS) from pre- to post-treatment?

Analyses: The following equation was specified to examine treatment as a predictor of changes in anxiety from pre- to post-treatment. Anxiety was assessed using the following scales of the IDAS: Traumatic Intrusions, Panic, and Social Anxiety. The equation was modeled separately for each of these scales as a measure of anxiety. Treatment group was entered as uncentered at Level 2 (along with continuous covariates social anxiety and age which were entered grand centered):

Level 1: Y_{ij} (Anxiety) = β_{0j} (Intercept) + β_{1j} (Time) + r_{ij}
Level 2: β_{0j} (Anxiety at post-treatment) = γ_{00} + γ_{01} (Treatment Group) + γ_{02} (Social Anxiety) +γ_{03} (Age) +u_{0j}

β_{1j} (Linear change in Anxiety) = γ_{10} + γ_{11} (Treatment Group) + γ_{12} (Social Anxiety) + γ_{13} (Age) + u_{1j}

Controlling for age and social anxiety at baseline, treatment group significantly predicted rates of change in PTSD-related intrusions (assessed using the IDAS Traumatic Intrusions scale) over the 8-week intervention, t (52) = -2.37, p = .021, and levels of intrusions at post-treatment, t (52) = -2.17, p = .034 (see Figure A8). Individuals in the yoga group experienced steeper linear decline in traumatic intrusions over the course of the 8-week intervention, and had significantly lower levels of traumatic intrusions at the end of treatment, relative to the wait-list control group. Treatment significantly predicted rates of change in social anxiety over the 8-week intervention, t (52) = -2.84, p = .006, and levels of social anxiety at post-treatment, t (52) = -2.83, p = .007 (see Figure A9). Individuals in the yoga group experienced a steeper linear decline in social anxiety over the course of the 8-week intervention, and had significantly lower levels of social anxiety at the end of treatment, relative to the wait-list control group. Treatment group did not significantly predict rates of change in panic over the 8-week intervention, t (52) = -1.11, p = .272, nor levels of panic at post-treatment, t (52) = -1.62, p = .111 (see Figure A10). Please see Table B11 for coefficients, *SE*s, confidence intervals, and effect sizes.

Aim 3: Do treatment groups differ with regard to changes in postpartum adjustment (assessed using the PPAQ) from pre- to post-treatment?

Analyses: Treatment group was entered uncentered as a dichotomous predictor of intercept and slope parameters at Level 2 (along with continuous covariates social anxiety and age which were entered grand centered) to determine whether significant differences existed between groups with regard to changes in adjustment over the course of the 8-week intervention (γ_{11}), and levels of postpartum adjustment at post-treatment (8 weeks

after randomization) (γ_{01}).

Level 1: Y_{ij} (PPAQ) = β_{0j} (Intercept) + β_{1j} (Time) + r_{ij}

Level 2: β_{0j} (PPAQ at post-treatment) = γ_{00} + γ_{01} (Treatment Group) + γ_{02} (Social Anxiety) +γ_{03} (Age) +u_{0j}
β_{1j} (Linear change in PPAQ) = γ_{10} + γ_{11} (Treatment Group) + γ_{12} (Social Anxiety) + γ_{13} (Age) + u_{1j}

Controlling for age and social anxiety at baseline, treatment significantly predicted rates of change in adjustment over the 8-week intervention, t (52) = -2.41, p = .019, but not levels at post-treatment, t (52) = -1.64, p = .107 (see Figure A11). Consistent with hypotheses, individuals in the yoga group experienced a steeper linear decline in levels of maladjustment (i.e., greater rate of improvement) over the course of the 8-week intervention, relative to the wait-list control group (see Table B11 for coefficients, *SE*s, confidence intervals, and effect sizes).

Aim 4: Do treatment groups differ with regard to changes in health related quality of life (HRQOL) (assessed using the SF-36 total score, SFMCS, and SFPCS) and overall level of satisfaction with life (assessed using the SWLS) from pre- to post-treatment?

Analyses: Treatment assignment was examined as a predictor of changes in HRQOL and satisfaction over time from pre- to post-treatment, and levels of HRQOL and satisfaction with life at post-treatment. Separate models were examined for each measure (and subscale), and treatment group was entered uncentered at Level 2 (age and social anxiety were entered grand centered). For example, for the SF-36 total score, the following equation was specified:

Level 1: Y_{ij} (SF-36) = β_{0j} (Intercept) + β_{1j} (Time) + r_{ij}
Level 2: β_{0j} (SF-36 at post-treatment) = γ_{00} + γ_{01} (Treatment Group) + γ_{02} (Social Anxiety) +γ_{03} (Age) +u_{0j}
β_{1j} (Linear change in SF-36) = γ_{10} + γ_{11} (Treatment Group) + γ_{12} (Social Anxiety) + γ_{13} (Age) + u_{1j}

Controlling for age and social anxiety at baseline, treatment group significantly predicted rates of change in HRQOL over the 8-week intervention for the SF-36 total score, t (52) = 5.09, p = < .001, the SFMCS subscale (i.e., mental component summary score of the SF-36), t (52) = 5.09, p = < .001, and the SFPCS subscale (i.e., physical component summary score of the SF-36), t (52) = 2.08, p = .042. Treatment group also predicted levels of HRQOL at post-treatment for the SF-36 total score, t (52) = 4.43, p < .001, the SFMCS, t (52) = 4.72, p < .001, and the SFPCS, t (52) = 2.44, p = .018 (see Figures A12 to A14). Individuals in the yoga group experienced steeper linear increase in HRQOL over the course of the 8-week intervention and had greater levels of HRQOL at post-treatment relative to the wait-list control group. Treatment did not significantly predict rates of change in satisfaction with life (assessed using the SWLS) over the 8-week intervention, t (52) = 1.38, p = .173, nor levels of life satisfaction at post-treatment, t (52) = 1.48, p = .145 (see Figure A15). Please see Table B11 for coefficients, *SE*s, confidence intervals, and effect sizes.

Aim 5: Are treatment gains maintained during the follow-up period?

Analysis: Paired sample t-tests were conducted to examine maintenance of treatment gains through the 2-month follow-up assessment by comparing scores at treatment termination (after 8 weeks of treatment) to scores at the 2-month follow-up period on primary dependent variables of depression (HDRS and IDAS depression scales) for the *yoga group only*. As predicted, findings were nonsignificant for HDRS, t (20) = .49, p = .632 (Week 8 M = 6.10; 2 month follow-up M = 5.62) and Well-Being scales, t (10) = 1.68, p = .124 (Week 8 M = 24.36; 2 month follow-up M = 22.91). Findings were significant for the IDAS General Depression scale, t (10) = -2.82, p = .018 (Week 8 M =

34.91; 2 month follow-up *M* = 38.18). Taken together, results suggest that individuals in the yoga group either maintained treatment gains or showed some increase in depressive symptoms over the 2-month follow-up period. Of note, women randomized to the control group started yoga after waiting 8 weeks post-randomization; thus, the control group was not an appropriate comparison group for the follow-up analyses.

Retention and Adherence

The percentage of women who completed the study (defined as the number of participants who completed the HDRS at week 8) was 85% (*n* = 23/27) for the yoga group and 93% for the control group (*n* = 27/29). At the 2-month follow-up assessment, 95.6% (*n* = 22/23) the yoga group completed the interview-based assessment (HDRS), and 4.3% (*n* = 1) were lost to follow-up. Regarding self-report data, 59.2% (*n* = 16/27) of women in the yoga group completed the questionnaire assessments at week 8, and 31.2% (*n* = 11/16) at the 2-month follow-up.

Exploratory Analyses

The extent to which the yoga intervention had an effect on theoretically-relevant process variables, *mindfulness* and *physical activity*, was examined to better understand hypothesized mechanisms of action by which yoga may be efficacious. These variables were examined via GCM over the course of the 8-week yoga intervention (similar to the approach taken in the primary analyses). Changes in individual scores on Level 1 process variables—measure of mindfulness (assessed using the FFMQ) and physical activity (assessed using the SBAS)—were examined from pre- to post-treatment (Level 1 slope effects) as well as levels of these variables at post-treatment (Level 1 intercept effects). Level 1 intercept and slope parameters of process variables were then predicted

by group assignment at Level 2 (along with continuous covariates social anxiety and age which were entered grand centered) to determine whether significant differences existed between groups.

Analyses: The following model was specified for the exploratory analyses:

Level 1: Y_{ij} (Process Variable) = β_{0j} (Intercept) + β_{1j} (Time) + r_{ij}
Level 2: β_{0j} (Process Variable at post-treatment) = γ_{00} + γ_{01} (Treatment Group) + γ_{02} (Social Anxiety) +γ_{03} (Age) +u_{0j}
β_{1j} (Linear change in Process Variable) = γ_{10} + γ_{11} (Treatment Group) + γ_{12} (Social Anxiety) + γ_{13} (Age) + u_{1j}

Controlling for age and social anxiety at baseline, treatment group significantly predicted rates of change in mindfulness over the 8-week intervention, t (51) = 3.87, p < .001, and levels of mindfulness at post-treatment, t (51) = 2.39, p = .021 (see Figure A16). Individuals in the yoga group experienced a steeper linear increase in mindfulness over the course of the 8-week intervention and had greater levels of mindfulness at 8 weeks, relative to the wait-list control group. Treatment did not significantly predict rates of change in physical activity over the course of the 8-week intervention, t (51) = 1.37, p = .177, nor did it predict levels of physical activity at post-treatment, t (51) = 1.72, p = .091 (see Figure A17). Please see Table B11 for coefficients, *SE*s, confidence intervals, and effect sizes.

Post-Hoc Analyses

Intervention-related variables were examined for the yoga group to determine whether women benefited more from attending a greater number of yoga classes or from having prior yoga experience on the primary dependent variable (HDRS). Dose-response relationship was examined as a predictor of depression (assessed using the HDRS) *for the yoga group only*. Number of classes attended was examined as both continuous and

dichotomous (≥ 9 classes attended = 1 and < 9 classes attended = 0) variables. The recommended "dose" of the yoga intervention was 16 yoga classes over 8 weeks. The number of classes attended, t (25) = .06, p = .952, prior yoga experience, t (25) = -.20, p = .843, and taking nine or more yoga classes, t (25) = .12, p = .904, did not predict levels of depression at 8 weeks post-treatment in the yoga group. Additionally, number of classes attended, t (25) = .05, p = .960, prior yoga experience, t (25) = .43, p = .672, and taking nine or more yoga classes, t (25) = -.01, p = .992, did not predict rates of change in levels of depression over the 8 weeks of treatment in the yoga group.

CHAPTER IV
DISCUSSION

The overall objective of the present study was to examine the efficacy of a Gentle Vinyasa Flow yoga intervention for postpartum depression (PPD). The primary aim was to investigate the effects of yoga on depression and well-being in a PPD sample, with secondary aims to evaluate yoga's effects on symptoms of anxiety, postpartum adjustment, and health-related quality of life. Finally, exploratory aims were developed to better understand the role of mindfulness and physical activity as hypothesized mechanisms of action by which yoga is efficacious.

Summary and Interpretation of Results

Primary Outcomes

The results from the current study suggest that yoga is an efficacious treatment for postpartum depression (PPD). Women in the yoga group experienced a significantly greater rate of improvement in depression and well-being over the course of the 8-week intervention, and lower levels of depression and higher levels of well-being at post-treatment, relative to the control group. These results were not influenced by baseline differences in age and social anxiety, which were controlled for in all analyses.

Secondary Outcomes

Anxiety

Our results demonstrated that controlling for baseline social anxiety and age, women in the yoga group experienced a greater rate of improvement in social anxiety and PTSD-related intrusions over the course of the 8-week intervention, than the control group. Women in the yoga group also had significantly lower scores of social anxiety

and intrusions at the end of treatment than the control group. Because women in the yoga group improved at a faster rate over the course of treatment with respect to social anxiety and traumatic intrusions than the control group, it is plausible that these women may have become more comfortable with the studio environment and the yoga classes over time. This explanation finds support in the context of previous findings highlighting the role of yoga in facilitating a sense of connectedness with oneself and others in a population of depressed women (Kinser et al., 2013; Uebelacker et al., 2010a) and may inform theories targeting self-efficacy as a mediator in the pathway between yoga and improved psychological and physical health (Uebelacker et al., 2010b).

There was no significant difference between groups in either rate of improvement over the 8-week intervention, or in levels at post-treatment, on panic scores. A potential explanation for this finding may stem from the novelty of attending a yoga class. Over 50% of the women in the yoga group did not have prior yoga experience; of the 46% who indicated having prior experience, it may have been for as little as one month (yoga experience was coded as a dichotomous variable such that practicing yoga for at least one month in a studio with a certified yoga instructor was coded as having prior experience). The perinatal anxiety literature suggests that symptom presentation of anxiety during the perinatal period is similar to that in the general population (Ross & McLean, 2006). Being in a new environment could have made it difficult for women in the yoga group presenting with higher levels of panic to feel safe and comfortable. Consistent with behavioral theories of anxiety (Abramowitz, 2013), a lack of control in one's environment or a feeling of helplessness can maintain and even exacerbate anxiety symptoms.

Additionally, individuals with panic disorder have a tendency to avoid exercise or any activity that elicits physiological sensations that are similar to symptoms associated with panic attacks (e.g., heart racing, shortness of breath). While the style of yoga used with this intervention was designed for postpartum women (e.g., did not reflect the rigor of a Power Vinyasa Flow class), women endorsing higher levels of panic at baseline may have been especially vulnerable to the novelty of the class environment, new poses, or the breathing associated with the poses, all of which may have supported the maintenance of panic symptoms. Drawing from the principles of exposure therapy for anxiety disorders (e.g., Abramowitz, 2013), it may be that longer exposure, experienced in either holding the poses for longer periods of time or in class duration, may be necessary to detect significant effects of a yoga intervention on panic symptoms.

Postpartum Adjustment

The yoga group showed greater improvement in postpartum adjustment over the course of the 8-week intervention, but did not differ in levels of adjustment at post-treatment, relative to the control group. This could be due to the fact that women in the yoga group endorsed higher scores on the PPAQ at baseline. Additionally, because the yoga group experienced a greater rate of improvement over the course of treatment, relative to the control group, the yoga group may have had significantly lower levels of maladjustment at post-treatment with a longer intervention (e.g., 12-week intervention).

Of note, when comparing the levels of postpartum maladjustment in the present sample with those detected in an IPT treatment trial for PPD (O'Hara et al., 2000), there were differences in average levels of maladjustment between the yoga and IPT groups at baseline (Yoga: $M = 2.46$, IPT: $M = 2.74$), 4 weeks (Yoga: $M = 2.32$, IPT: $M = 2.59$), and

8 weeks (Yoga: *M* = 2.19, IPT: *M* = 2.44). While average scores of maladjustment were slightly higher at each time point in the IPT trial, the results from the current study suggest that the yoga group still experienced significantly greater rates of change in maladjustment (e.g., greater reduction) over the 8-week intervention than the control group. Because yoga may be best conceptualized as a behavioral (versus psychological) intervention, it may be better suited for targeting *physical* aspects of maternal adjustment. A review of the CAM literature suggests that yoga is beneficial in improving psychological and physical outcomes, such as HRQOL, sleep, and weight loss (Field, 2011; Lin et al., 2011; Onken et al., 2006), and is as effective as, or even more effective than, exercise on health-related outcomes, including stress (Ross & Thomas, 2010). Additionally, because a potential mechanism of action underlying yoga's efficacy is physical activity (i.e., movement associated with practicing the poses), in contrast with a psychological intervention such as Interpersonal Psychotherapy with treatment targets including interpersonal relationships and adjustment to motherhood (O'Hara et al., 2000), alternative measures that emphasize the physical aspects of maternal adjustment may be better suited for yoga efficacy studies.

Quality of Life

Women in the yoga condition experienced significantly greater improvement in HRQOL scores over the course of treatment than the control group. The total score of the SF-36, and the component summary scales—SFMCS and SFPCS—were used to measure HRQOL. These measures tap an individual's general perception of physical and social functioning, and emotional well-being (Ware & Sherbourne, 1992). Using the SF-36, PPD studies have shown clear and strong evidence for a negative association between

depression and maternal role functioning in various domains such as work, family, and social relationships (Brown & Lumley, 2000; DaCosta et al., 2006). Overall level of HRQOL has been shown to serve as a proxy for self-efficacy and a sense of empowerment in studies on PPD and depressed women (e.g., DaCosta et al., 2006; Kinser et al., 2013), which also may shed light on mechanism driven theories highlighting self-efficacy as a potential mediator by which yoga is efficacious. It is plausible that because yoga is a holistic system affecting mind, body, and spirit through the integration of physical activity (poses), mindfulness, and breathing, it may have a greater and more direct impact on HRQOL.

In contrast to these findings, yoga did not significantly influence women's perceptions of their overall satisfaction or happiness with life, as evidenced in the null findings for satisfaction with life (SWLS) scores. The SWLS assesses factors such as social relationships and goals that are consistent with life values (Pavot & Diener, 2008). These findings could be due to the fact that, at baseline, women in both groups endorsed levels of satisfaction that were in the average range and consistent with norms for 'emotionally healthy' individuals in the Western culture (Pavot & Diener, 2008). While women in the current study appeared to be generally satisfied with their lives, there may have been other life domains in which they could make improvements (Diener, 2006). Notably, at post-treatment women on average scored in the high range (scores between 25-29; Diener, 2006), suggesting that they enjoy their lives and are generally satisfied with life domains such as work performance, family, spiritual development, friends and leisure activities (Diener, 2006). Finally, because baseline SWLS scores were in the average range for both groups, the null findings could also be due to the fact that there

was a ceiling effect. Thus, there was little to no room for improvement over the course of the 8-week intervention.

Maintenance of Treatment Gains

Treatment gains were maintained for the clinician-rated assessment of depression (HDRS) and the self-report assessment of well-being (IDAS Well-Being scale) during the 2-month follow-up period for the yoga group only. Null findings were detected using the IDAS General Depression scale. Inconsistency in findings could be due to the fact that more women were lost to follow-up for completing self-report questionnaires (31%), compared to the clinician-rated HDRS (4%). Thus, the sample size was smaller for the analysis using self-report data. Importantly, because these analyses lack comparison between groups, these data are purely descriptive.

Exploratory Analyses

Mindfulness and physical activity, two theoretically important components of yoga and hypothesized mechanisms of action, were examined as exploratory process variables. In the current study, women in the yoga group experienced greater improvement in mindfulness scores over the course of the 8-week intervention, relative to the control group. There was no significant difference between groups in either rate of change or levels of physical activity scores at post-treatment. A potential explanation for these null findings may be related to the fact that on-the-job activity is one of the two items on the Stanford Brief Activity Survey (SBAS) used to calculate intensity of physical activity. Therefore, women may have been incorrectly characterized as engaging in lower levels of activity merely by indicating that they were unemployed at the time of assessment.

The overall objective in using the SBAS was to better understand the role of physical activity as a mediator in treatment outcomes. Given the current findings, it may be worthwhile to implement more direct and objective physiological assessments of physical activity such as fitness measures (e.g., oxygen uptake assessments), measures of energy expenditure using heart rate responsiveness to fixed workloads, or a pedometer (counts steps that a person takes) (Welk, 2002). It is possible to collect informative data using self-report questionnaires assuming well-validated and psychometrically robust measures designed to assess the construct of physical activity are used (Bauman et al., 2006). Perhaps the question in the context of physical activity as a mediator should be whether postpartum women feel a sense of vitality for life and are engaging in some form of physical activity. Or, is poor emotional health interfering with their quality of life? And, how does yoga impact, if at all, these factors? Lastly, it is arguable whether the SBAS is the most appropriate measure to assess levels of physical activity in this population. It may be that a measure with items specific to childrearing activities would be more appropriate in a postpartum population. Other measures worth considering are those that tap self-efficacy specific to motherhood including feeding, burping, diapering, bathing, and holding one's baby (e.g., Infant Care Survey; see Logsdon et al., 2008).

Implications

Empirical support for the role of yoga as a CAM therapy for improving psychological and physical functioning in clinical and non-clinical populations is gaining traction (e.g., Field, 2011; Li & Goldsmith, 2012; Lin et al., 2011; Uebelacker et al., 2010a). To our knowledge, the current study represents the first efficacy trial of yoga for PPD, and extends the empirical support of CAM therapies for perinatal women. Women

in the yoga group experienced significant benefits as evidenced by greater improvement in scores of depression over the course of 8 weeks, and lower levels of depression at post-treatment, relative to a control group.

It is important to highlight comparison between the current findings and treatments with demonstrated efficacy for PPD and general depression. A meta-analytic review of psychological treatments for PPD, including CBT and IPT, yielded a medium effect size for treatment compared to control groups, Cohen's d = 0.51, CI [0.34, 0.68] (Cuijpers et al., 2008). In the current study, there were large effect sizes favoring yoga relative to a control for the primary outcome measure of depression (HDRS) for both rate of change over the 8-week intervention (Cohen's d = -1.06), and levels of depression at post-treatment (Cohen's d = -0.82). These findings are consistent with large effect sizes detected in a previous study on yoga for depression in college students (Cohen's d = 1.59, favoring yoga; Woolery et al., 2004). Regarding specific PPD treatment studies, in particular the more well-established treatment for PPD is IPT. Importantly, the current study yielded comparable results to an IPT for PPD study (O'Hara et al., 2000) on scores of depression and postpartum adjustment, detecting significant treatment x time interaction effects in favor of yoga. This is especially notable given that yoga is conceptualized as a behavioral mind-body intervention, compared to IPT, which is designed to target interpersonal relationships and maternal adjustment.

Current findings are also comparable to results supporting CBT for treatment of depression and anxiety. One meta-analytic review showed that CBT for depression was more effective relative to wait-list control conditions with medium effect sizes (Hofmann et al., 2012). Further, CBT for social anxiety disorder has yielded medium to large effect

sizes relative to wait-list controls (Hofmann et al., 2012), findings that are consistent with current findings demonstrating large to medium effect sizes for slopes of social anxiety scores (Cohen's *d* = -1.03, favoring yoga) and intercepts (Cohen's *d* = -0.72, favoring yoga).

In the context of yoga as a CAM therapy, current findings are also consistent with previous research into the effects of yoga on depression, anxiety, and quality of life in various populations (e.g., Lin et al., 2011; Uebelacker et al., 2010b). A recent meta-analytic review of yoga for cancer patients detected small to large effect sizes favorable for yoga on scores of depression, standardized mean difference (SMD) = -0.95, CI [-1.55, -0.36], anxiety, SMD = -0.76, CI [-1.34, -0.19], and quality of life, SMD = -0.29, CI [-0.58, 0.01] (Lin et al., 2011). Current study results detected large effect sizes when examining slope effects (treatment x time interaction) for depression, Cohen's *d* = -0.91 to -1.06, medium to large effect sizes when examining slope effects for anxiety, Cohen's *d* = -0.56 to -1.03, as well as for HRQOL, Cohen's *d* = 0.71 to 1.26. While most of the research studies examining yoga for psychological and physical functioning in various populations are associated with significant methodological weaknesses, these comparisons are notable in suggesting that a yoga intervention for PPD has generated comparable if not superior effects to previous yoga interventions targeting other populations.

This study is the first to implement the Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007), a self-report measure of depression and anxiety, in a yoga efficacy study. The IDAS is a well-validated measure of mood and anxiety symptoms, with strong data supporting its use in a postpartum sample (Watson et al.,

2007). The IDAS scales, General Depression and Well-Being, were used as measures of depression in the current study. While the construct of well-being is typically not conceptualized as part of depression, Watson et al. (2007) detected a distinct pattern of findings in the development of the IDAS suggesting that the Well-Being scale (and other depression scales of the IDAS) was more strongly correlated with the BDI-II than with the BAI, thus tapping content traditionally linked to manifestations of depression (versus anxiety). Further, results from the current study demonstrated a significant and positive correlation between the Well-Being scale and measures of health-related quality of life (r = .27), satisfaction with life (r = .43) and mindfulness (r = .44), and a negative correlation with the IDAS General Depression scale (r = -.43) and postpartum maladjustment (r = -.39). These findings are consistent with the mood literature suggesting that low positive affect has a stronger association with depression, relative to anxiety (Clark & Watson, 1991), and lends additional support for the conceptualization of the Well-Being scale as a measure of depression.

The use of the HDRS in the current study also warrants discussion in the context of subclinical depression. The HDRS is the most commonly used primary outcome measure in depression treatment trials (Cuijpers et al., 2010), and is often used in PPD treatment trials (e.g., Cuijpers et al., 2007; O'Hara et al., 2000). The present investigation relied on a HDRS score of ≥ 12 as entrance criterion into the study, a score that represents 'mild' or subclinical depression. Women in the yoga group, on average, had an HDRS score of 17, which according to the depression literature is considered to be mild or "subclinical depression". Nonetheless, the present findings demonstrated significant effects using the HDRS as the primary outcome measure, detecting large

effect sizes comparable to that found in PPD and general depression treatment trials (Cuijpers et al., 2008; Cuijpers et al., 2010). These findings have broader implications for healthcare utilization. Postpartum women who present with subclinical depression (e.g., score of ≥ 12 on the EPDS) overutilize healthcare services (e.g., increased visits to physicians; Dennis, 2004), relative to nondepressed women (DaCosta et al., 2006). Thus, from a public health perspective, it is important to consider the clinical implications associated with subclinical depression. Subclinical depression also is an invalidating experience and is linked to increased risk of major depression (Cuijpers et al., 2007. Current findings suggest that yoga for subclinical depression in postpartum women has significant effects on reducing symptoms of depression, which may potentially reduce the incidence of moderate to severe forms of PPD.

Yoga Styles

While an aim of this study was not to examine potential differences between various styles of yoga, our findings suggest that a Gentle Vinyasa Flow style of yoga may have differential effects on symptoms of depression and anxiety. While there were clear and significant treatment effects for depression, social anxiety, and traumatic intrusions, significant effects were not detected for panic. The Gentle Vinyasa Flow class included activating poses, such as sun salutations and balancing poses in the beginning of class, and floor poses including backbends and stretching poses (the yin element of the class) at the end of class. Of note, backbends are known to open the chest and, according to yoga philosophy, are hypothesized to target depression (e.g., McCall, 2007; Weintraub, 2004). In a Yin yoga class, the emphasis is on floor poses with minimal involvement, if any, of activating and/or standing poses. Yoga philosophy suggests that yin is energetically

opposite to the yang quality of typical Vinyasa flow classes as evidenced in the grounding effects of longer held poses (up to 5 minutes versus 1 minute in a Vinyasa class) on the floor versus the movement associated with sun salutations and balancing poses in a flow class. According to yoga philosophy, these longer held poses are thought to activate the parasympathetic nervous system and, thus, may contribute to feeling grounded and centered in the body (Grilley, 2012; McCall, 2007; Powers, 2008). Because anxiety plays a significant role in the clinical presentation of women with PPD (Ross & McLean, 2006; Wenzel et al., 2003, 2005), the style of yoga should be given closer attention in future studies as it may inform the development of efficacious yoga interventions for comorbid anxiety (especially panic) in PPD.

Mechanisms

There is scant evidence on mechanisms by which yoga may be efficacious in improving psychological and physical functioning. Theory-driven hypothesized mechanisms include physical activity and mindfulness. As evidenced in the current findings on process variables, a potentially important area for future efficacy research is in the investigation of mindfulness as a mediator of treatment outcomes. Research focused on evidence-based mechanisms is gaining traction in psychotherapy treatment trials (Kazdin, 2008), as well as in the yoga literature (e.g., Sherman, Wellman, Cook, Cherkin, & Ceballos, 2013). The yoga intervention in the current study did not incorporate a formal mindfulness technique; however, the intervention was designed such that an emphasis was placed on developing and nurturing present moment experience during class. For example, the dialogue used to guide the participants through the yoga sequence included phrases such as “notice if your mind has wandered or drifted, and

come back to your breath" and "stay with any physical sensations arising as you hold the pose." The integration of a formal mindfulness meditation component with a yoga intervention should be considered in future efficacy research on yoga for PPD. The psychological benefits associated with mindfulness meditation techniques are manifold. For example, a *controlled focus* meditation practice, with instructions to concentrate on "loving kindness and compassion" or to "use breath as a focal point," is associated with increased attention and concentration, and improved psychological functioning (e.g., decrease in negative rumination) (Shapiro et al., 2008; Travis & Shear, 2010). "Open monitoring" or mindfulness-based meditation (e.g., Vipassana, Zen) is another form of meditation that encourages the practitioner to notice present moment experiences without grasping or evaluating (Cahn & Polich, 2006; Chiesa, 2010). Instructions associated with this style of meditation can be statements such as: "Notice the thought arise, then let it pass by" with the goal of developing acceptance of what is arising in the moment versus resistance or distraction (Chiesa, 2010). There are strong data supporting this style of meditation in improving psychological and physical functioning in patients with mood and anxiety disorders, as well as with chronic medical conditions (Edenfield & Saeed, 2012; Fjorback, Arendt, Ørnbøl, Fink, & Walach, 2011; Shapiro et al., 2009). These styles of meditation should be considered in the design of yoga efficacy studies in the future.

Intervention Characteristics

Research into the benefits of yoga is gaining traction in the scientific literature. The body of empirical evidence on the benefits of yoga, albeit scant, is beginning to consider important questions regarding study design. Investigators are beginning to

consider the elements of yoga studies in the context of well-established psychotherapy and pharmacotherapy treatment trials. As such, it is important for yoga researchers to develop rigorously controlled studies that include clear randomization procedures, adequate comparison groups, and adequate description of the yoga style and protocol (e.g., sequence of poses, studio environment) implemented in the intervention. Additionally, we need to systematically examine intervention specific characteristics, including number of classes attended, prior yoga experience, and the role of a home based practice to develop an understanding into the potential factors contributing to the efficacy of yoga for PPD. Additionally, examination of these variables will help to address important questions such as dose-response relationship and whether a home-based practice influences this relationship, and the role of yoga style in the effects on psychological and physical functioning (Sherman, 2006; Kinser et al., 2013). Results from the current study did not support a dose-response relationship, and there were no differences in treatment outcomes based on participation in the home-based practice. While it is critical for researchers to focus on the systematic study of yoga interventions to support replicability and generate empirical support for yoga, it also is important to preserve the tradition of yoga as much as is feasible. Thus, there is a fine line to walk as researchers move forward in paving the way for developing rigorously controlled studies in an effort to generate support for yoga as an alternative treatment option.

Acceptability of Yoga

The use of a yoga intervention for the treatment of depression in postpartum women has several advantages for this population in which suboptimal treatment of depression may be a manifestation of barriers to care and maternal treatment preferences

(Dennis & Chung-Lee, 2006; Goodman, 2009; O'Mahony et al., 2013). Specifically, a yoga intervention addresses barriers associated with pharmacological interventions (e.g., medication side effects for breastfeeding mothers) and psychological interventions such as stigma and shame (Dennis & Chung-Lee, 2006; Freeman, 2009; Goodman, 2009). The current study demonstrated a retention rate (85%) and treatment adherence comparable to previous yoga studies for depression in women (ranging between 80%-90%; Kinser et al., 2013; Uebelacker et al., 2010b), and absence of adverse effects (e.g., women did not drop out due to contraindications related to intervention). Taken together, the yoga intervention based on a Gentle Vinyasa Flow class appears to be safe, acceptable, and feasible. In the context of the broader CAM literature, a yoga intervention may be more readily adopted by depressed postpartum women who express concerns regarding talking about their feelings and being perceived as "weak" or unable to fulfill their role as a mother (Dennis & Chung-Lee, 2006; O'Mahony et al., 2013).

Strengths and Limitations

The study has notable strengths, including the use of outcome measures similar to those used in previous PPD treatment trials (e.g., HDRS for depression and PPAQ for adjustment in the postpartum period), masked clinical assessors, a rigorous randomization procedure, and a yoga intervention developed specifically for postpartum women. To facilitate replication studies, the yoga intervention was standardized in that the sequence of poses was the same in each class. A treatment manual was developed with instructions for setting up the poses, along with a table outlining the sequence of poses. The yoga sequence was designed specifically for a postpartum population such that consideration was given to excluding certain backbends and floor poses that may have been

contraindicated for postpartum women. Finally, we developed an adherence checklist specifically for this study to monitor treatment fidelity.

There also were several limitations of the study that warrant discussion. First, the sample size was modest (N = 57), and substantially smaller than other treatment trials for PPD (e.g., *N* = 120; O'Hara et al., 2000). Second, with respect to self-report data, five women (31%) in the yoga group were lost to follow-up between post-treatment and the 2-month follow-up assessment. This could have been due to lack of accountability given that women were no longer asked to attend yoga classes or to complete interview or questionnaire-based assessments until the 2-month follow-up assessment. Third, the fact that our sample consisted of primarily White, well-educated, married women limits the generalizability of our findings. Finally, weaknesses specific to the study design included the use of a wait-list control group and not assessing whether women in the control group participated in yoga classes after the 8-week waiting period. The length of the follow-up period was only 2 months after the 8-week treatment period. The treatment literature for PPD and general depression suggests that a typical length is 12-months or more, which allows for adequate evaluation of important clinical issues such as rates of recovery and relapse (Cuijpers et al., 2008). Finally, we relied on class instructors (including the PI) who were involved with the development of the intervention, and the PI taught the majority of yoga classes.

CHAPTER V
CONCLUSION

The current study demonstrates support for a Gentle Vinyasa Flow yoga intervention as an efficacious CAM treatment for PPD. This is the first study to examine the efficacy of yoga for PPD, having important implications for both PPD and CAM treatment literatures. The findings from the current study are notable for several reasons. Yoga is safe, acceptable, and feasible; thus, this type of intervention may address existing barriers to care associated with current PPD treatments, including medication side effects and stigma. Second, the current intervention shows promise for targeting comorbid anxiety (especially social anxiety and PTSD-related intrusions) in the context of PPD, as well as improving HRQOL in depressed women. Third, the current findings highlight future areas of research, including mechanisms of action such as mindfulness. Fourth, this randomized controlled trial addresses some of the methodological weaknesses associated with existing CAM studies and contributes to the growing empirical base for yoga's efficacy. These findings substantiate a compelling argument for pursuing large-scale replication studies to test the efficacy of yoga in diverse samples to support generalizability in clinical work. Lastly, findings may have broader implications for women's mental health and the use of CAM therapies in primary care settings.

APPENDIX A
FIGURES

Figure A1. Birth Record Recruitment Flowchart

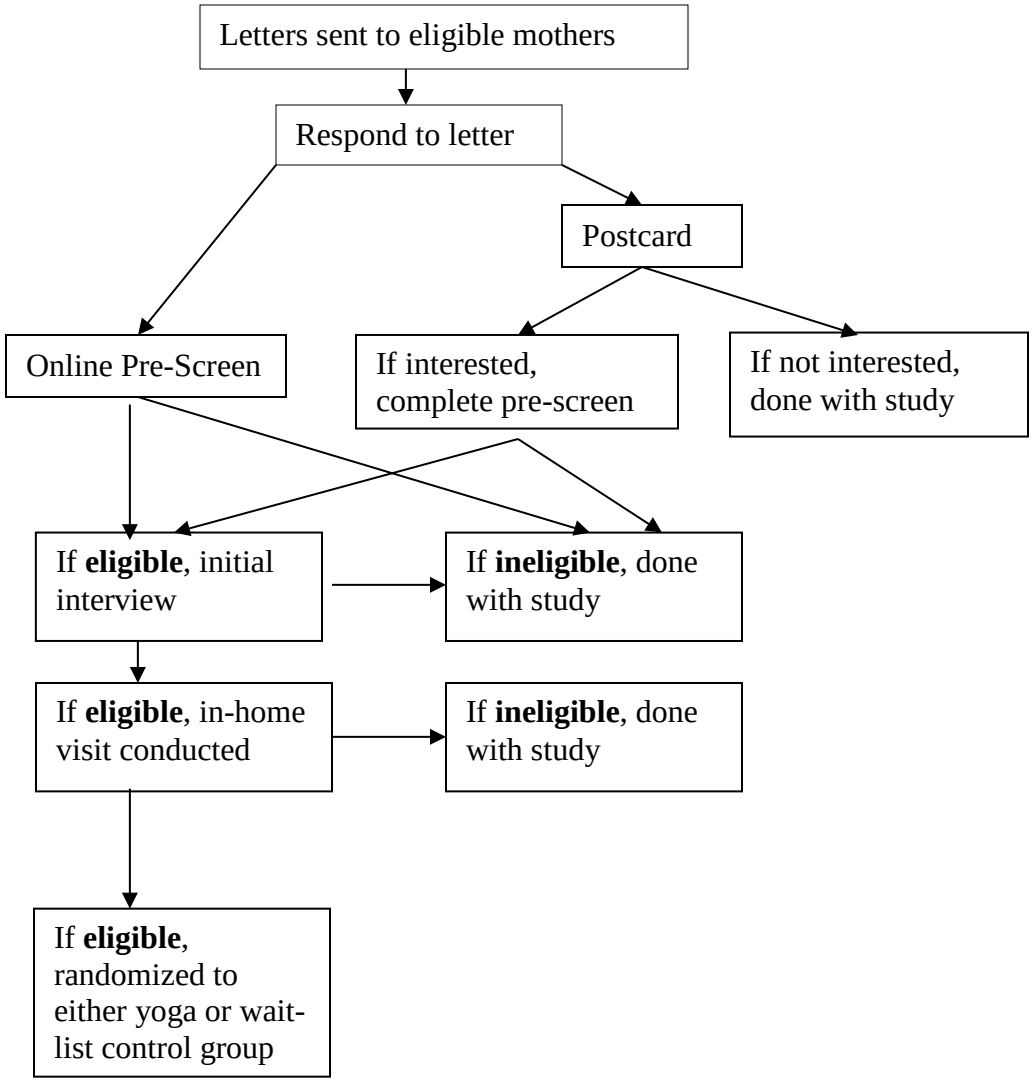


Figure A2. Poster and Electronic Mail Recruitment Flowchart

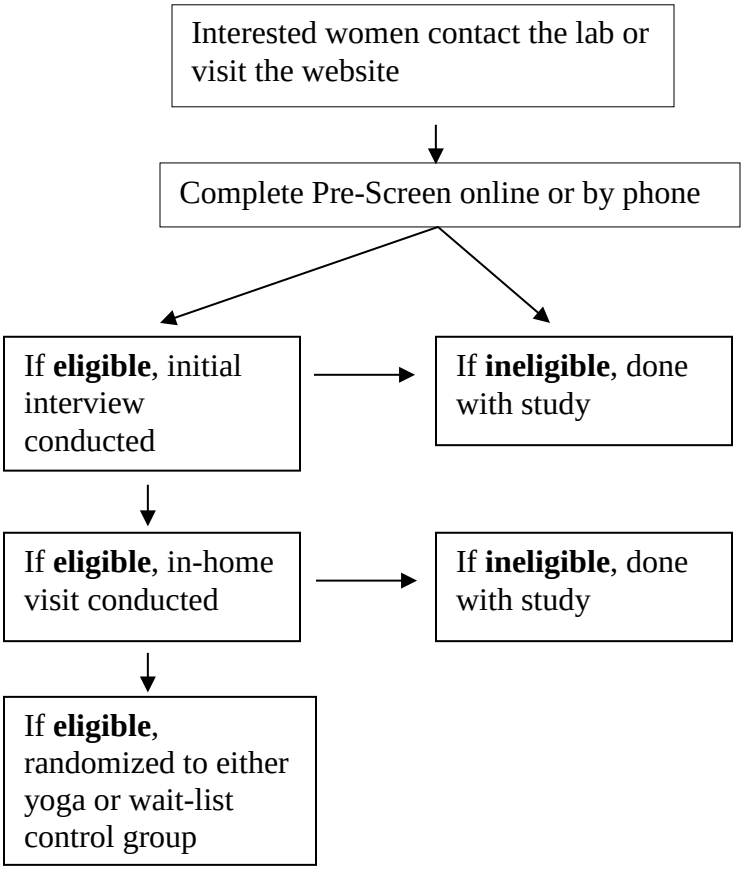


Figure A3. Assessment Timeline

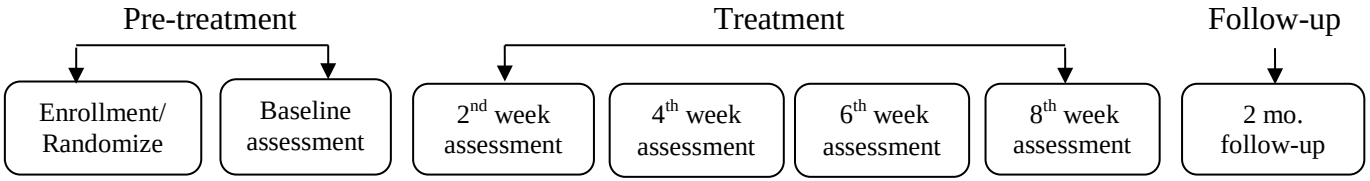


Figure A4. Participant Flow Diagram

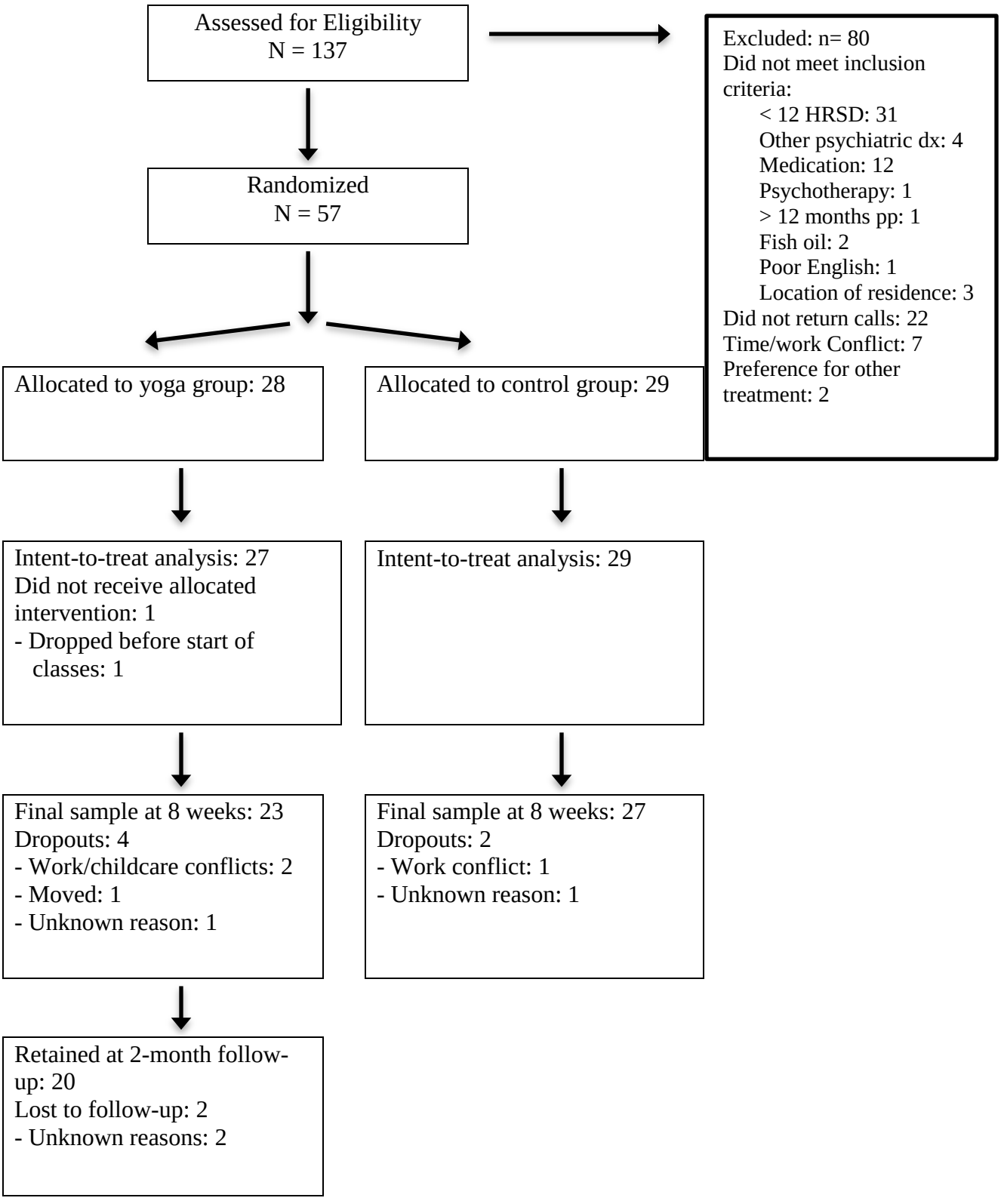


Figure A5. Treatment Predicting Change in Depression (HDRS) over 8-week Intervention

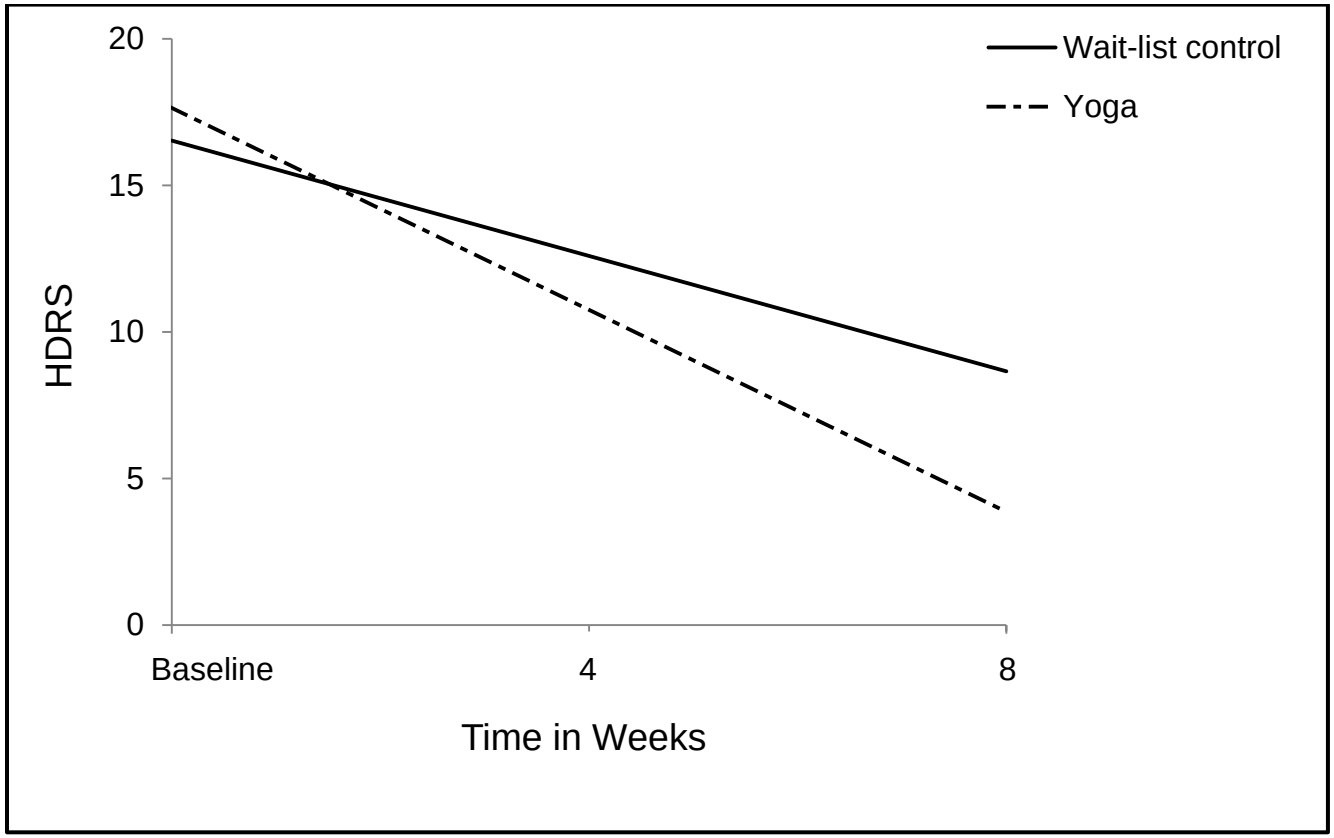


Figure A6. Treatment Predicting Change in Depression (IDAS General Depression scale) over 8-week Intervention

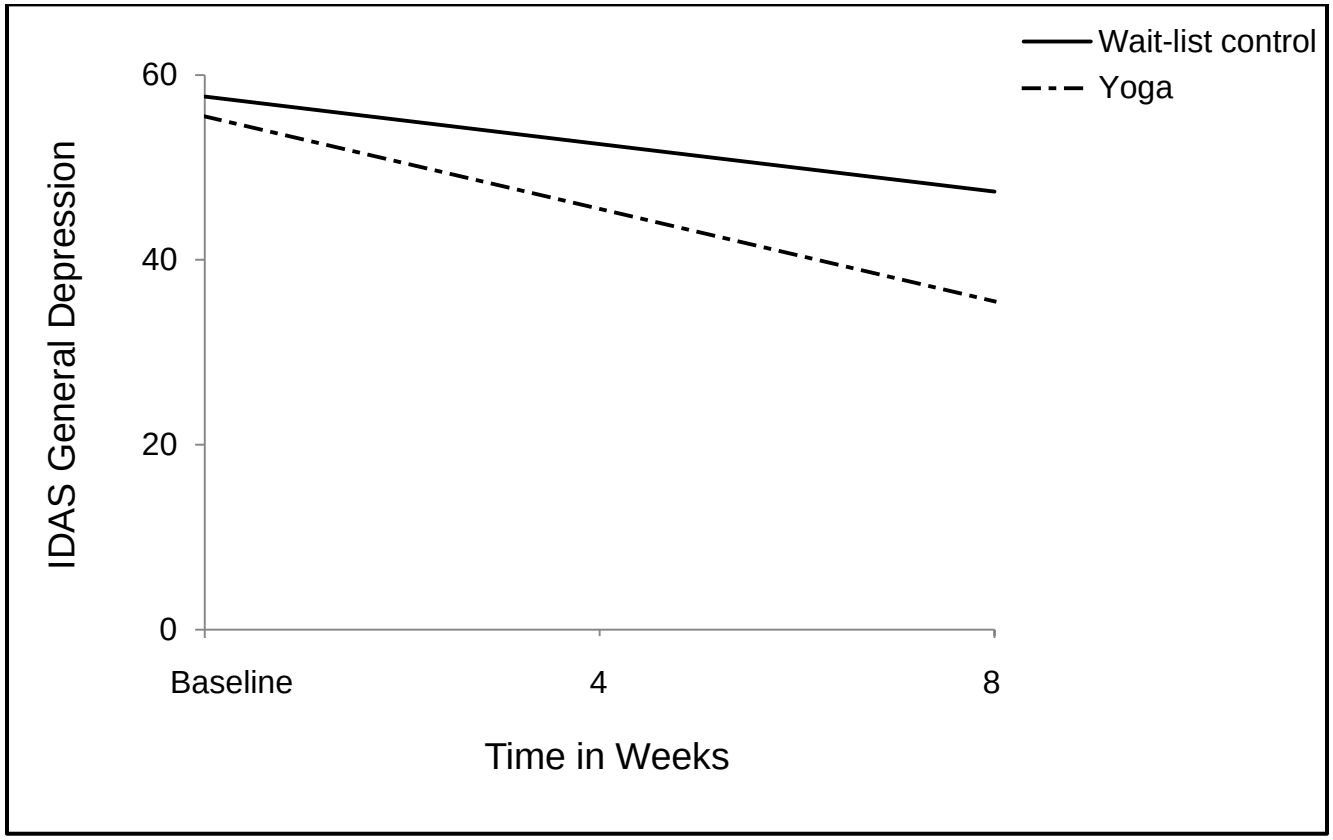


Figure A7. Treatment Predicting Change in Well-Being (IDAS Well-Being) over 8-week Intervention

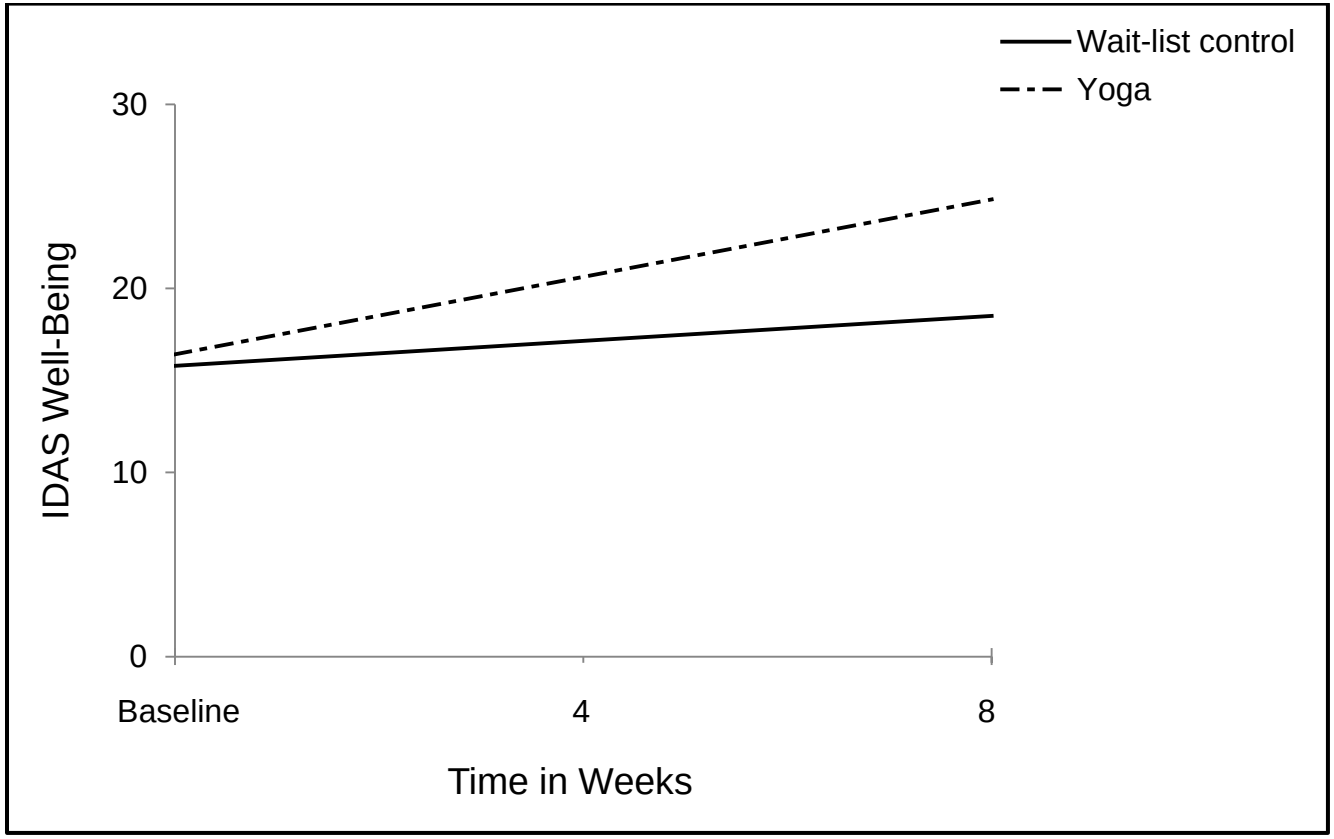


Figure A8. Treatment Predicting Change in Traumatic Intrusions over 8-week Intervention

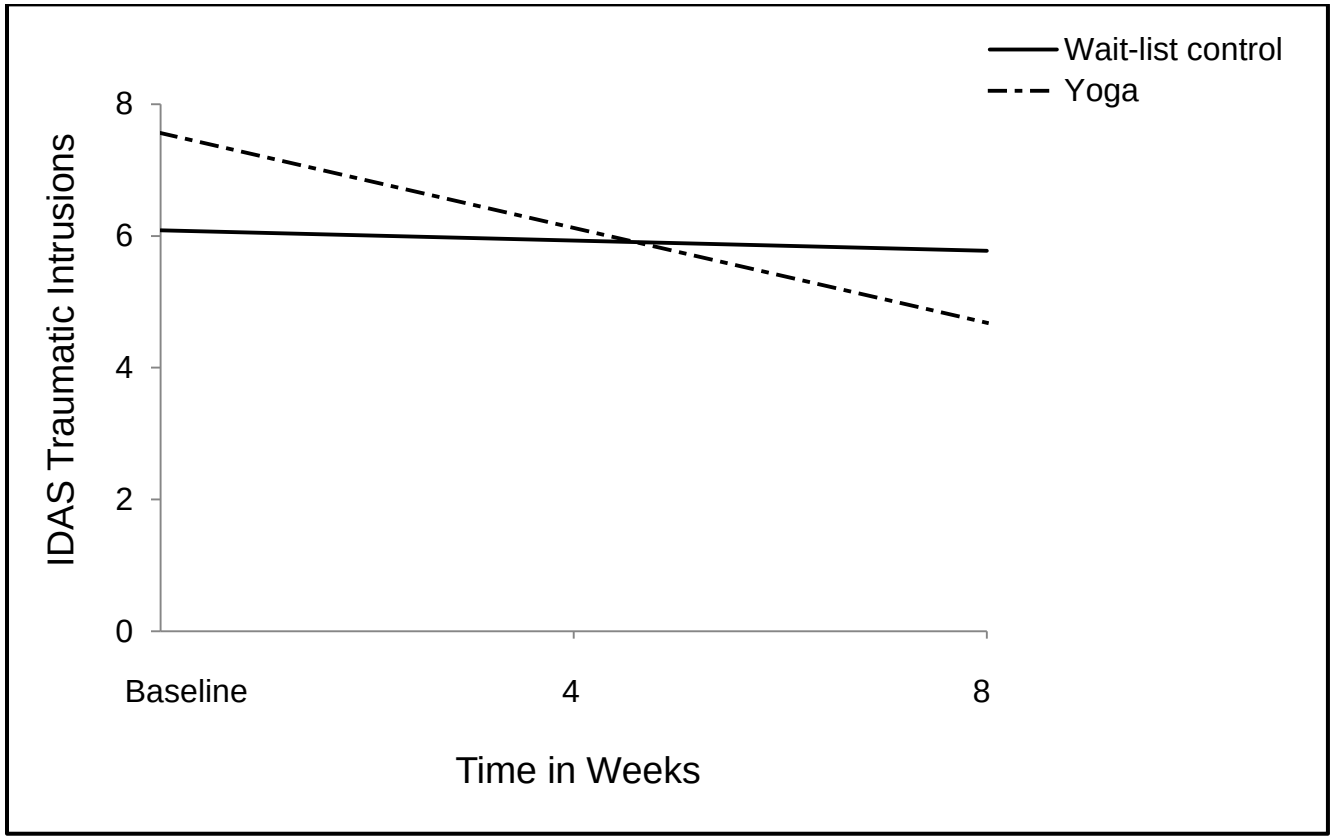


Figure A9. Treatment Predicting Change in Social Anxiety over 8-week Intervention

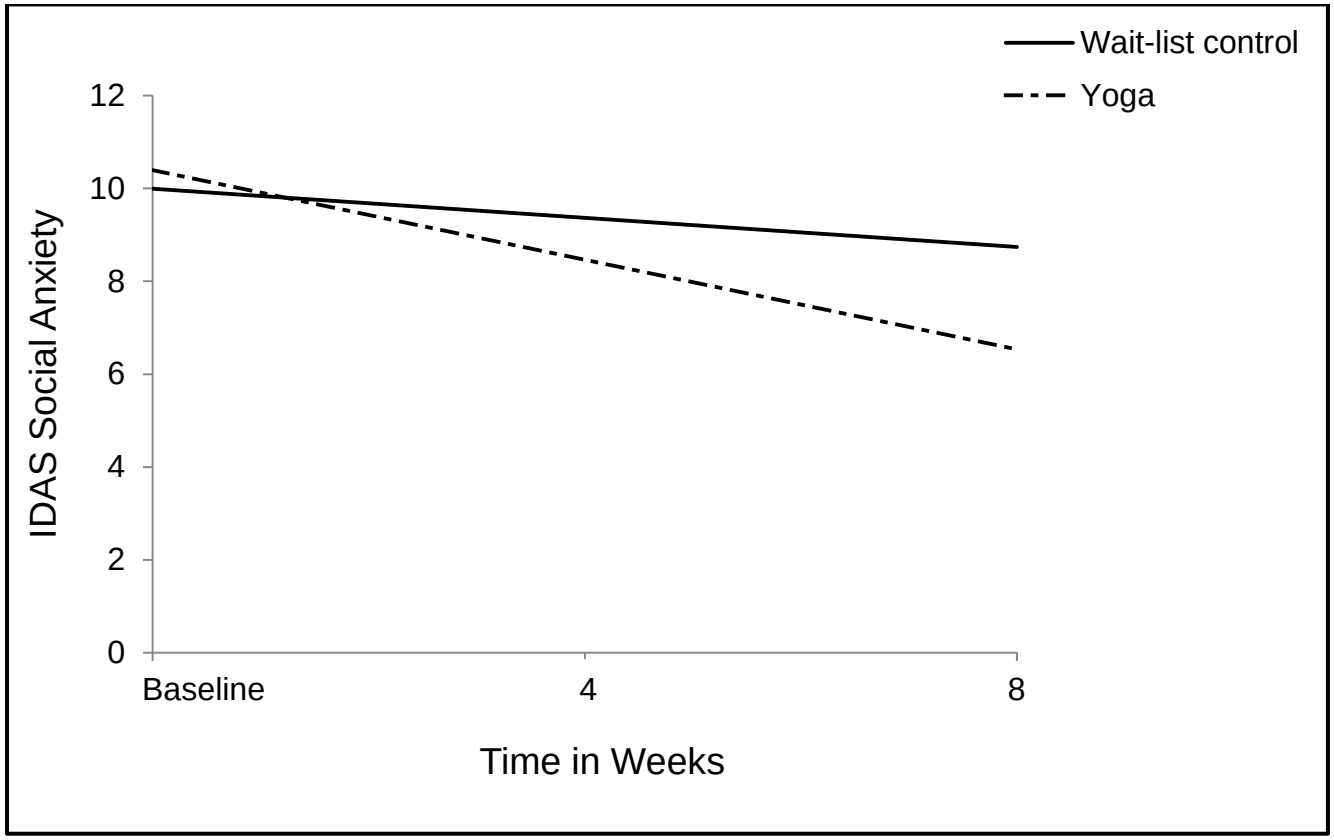


Figure A10. Treatment Predicting Change in Panic over 8-week Intervention

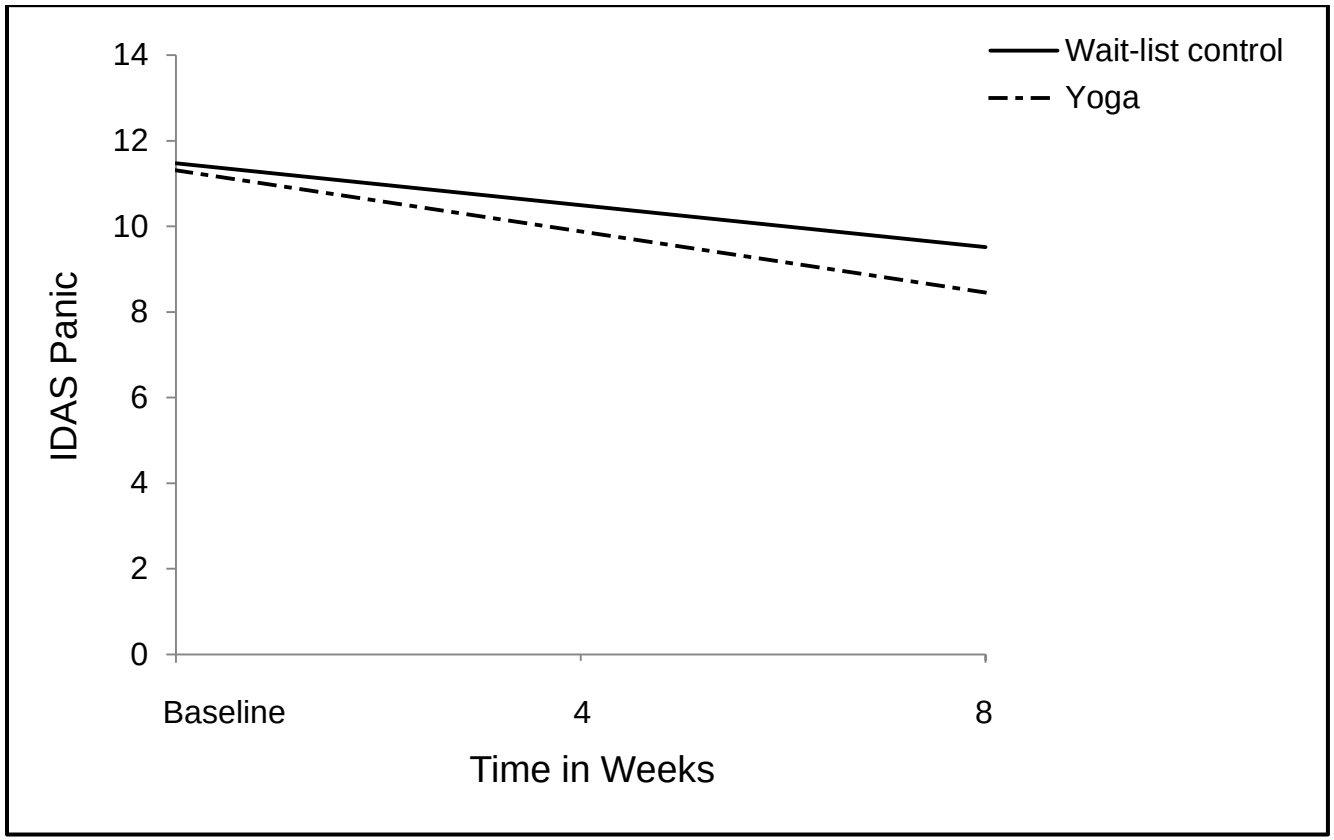


Figure A11. Treatment Predicting Change in Postpartum Adjustment (PPAQ) over 8-week Intervention

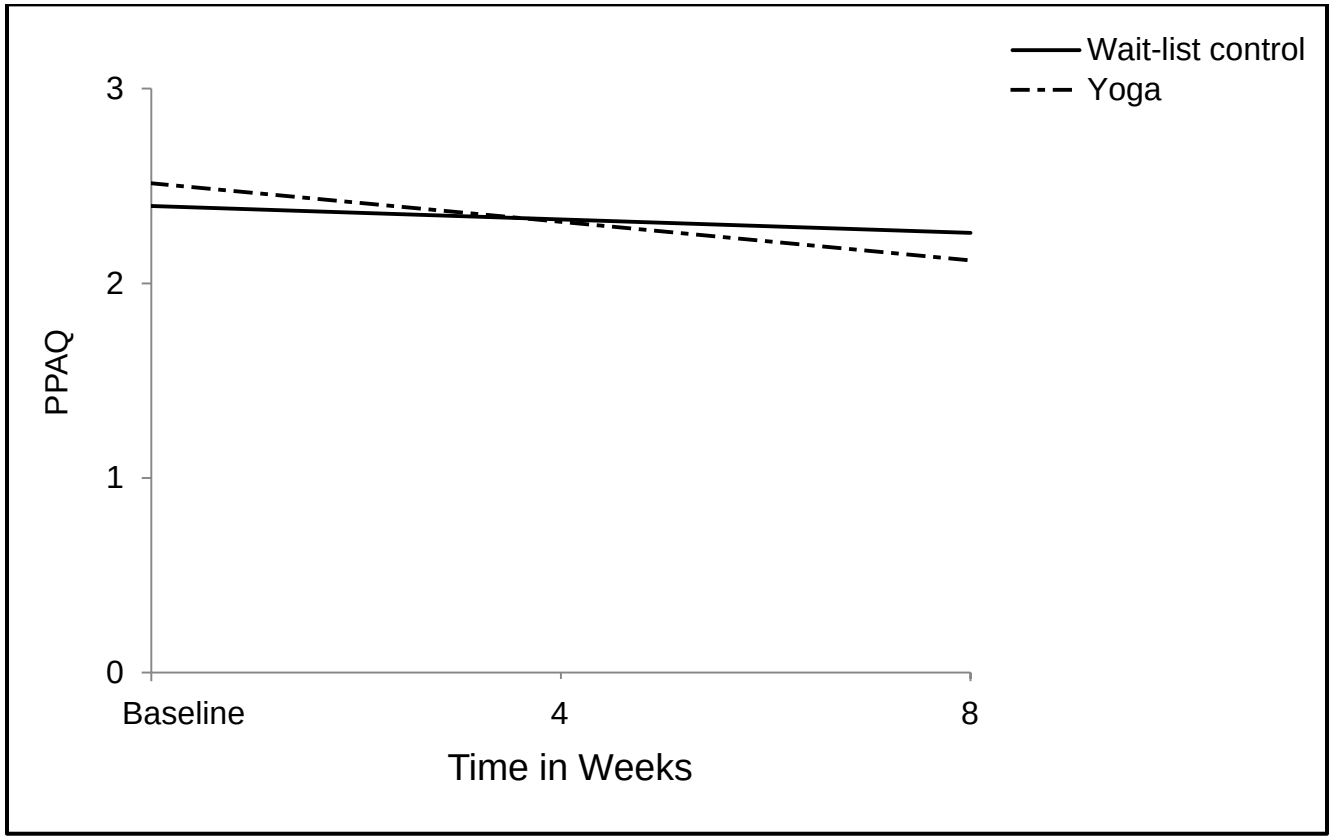


Figure A12. Treatment Predicting Change in HRQOL (SF-36 Total Score) over 8-week Intervention

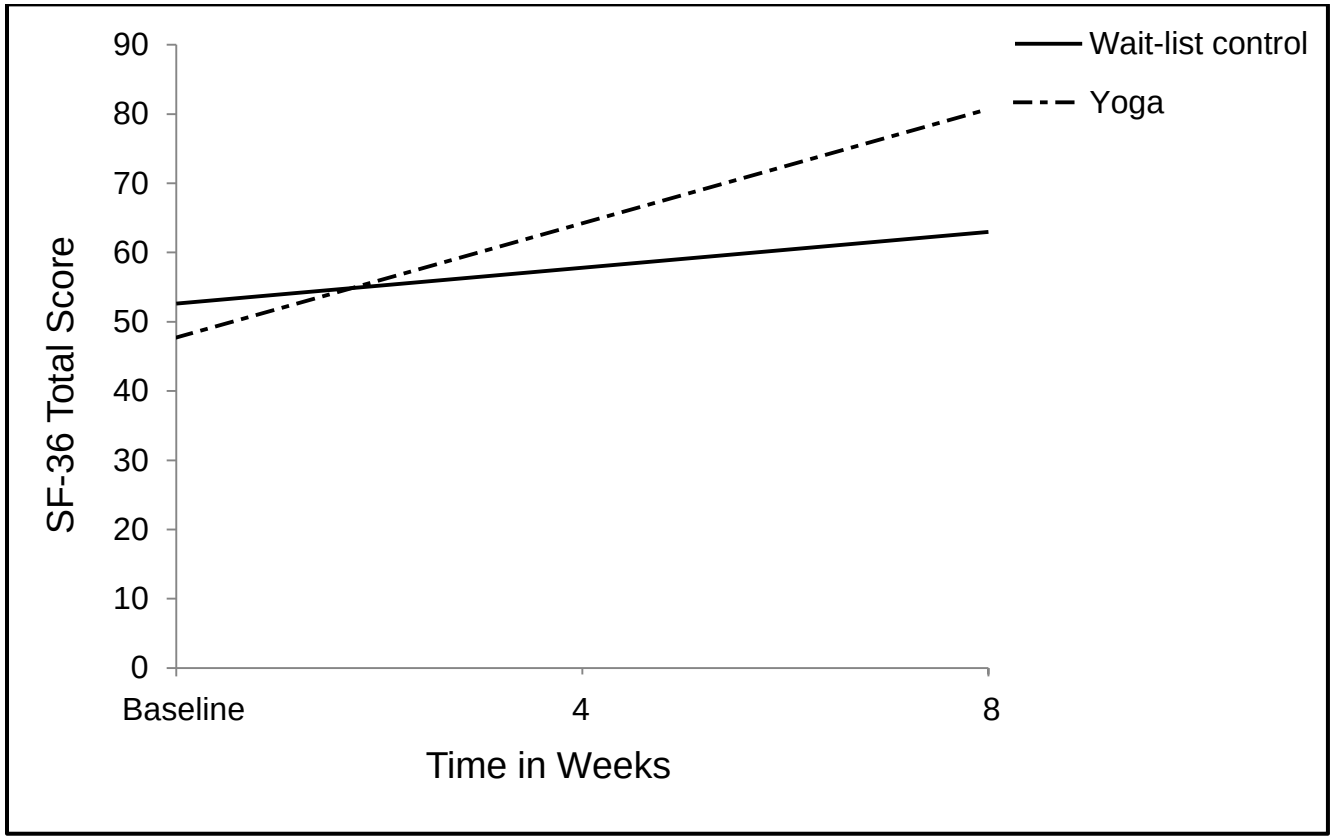


Figure A13. Treatment Predicting Change in HRQOL (SFMCS) over 8-week Intervention

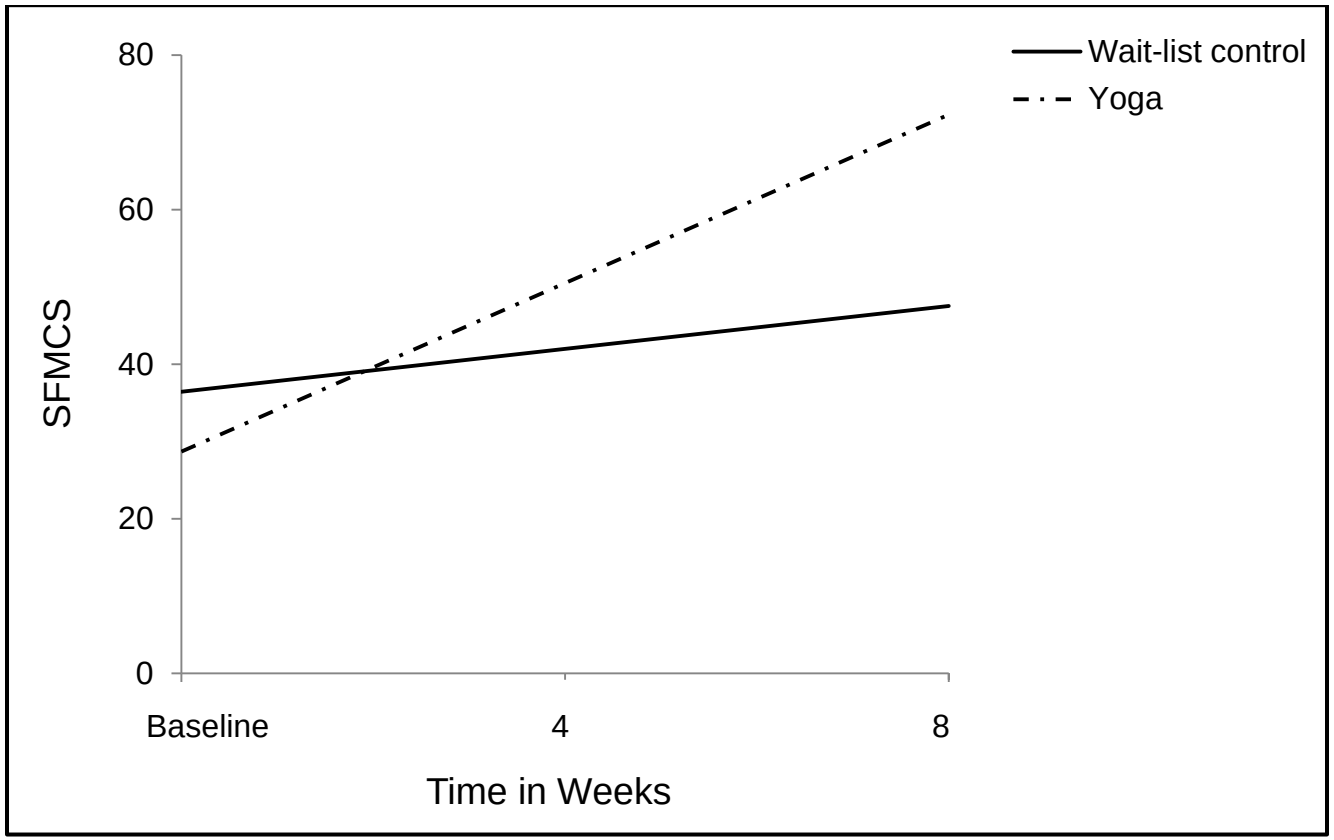


Figure A14. Treatment Predicting Change in HRQOL (SFPCS) over 8-week Intervention

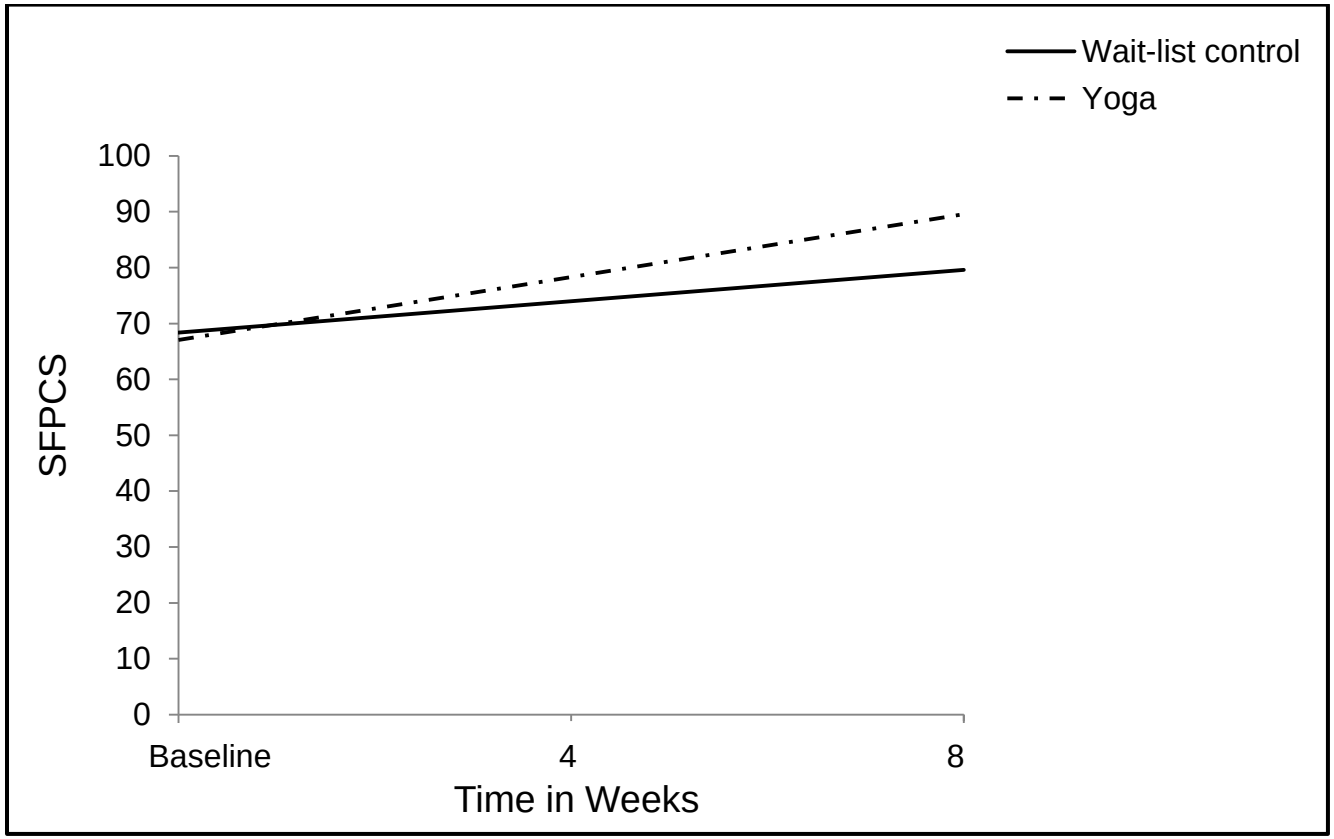


Figure A15. Treatment Predicting Change in Life Satisfaction (SWLS) over 8-week Intervention

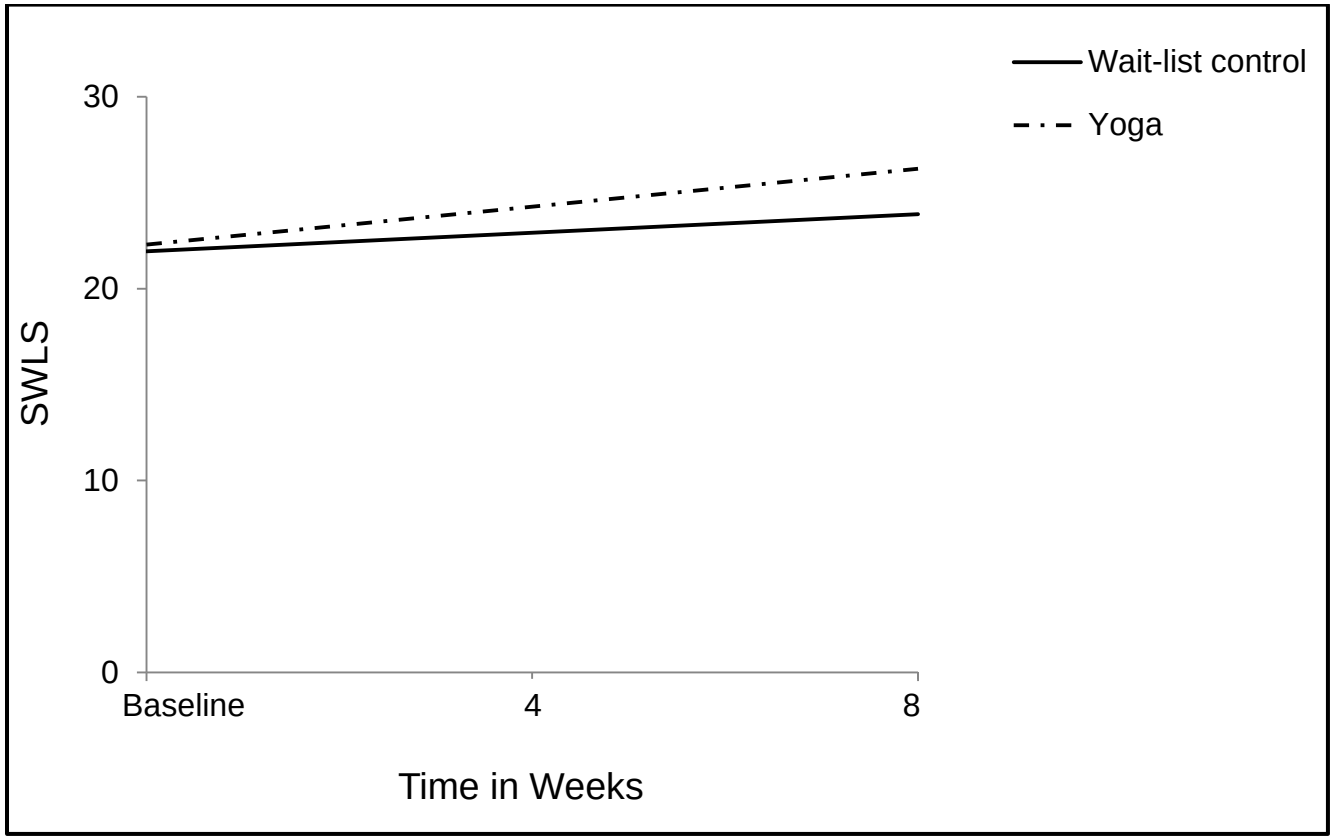


Figure A16. Treatment Predicting Change in Mindfulness (FFMQ) over 8-week Intervention

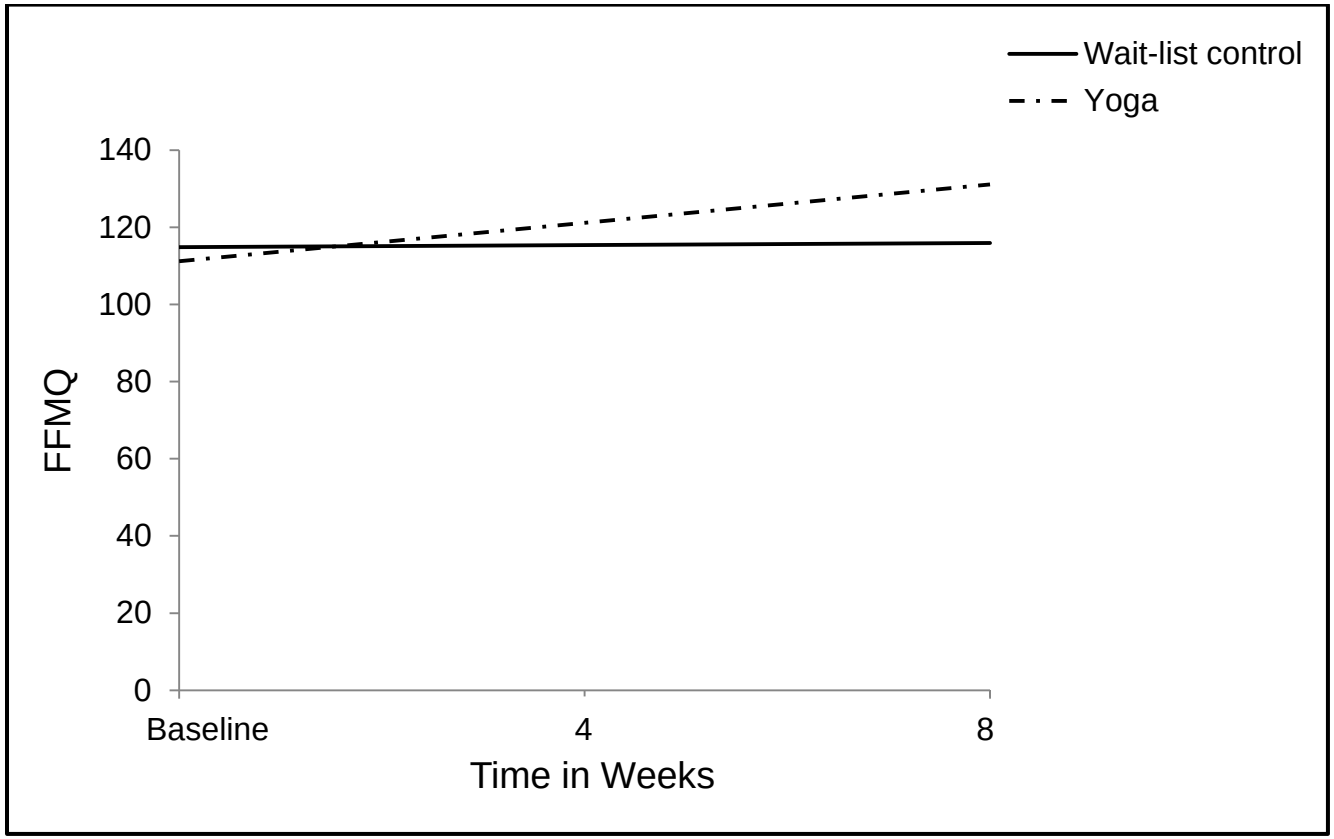
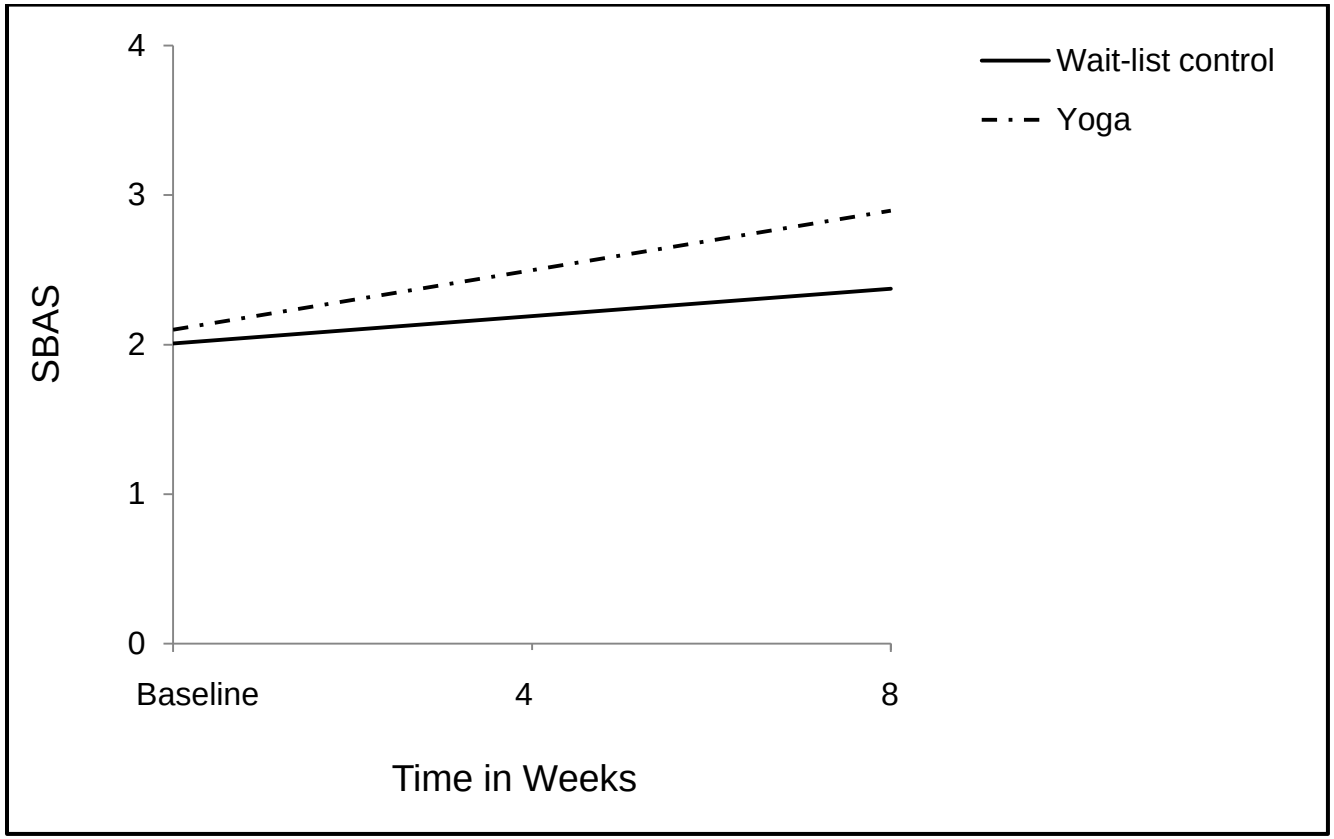


Figure A17. Treatment Predicting Change in Physical Activity (SBAS) over 8-week Intervention



APPENDIX B
TABLES

Table B1. Measures Administered at Each Assessment over the Course of the Study

Measure	Type	Screen	Intake	Week 2	Week 4	Week 6	Week 8	2 mo. F/U
PHQ-9	Self-report	x						
SCID	Interview		x					
HDRS	Interview		x	x	x	x	x	x
IDAS	Self-report		x	x	x	x	x	x
PPAQ	Self-report		x	x	x	x	x	x
SF-36	Self-report		x	x	x	x	x	x
SWLS	Self-report		x	x	x	x	x	x
FFMQ	Self-report		x	x	x	x	x	x
SBAS	Self-report		x	x	x	x	x	x

Note: PHQ-9 = Patient Health Questionnaire-9; SCID = Structured Clinical Interview for DSM-IV Axis I Disorders; HDRS = Hamilton Depression Rating Scale; IDAS = Inventory of Depression and Anxiety Symptoms; PPAQ = Postpartum Adjustment Questionnaire; SF-36 = Short Form-36; SWLS = Satisfaction with Life Scale; FFMQ = The Five Facet Mindfulness Questionnaire; SBAS = Stanford Brief Activity Survey.

Table B2. Instruction Sheet for Wait-list Control Group

You have been assigned to a Wait-List Control (WLC) group for the yoga research study. You will receive the 8-week yoga program after an 8-week waiting period. During the 8-week waiting period, please maintain your usual activities and refrain from seeking any form of conventional or alternative treatment, including the following:

Conventional Treatments

Electroconvulsive Therapy (ECT)

Medications:

- Antidepressants (e.g., sertraline, prozac, buproprion, nortryptyline)
- Any other psychotropic medication (e.g., benzodiazepines)

Psychological and Psychosocial Interventions:

- Psychotherapy (Cognitive Behavior Therapy, Interpersonal Psychotherapy)
- Any psychosocial intervention that is led by a qualified mental health professional
    - Peer/partner support groups (Postpartum support group)
    - Non-directive counseling

Alternative treatments

- Bright light therapy
- St. John's Wort
- Omega-3 fatty acids
- Acupuncture
- Infant/mother massage
- Energy work (e.g., Reiki)
- Mindfulness program (e.g., Mindfulness Based Stress Reduction Program)

Please do not hesitate to contact Melissa Buttner (PI) at the Iowa Depression and Clinical Research Center (IDCRC) should you have any questions or concerns. She may be reached at (319) 335-0307/866-UI-WOMEN or via e-mail: melissa-buttner@uiowa.edu.

Table B3. Measures to Assess Constructs in the Study

Measure	Construct(s)	Type of variable
PHQ-9	Depression	Screen
SCID	Mood, anxiety, psychotic, and personality disorders	Diagnostic
HDRS	Clinical rating of depressive symptoms	Diagnostic/Outcome
IDAS	Depression and anxiety symptoms	Outcome
PPAQ	Adjustment specific to the postpartum period	Outcome
SF-36	QOL: Health-related quality of life (HRQOL)	Outcome
SWLS	QOL: Overall satisfaction with life	Outcome
FFMQ	Mindfulness	Process (Exploratory)
SBAS	Physical activity	Process (Exploratory)

Table B4. Yoga Sequence and Poses

Sequence (time)	Yoga Pose
Breathing/Meditation (5 minutes)	Belly breathing Meditation (use breath as a focal point)
Warm-up (8-10 minutes)	Seated: Arms overhead/down (5 sets) Cat Stretch (5 sets) Thread the Needle (R/L: 5 breaths) Downward Dog (DD) (5 breaths) *Transition: walk to top of mat* Standing forward bend (5 breaths) Spinal roll up (5 breaths) Mountain pose (5 breaths) Sun Salutation A (3-5x, with modifications)
Integrative (25 minutes)	Lateral side stretch (R/L: 5 breaths) Standing: Arms overhead/down (5 sets) Modified crescent lunge (R/L: 5 breaths) Transition: Spinal roll up to mountain pose Warrior II* (R: 5 breaths) Exalted Warrior* (R: 5 breaths) *R: L (5 breaths) Forward bend (5 breaths) Modified extended side angle* (R: 5 breaths) Triangle* (R: 5 breaths) *R: L (5 breaths) Tree (R/L: 5 breaths)
Transition to Floor Sequence (1 minute)	Child's pose[a] (5 breaths) *Transition: table top position* Cat Stretch (5 sets)
Cool down stretches/Close of practice (20-22 minutes)	Half camel pose[a] (2 sets: 5 breaths) *Transition: DD -> top of mat, seated position, roll back onto mat* Bridge Pose (2 sets: 5 breaths) One knee-to-chest pose (R/L: 5 breaths) Both knees-to-chest (1 set: 5 breaths) Modified supine twist (R/L: 5 breaths) Happy baby pose (5 breaths) Corpse pose (8-10 minutes)

Note. R = right; L = left; R:L = Repeat same posture on the left side.

[a] These poses are hypothesized to target symptoms of depression and anxiety in the tertiary yoga literature (McCall, 2007; Weintraub, 2004).

Table B5. Frequently Asked Questions (FAQs)*

What Should I Wear? Wear light, comfortable clothes in which you can move easily but that cover your body appropriately to accommodate postures (e.g., forward bends) that can be revealing.

What Should I Bring To Class? Bring a large towel and water to class. Mats will be supplied for the yoga classes.

What Is Proper Class Etiquette?

- Be on time and only leave early if you must. If you need to leave early, please inform me via e-mail (melissa-buttner@uiowa.edu) before the day of the class, or let me know before class starts.
- Remove your shoes before entering the studio.
- Leave all cell phone and pagers with your personal belongings in the changing room.
- Be considerate of your neighbor's space when you set up your mat.
- Avoid strong perfumes or lotions.

What are the Benefits of Yoga? The nicest thing about yoga is the range of benefits you'll receive. On a physical level, you'll experience more strength, better balance, increased stamina, better breathing, improved flexibility, better posture and healthier circulation. On a mental level, the practice of yoga itself may help to engage the student in meditation, which leads to improved focus, a calm mind and general happiness.

What If I'm Not Flexible? A common misconception of yoga is the need to be flexible in order to do the postures. Yoga is not about having the flexibility to bend your body into a certain position. The aim of a yoga practice is improved physical and emotional health, strength, and stability. With a regular practice suited to your body's individual daily needs, you will notice increased flexibility over time.

What Can I Expect the Next Day? If this is your first yoga class or you haven't practiced in awhile, expect to feel a little sore the next day. You may also experience a headache. This is typically a sign that your body has started the detoxification process. Drink a lot of water before and after class.

How Should I Prepare For Class?

- Try to drink as much water as you can before class to avoid dehydration.
- Avoid large meals up to three hours prior to class.

Note: * FAQs adapted from http://www.yogasourcelosgatos.com, YogaSource Studio, Los Gatos, CA.

Table B6. Yoga Instruction Manual

Sequence I: Breathing/Meditation (5 minutes)

- Sit upright with an erect spine and legs crossed at ankles; lengthen through the crown of the head towards the ceiling (may alternate between starting in a seated position and child's pose)
- Draw shoulders back and down from the ears
- Begin to relax the face and jaw
- Start to notice the rise and fall of the abdomen with every inhale and exhale

Note: As student's begin to prepare for their practice by connecting to their breath and dropping into their bodies, encourage them to use the breath as an anchor point during their practice to bring them back to the present moment when the mind wanders or drifts.

Sequence II: Warm-up (10-15 minutes)

Seated: Arms Overhead/Down

- Remain in a seated position (if starting in child's pose with knees wide, slide hands back to knees and draw knees together, come back to a seated position) back straight, navel pulled in slightly
- On the inhale, lift your arms overhead; on the exhale, draw your arms down to your side laterally, as though you are pushing something down with the palms of your hands (*Modification: arms may be slightly bent*)
- Repeat this movement, and link breath with movement
- Repeat for 4 sets

Transition to tabletop position: At the end of the last set, bring your hands forward to the top of the mat, separate your hands shoulder width distance and press down into your palms. Slide your knees forward slightly so they are directly underneath your hips, and are hip width distance; shins and feet are resting on the mat.

Cat Stretch/Spine Flexion *(from tabletop position)*

- Place your hands under your shoulders and your knees under your hips. Spread your fingers wide, and press through the base of your fingers *(Modification: balance on your knuckles if you feel strain in your wrists*)
- On the in breath, focus on your neutral spine
- As you exhale, draw your belly in, round your back, and draw the tailbone down between your legs
- Drop your head down, and tuck your chin towards your chest as you look up toward your navel. On your next inhale, tilt your pelvis back to neutral position so that your back is in a flat position, chin forward away from chest and eye gaze forward.
- Inhale, maintain a neutral spine; on the exhale repeat the rounding of the back and tilting of the pelvis
- Repeat for 5 sets

Table B6. Continued

Thread the needle

- From tabletop position, slide your right hand through the space between your left arm and left thigh as though you are threading a needle
- Draw your torso, chest, and right ear down toward the mat; eye gaze at the edge of your mat
- Press down through your left hand, and put a slight bend in your left elbow (*Variation*: To increase the stretch through your torso and shoulders, reach your left hand towards the ceiling and continue to stretch through your right hand, sliding it away from your body)
- Hold for 5 breaths; to release, take an inhale and on the exhale slide right hand back to the mat to come back into table top position; inhale, on the exhale repeat on left (hold for 5 breaths)

Transition: tabletop position

Downward Facing Dog Pose (*from tabletop position*)

- Spread your fingers wide, and root down through your palms
- As you inhale, curl your toes under and on your exhale, lift your knees away from the mat and hips toward the ceiling
- Knees are slightly bent and heels are lifted away from the floor
- Lift the sit bones toward the ceiling, and press your thighs back
- Press your heels down toward the mat, and straighten your knees
- Press down into the palms of your hands and draw your shoulder blades down your back, toward your tailbone
- Press firmly and evenly down through your palms and fingers, and engage your legs

Transition: slowly walk your feet forward to the top of your mat, preparing for standing forward fold.

Standing Forward Fold

- Separate feet hip width distance (wider if you feel strain in the lower part of your back)
- Soften your knees, draw the navel in toward your spine
- While rooting down through your feet, feel your legs engage and sit bones extending upward
- Allow your shoulders to roll forward towards the mat, harms hang heavy (*Variation*: grab opposite elbows)

Spinal Roll Up

- Bring hands down to the mat, and roll up one vertebra at a time, bring the chin up last

Table B6. Continued

- Reach both arms up toward the ceiling and then lower arms down to your side with palms facing out

Mountain Pose

- Stand tall, draw shoulder blades back and down
- Crown of the head lengthens toward the ceiling
- Pelvis is neutral, tailbone draws down toward your mat
- Root down through the soles of your feet as you spread your toes wide apart

Sun Salutation A

- Plank: starting position for a push up.
- Pressing hands into the ground-wrists elbows and shoulders are in one line
- Press out through your heels as though you were standing in Mountain Pose
- Keep from sinking in the lower back or pelvis by reaching your tailbone toward your heels and drawing your navel toward your lower spine
- *Modified version: build from this point*
- As you exhale, lower your knees, chest, and chin to the floor ("eight point posture")
- Inhale into cobra. Press your hips toward the floor as you slide your chest forward between your hands, point your toes and roll up into Cobra. Then, pull back into downward facing dog.

Sequence III: Integrative poses (25-30 minutes)

Standing: Lateral Stretch

- On the inhale, reach your right arm toward the ceiling
- Exhale, stretch right hand towards left side of room as you press your right hip in the opposite direction
- Lift out of your waist, draw your navel in toward the spine, and press your feet down into the mat (hold for 5 breaths)
- Inhale to stay, on the exhale reach your right arm back up to the ceiling and float the arm down to your side
- On your next inhale, reach your left arm up toward the ceiling and continue to lengthen out of your waist; on the exhale stretch your left arm towards the right side of the room and press your left hip towards the left, in the opposite direction
- Right hand slides down your right leg as you continue to press down through your feet, thighs are contracted, legs are strong. Both hips are level, in one line from the side.
- Take an inhale through the nose, as you exhale use the left arm to pull you back up to standing position, left arm floats down to your side

Table B6. Continued

Standing: Arms overhead/down

- As you inhale, reach both arms overhead and as you exhale float your arms down to your side, creating natural resistance through the arms
- Repeat 4 more times, linking breath with movement; as you inhale reach arms overhead and on the exhale, draw your arms down to the side

Transition: Mountain pose to forward fold

Modified Crescent Lunge

- From forward fold, step left foot back, and come into a lunge with your right knee directly above your ankle
- Keep your fingers on the mat for support; work to lift your torso off your thigh with the crown (top) of your head extended toward the front of the room
- Lower your left knee to the mat and flatten your left foot, toes extending
- Place your hands on top of your right knee; hold this position, keep your pelvis neutral (tailbone draws down toward the floor)
- To move deeper into lunge, bend the front knee and allow the hips to come forward toward the mat
- To release, press hands down into the mat, use for support as you lift the left knee off the mat, curl over your left toes, step your left foot forward to meet your right foot.
- Inhale, lift the chest; on the exhale, fold forward. Repeat lunge on opposite side using same instructions.

Standing Forward Fold

- Stand in mountain pose, hands on hips. As you exhale, bend forward from the hips and lengthen the front of the torso.
- With knees straight, or slightly bent, bring your finger tips (or palms) to the floor slightly in front of your feet
- Press heels firmly into the floor and tilt your tailbone back, spiral the thighs inward
- With each inhale, lift and lengthen the torso; with each exhale, release more fully into the forward bend
- Relax your neck, allow the head to hang heavy, soften the jaw
- Release any tension in the neck or shoulders

Warrior II Pose

- Start in a wide stance, turn the right foot out, the left foot slightly in, bend the right knee and draw the knee toward the little-toe of the front foot
- If the knee goes past the heel, slide your front foot forward (or slide back foot back) for a wider stance
- Front sit (R/L) bone draws down and under toward the mat

Table B6. Continued

- Back leg is strong; press outer edge of back foot toward the mat to create lift through the arch of the foot
- Shoulder blades draw down the back; energy draws up through the spine and crown of head

Triangle

- Start with a wide stance, length of arms extended parallel to the floor. Turn right foot to a 90 degree angle, the left foot turns in slightly.
- Shift hips to the left, draw the right sit bone under while reaching out to right through the spine and arm; create maximum extension through the arms.
- Release hand (R/L) to lower leg or ankle (shin to modify), opposite hand reaches toward the ceiling. Legs are straight and engaged without hyper-extending through the front knee.
- Torso is long, and the neck is relaxed

Standing Forward Bend

- Feet separated wide (similar to triangle pose), outer edges of the feet parallel
- Knees should be slightly bent (prevents constriction in the hamstrings and lower area of the back)
- Draw pubic bone back and up while stretching the belly button and sternum toward the floor
- Bring weight forward to the balls of the feet while grounding the fronts of the heels, hips should be directly over the heels, and neck relaxed (chin should not be forward; eye gaze down toward the mat).
- Legs are straight (slight bend in the knees) and strong

Tree Pose

- Press down through the heel of the left foot to encourage engagement through the leg and heel
- Pick up your right foot and place on the inside of your ankle, shin, or thigh
- Place hands at hips to modify; or, place palms together at center of chest and either stay here or reach hands overhead
- Repeat on opposite side

Transition to Floor Sequence: step to top of mat -> mountain pose into forward fold -> modified high plank to low plank pose to upward dog

Cat Stretch/Spinal Flexion: see “Warm-up sequence” for instructions

Child’s Pose

- Slide your arms forward to the top of the mat and your hips toward your heels; allow your forehead to rest down on the floor.

Table B6. Continued

- Stretch the arms in front of you for greater extension of the spine; feel free to let your arms come alongside your body to relax your shoulders.
- Stretch through your fingers on an inhale, and sink back toward your heels on the exhale.
- To transition, keep your hands at the top of the mat and bring yourself back up into tabletop position, slide your knees toward the middle of your mat, stack the hips above the knees.

Sequence IV: Cool down stretches/close of practice (20-22 minutes)

Camel Pose

Transition: Tabletop position

- Place palms on your sacrum with fingers pointed down, lift your chest, and let your head drop back if comfortable (if not, keep head up and face forward).
- Press your pelvis forward and arch your back, continue to breathe long and deep through your nose.
- To move into the full expression of the pose, lean back and place your right hand on your right heel, then your left hand on your left heel.
- Continue to press your pelvis forward and lift your chest so that the weight of your body is not in your hands.
- To release out of pose, move your right hand to your lower back, then your left hand.

Bridge

- From a supine position, slide feet toward buttocks, with feet hip width distance and parallel.
- Take a deep breath in, on the exhale press down through the feet and lift up your hips.
- Feel your inner thighs spiral toward one another as you root down through your feet, the tailbone is lengthening down toward your feet.
- Draw your arms underneath your back, clasp your hands together and interlace your fingers. Move the shoulder blades together, releasing any tension from your neck, and draw your chin toward your chest.
- Hold for 5 full breaths. On the last inhale, start to lower body slightly to the mat and as you exhale, bringing arms out from underneath your back and your lower back to the mat one vertebrae at a time. Straighten your legs out in front of you.

One Knee-to-Chest Pose

- From a supine position, draw your right knee toward your chest, and clasp your hands on the shin, below the kneecap.
- Left leg stays straight; flex the left foot to maintain a strong and active leg.

Table B6. Continued

- Squeeze your elbows down and in toward the sides of your body, and gently tilt your chin toward your chest (you should feel extension in the neck; if any strain, lift the chin slightly).
- On the inhale, soften your grip slightly; on the exhale, move deeper into the stretch.
- To release, unclasp the hands and bring the right leg back to a straight position; complete on the left side.

Both Knees-to-Chest Pose

- Lying on your back, draw the knees toward your chest, keep your feet side by side, in a relaxed position. Reach for opposite elbows across your shins (or forearms/wrists if can't reach the elbows).
- On the inhale, release knees slightly away from your chest; on the exhale, squeeze the knees in. At the same time, work to keep the lower part of your back and tailbone rooted into the mat.
- Relax your chin down toward your chest; again, focus on extension in the neck.

Supine Twist

- Draw both knees in toward your chest and allow your knees to drop over toward your left.
- Place your left hand on top of the right knee, and extend your right arm out to the side, away from your body. You may look over your right shoulder unless this strains your neck.
- The twist should be felt in your torso and through the upper part of your back, and cervical spine.
- Take a deep breath in, on the exhale release and come back to center with knees in toward your chest. Repeat by moving your knees to the opposite side.

Happy Baby Pose

- With legs straight in front of you, draw your knees back into your chest. Lift your feet up, but keep your knees bent. Grab for the outer edges of your feet, keep the feet flexed. The soles of your feet are facing up.
- Tuck your chin toward your chest (create extension in the neck), stretch your knees toward your chest. Press your lower back down into the mat, with the tailbone lengthening away from your body.
- To intensify the stretch, spread the feet wider apart, as you continue to press the lower part of your back down into the mat.
- To release, bring the soles of your feet together and lower your feet down to the mat, arms are down alongside your body. Rest here in bound angle pose.
- Slide your feet forward toward the top of your mat, arms down alongside the body.

Table B6. Continued

Corpse Pose

Integration: This is the final pose that closes the student's yoga practice, allowing for full integration of the practice. In yoga philosophy, this is an important pose in the practice as it provides an opportunity for reintegration after practicing the physical postures and breathing series.

Instruction:

- Lie on your back, and spread out comfortably on your mat.
- Relax arms and legs on the mat, with palms of the hands facing up.
- Lift your chest slightly off the mat and draw your shoulders down and back away from your ears.
- Take a deep breath in, and on the exhale allow your body to sink down into the mat and breathe naturally.

Recommendations:

- Give minimal instruction to students during this time
- Encourage students to notice what is arising in the moment, and to let thoughts, feelings, and emotions pass by without attaching to what is arising.
- Bring the class back from the resting point (Savasana) with a cue to be mindful of the breath.
- With a deep inhalation, bring hands overhead before rolling over to the right side to come into a fetal position; continue to stay connected with breath and body.
- Slowly rise up to a seated position at the top of your mat. Bring hands together, palms face one another, spread the fingers wide, at the center of your chest (spend a few moments here--may invite students to come back to an intention they set for themselves at the beginning of the practice).

Note: The instructions and notes throughout this document were derived from tertiary resources on yoga (Grilley, 2010; Powers, 2008; Stephens, 2010; Weintraub, 2004) and the PI's experience as a yoga instructor. The instruction manual corresponds with the yoga intervention developed for the current study.

Table B7. Adherence Checklist

	Posture done?		Posture done in correct sequence?		Mindfulness language used?[a]	
Poses	Yes	No	Yes	No	Yes	No
Belly breathing/seated meditation						
Seated: arms overhead/down						
Shoulder opening						
Cat stretch						
Thread the needle						
Downward dog (DD)						
Transition: walk to top of mat						
Standing forward bend						
Spinal roll up						
Mountain pose						
Lateral side stretch						
Standing: arms overhead/down						
Modified crescent lunge						
Spinal roll up to mountain pose						
Warrior II* Exalted warrior* *R: L						
Forward bend (5 breaths)						
Modified extended side angle* Triangle* *R: L						
Tree						

Table B7. Continued

Transition: Table top position

Child's pose

Cat stretch

Half camel

Transition: DD -> seated position

Pelvic tilts

Bridge

One knee-to-chest

Both knees-to-chest

Modified supine twist

Happy baby

Corpse pose

	Responses	
	Yes	No
Was the class completed in 60 minutes?		
Was personalized instruction offered during class?		
Was the instructor's voice audible?		
Any general comments/feedback?		

Note. R = right; L = left; R:L = repeat same pose on the left side.

[a] Examples of phrases used to promote mindfulness skills include the following: "*Come back to your breath,*" "*Notice if your mind has wandered or drifted; if so, gently bring yourself back to your practice,*" "*As you hold this pose, notice the physical sensations in your body.*"

Table B8. Class Sizes over the Course of the Study

Class size (number of participants)	Total number of classes
1	50
2	31
3	29
4	33
5	6
6	2
8	2

Table B9. Baseline Sociodemographic and Intervention Characteristics

Variable	Yoga (n = 27) Mean (SD) or n (%)	Wait-list Control (n = 29) Mean (SD) or n (%)
Age	29.81 (5.17)	32.45 (4.78)
Education	16.89 (2.24)	16.38 (2.29)
Months postpartum	4.63 (3.47)	4.72 (2.91)
No of classes attended*	11.44 (4.48)	
Home practice (minutes)*	72.41 (68.17)	
Breastfeeding	21 (78%)	21 (72%)
Non-Hispanic	26 (96%)	27 (93%)
White	24 (89%)	27 (93%)
Married	22 (82%)	22 (76%)
Primiparous	16 (59%)	12 (41%)
Income (≥ $50,000)	16 (59%)	19 (65%)
Employed	15 (56%)	22 (76%)
Past MDE	19 (70%)	16 (55%)
Prior yoga experience	13 (48%)	10 (34%)
Attended > 9 classes*	17 (63%)	

Note: * These variables are specific to the yoga group; thus, statistics are not provided for the wait-list control group.

Table B10. Means for Outcome and Process Variables between Groups (with Standard Deviations in Parentheses)

	Baseline		Week 2		Week 4		Week 6		Week 8	
Variable	Yoga	WLC	Yoga	WLC	Yoga	WLC	Yoga	WLC	Yoga	WLC
HDRS	17.33 (5.10)	15.34 (3.12)	10.37 (5.36)	12.07 (5.39)	8.77 (6.77)	10.23 (5.01)	6.35 (5.22)	9.41 (5.43)	5.87 (6.03)	8.52 (5.43)
GD	58.19 (9.10)	57.21 (9.49)	49.40 (9.14)	53.39 (10.93)	46.91 (11.89)	50.92 (10.46)	41.71 (6.88)	49.00 (12.57)	36.56 (6.51)	49.56 (9.16)
WB	17.37 (4.24)	16.28 (3.99)	19.96 (4.78)	17.07 (4.09)	21.74 (6.49)	17.75 (4.96)	22.65 (5.23)	17.73 (5.56)	24.25 (3.79)	17.67 (4.75)
SA	10.96 (3.33)	9.03 (3.66)	9.00 (3.14)	8.71 (3.43)	8.87 (3.48)	8.63 (3.16)	7.71 (1.99)	8.18 (3.62)	7.00 (2.03)	8.44 (3.73)
TI	7.30 (4.20)	5.62 (2.30)	6.88 (3.17)	5.75 (2.10)	6.26 (3.19)	5.38 (2.02)	4.71 (1.16)	5.32 (2.08)	4.94 (1.39)	5.39 (2.23)
Panic	11.44 (3.00)	11.03 (3.21)	9.76 (2.11)	10.00 (2.71)	10.43 (2.52)	10.00 (2.96)	8.88 (1.17)	9.59 (2.13)	8.75 (1.18)	9.83 (2.91)
PPAQ	2.46 (0.34)	2.34 (0.29)	2.36 (0.31)	53.39 (10.93)	2.29 (0.31)	2.32 (0.35)	2.22 (0.23)	2.29 (0.35)	2.19 (0.23)	2.29 (0.34)
SF-36	51.54 (11.73)	56.33 (14.06)	59.23 (12.88)	56.53 (16.30)	66.28 (15.25)	61.12 (15.90)	76.48 (11.01)	65.00 (14.99)	75.19 (12.72)	63.18 (15.27)
SFMCS	34.59 (13.60)	41.33 (16.66)	42.52 (15.83)	40.36 (19.70)	52.66 (20.28)	44.51 (21.36)	64.65 (18.67)	47.62 (21.25)	63.76 (16.91)	47.09 (21.28)
SFPCS	68.91 (15.58)	71.34 (16.87)	75.93 (15.42)	72.71 (19.16)	79.91 (16.69)	77.73 (16.65)	88.31 (7.24)	82.38 (13.01)	86.64 (11.39)	79.27 (16.38)
SWLS	22.85 (6.19)	22.34 (5.69)	24.61 (5.11)	23.32 (5.99)	26.33 (6.04)	24.21 (5.86)	27.12 (5.89)	25.05 (5.17)	26.06 (6.86)	25.67 (4.17)
FFMQ	113.12 (21.50)	117.69 (19.44)	117.52 (19.02)	114.64 (25.09)	122.57 (23.90)	114.64 (21.34)	126.47 (19.73)	117.43 (25.92)	129.33 (22.56)	115.11 (24.34)
SBAS	2.12 (0.67)	2.14 (0.69)	2.52 (0.89)	2.07 (0.68)	2.64 (0.90)	2.23 (0.97)	2.88 (0.99)	2.38 (0.97)	2.87 (0.99)	2.39 (1.09)

Note: GD = IDAS General Depression scale; WB = IDAS Well-Being Scale; SA = IDAS Social Anxiety; TI = IDAS Traumatic Intrusions

Table B11. Treatment Predicting Outcome and Process Variables at Post-Treatment and over 8-week Intervention

Variable	Treatment Predicting Levels at Post-Treatment						Treatment Predicting Change over 8-week Intervention					
	γ	*SE*	95% CI γ	*t*(52)[a]	Stand. effect	% of variance	γ	*SE*	95% CI γ	*t*(52)[a]	Stand. effect	% of variance
HDRS	**-4.79**	**1.59**	**[-7.91, -1.68]**	**-3.02****	**-0.82**	**19.79%**	**-0.55**	**0.19**	**[-0.92, -0.18]**	**-2.94****	**-1.06**	**13.69%**
IDAS: GD	**-11.88**	**2.78**	**[-17.33, -6.43]**	**-4.27*****	**-0.92**	**34.91%**	**-1.09**	**0.41**	**[-1.88, -0.47]**	**-3.26****	**-0.91**	**17.89%**
IDAS: WB	**6.31**	**1.56**	**[3.25, 9.38]**	**4.04*****	**0.94**	**21.70%**	**0.56**	**0.19**	**[0.19, 0.93]**	**2.94***	**0.90**	**11.42%**
IDAS: SA	**-2.21**	**0.78**	**[-3.74, -0.68]**	**-2.83***	**-0.72**	**32.21%**	**-0.26**	**0.09**	**[-0.43, -0.08]**	**-2.84***	**-1.03**	**11.17%**
IDAS: TI	**-1.09**	**0.50**	**[-2.07, -0.11]**	**-2.17***	**-0.76**	**65.70%**	**-0.25**	**0.11**	**[-0.46, -0.04]**	**-2.37***	**-0.92**	**8.66%**
IDAS: Panic	-1.06	0.65	[-2.33, 0.22]	-1.62	-0.65	4.70%	-0.09	0.08	[-0.24, 0.07]	-1.11	-0.56	33.80%
PPAQ	-0.14	0.09	[-0.31, 0.03]	-1.64	-0.45	1.65%	**-0.02**	**0.01**	**[-0.05, -0.00]**	**-2.41***	**-0.71**	**7.09%**
SF-36 Total	**17.74**	**4.00**	**[9.90, 25.59]**	**4.43*****	**0.99**	**22.65%**	**2.23**	**0.44**	**[1.37, 3.09]**	**5.09*****	**1.26**	**37.35%**
SFMCS	**24.75**	**5.25**	**[14.47, 35.04]**	**4.72*****	**1.03**	**25.85%**	**3.20**	**0.56**	**[2.11, 4.29]**	**5.09*****	**1.46**	**46.27%**
SFPCS	**10.01**	**4.10**	**[1.98, 18.05]**	**2.44***	**0.73**	**11.22%**	**1.12**	**0.54**	**[0.06, 2.17]**	**2.08***	**0.71**	**21.61%**
SWLS	2.36	1.60	[-0.76, 5.49]	1.48	0.38	6.74%	0.20	0.14	[-0.08, 0.48]	1.38	0.58	-5.88%
FFMQ	**15.19**	**6.36**	**[2.74, 27.65]**	**2.39***	**0.62**	**13.31%**	**1.86**	**0.48**	**[0.92, 2.80]**	**3.87*****	**1.13**	**24.72%**
SBAS	0.52	0.30	[-0.07, 1.12]	1.72	0.55	4.77%	0.04	0.03	[-0.02, 0.10]	1.37	0.72	-1.16%

Note: Values in bold indicate statistically significant findings ($p < .05$). γ = unstandardized coefficient; *SE* = standard error; 95% CI γ = 95% confidence interval of unstandardized coefficient; Stand. effect $\gamma_p 1/\sqrt{\tau}_{pp}$ (i.e., standardized difference in outcome variable between the two groups for each one-unit increase in the predictor).

$p < .05$. ** $p < .005$. *** $p < .001$.

[a] dfs for the t-statistic vary (dfs range from 51 to 53) due to the fact that some participants had less than 3 data points.

NOTES

[1] Dr. Jane Engeldinger in the Department of Obstetrics & Gynecology at UIHC served as a medical consultant on my dissertation research project, providing medical expertise on an as needed basis. Additionally, Dr. Engeldinger reviewed and approved the proposed yoga intervention and exclusion criteria for the current study.

[2] The yoga consultants on the study were Darcy LeFevre and Dr. Betsy Rippentrop. Mrs. LeFevre is a certified yoga instructor in the Barkan Method (a form of Hatha yoga), and has over 8 years of experience in yoga instruction. In addition, she has expertise in pre- and postnatal yoga, including her direct experience with practicing yoga during both of her pregnancies and wide knowledge base of yoga modifications for pre- and postnatal yoga. Mrs. LeFevre currently teaches Vinyasa Flow yoga at HotHouse Yoga Studio in Coralville and Iowa City, Iowa.

Dr. Rippentrop, Ph.D., is a licensed psychologist who has trained at the University of Iowa, the University of Iowa Hospitals and Clinics (Orthopaedics), and Rush Medical Center in Chicago. She has specialized training in pain management, sleep disorders, hypnosis, and mind/body interventions for physical and mental health. She has published on the relationship between spirituality and health, women's health, and chronic pain management, and is a certified yoga instructor in the Anusara (a form of Hatha yoga) style of yoga. Dr. Rippentrop is the owner of Heartland Yoga in Iowa City, Iowa and has over 10 years of experience in yoga instruction, with expertise in pre- and postnatal yoga.

[3] Yoga Alliance was formed in 1999 as the national education and support organization for yoga in the United States. This organization functions to ensure a comprehensive understanding of the benefits of yoga, that the teachers of yoga value the history and traditions of yoga, and to help disseminate this information to the yoga community.

[4] Within the yoga literature for depression, hypothesized mechanisms of action by which yoga may generate beneficial effects include an improved sense of self-mastery and self-efficacy (Uebelacker et al., 2010a). Building on this literature, women may experience a sense of mastery and improved sense of self over the course of the 8-week intervention due to potential changes in their strength, flexibility, and balance often associated with a regular yoga practice (Feuerstein, 2001). Increasing the level of difficulty (with modifications) of a yoga sequence may also support improvements in self-efficacy and mastery.

REFERENCES

Abramowitz, J. S. (2013). The practice of Exposure Therapy: Relevance of Cognitive-Behavioral Theory and Extinction Theory. *Behavior Therapy,* http://dx.doi.org/10.1016/j.beth.2013.03.003

American Academy of Pediatrics (2005). Policy statement: Breastfeeding and use of human milk. *Pediatrics, 115,* 496-506.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (Fourth Edition - Text Revision) (DSM-IV-TR). Washington, D.C.: American Psychiatric Association.

Angst, J., Sellaro, R., & Merikangas, K. R. (2000). Depressive spectrum diagnoses. *Comprehensive Psychiatry, 41,* 39-47.

Appleby, L., Warner, R., Whitton, A., & Faragher, B. (1997). A controlled study of fluoxetine and cognitive-behavioural counselling in the treatment of postnatal depression. *British Medical Journal, 314*, 932-936.

Armstrong, K., & Edwards, H. (2003). The effects of exercise and social support on mothers reporting depressive symptoms: a pilot randomized controlled trial. *International Journal of Mental Health Nursing, 12*, 130-138.

Armstrong, K., & Edwards, H. (2004). The effectiveness of a pram walking exercise programme in reducing depressive symptomatology for postnatal women. *International Journal of Nursing Practice, 10*, 177-194.

Artal, R., & O'Toole, M. (2003). Guidelines of the American College of Obstetricians and Gynecologists for exercise during pregnancy and the postpartum period. *British Journal of Sports Medicine, 37,* 6-12.

Atkins, D.C. (2005). Using multilevel models to analyze couple and family treatment data: Basic and advanced issues. *Journal of Family Psychology, 19*, 98-110.

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*, 27-45.

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., . . . Williams, M. G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment, 15*, 329-342.

Banerjee, B., Vadiraj, H. S., Ram, A., Rao, R., Jayapal, M., Gopinath, K. S., ... Hande, M. P. (2007). Effects of an integrated yoga program in modulating psychological

stress and radiation-induced genotoxic stress in breast cancer patients undergoing radiotherapy. *Integrative Cancer Therapies, 6*, 242-250.

Barnes, P. M., Bloom, B., & Nahin, R. (2008). Complementary and alternative medicine use among adults and children: United States, 2007. *CDC National Health Statistics Report #12* (accessed November 25, 2010).

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression*. New York, NY: The Guilford Press.

Beck, C. T. (2001). Predictors of postpartum depression: An update. *Nursing Research, 50,* 275-285.

Beddoe, A. E., Lee, K. A., Weiss, S. J., Kennedy, H., & Yang, C. P. (2010). Effects of mindful yoga on sleep in pregnant women: A pilot study. *Biological Research for Nursing, 11,* 363-370.

Berger, B. G., & Owen, D. R. (1988). Stress reduction and mood enhancement in four exercise modes: Swimming, body conditioning, hatha yoga, and fencing. *Research Quarterly for Exercise and Sport, 59*, 148-159.

Bishop, F. L., Yardley, L., & Lewith, G. T. (2007). A systematic review of beliefs involved in the use of complementary and alternative medicine. *Journal of Health Psychology, 12,* 851-867.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., . . . Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*, 230-241.

Bloch, M., Meiboom, H., Lorberblatt, M., Bluvstein, I., Aharonov, I., & Schreiber, S. (2012). The effect of sertraline add-on to brief dynamic psychotherapy for the treatment of postpartum depression: a randomized, doubleblind, placebo-controlled study. *Journal of Clinical Psychiatry, 73*, 235-41.

Blumenthal, J. A., Emery, C. F., Madden, D. J., Schniebolk, S., Walsh-Riddle, M., George, L. K., . . . Coleman, R. E. (1991). Long-term effects of exercise on psychological functioning in older men and women. *The Journal of Gerontology, 46,* 352-361.

Boath, E., Bradley, E., & Henshaw, C. (2004). Women's views of antidepressants in the treatment of postnatal depression. *Journal of Psychosomatic Obstetrics and Gynecology, 25*, 221-233.

Bower, J. E., Woolery, A., Sternlieb, B., & Garet, D. (2005). Yoga for cancer patients and survivors. *Cancer Control, 12*, 165-171.

Boyce, P. M., Johnstone, S. J, Hickey, A. R., Morris-Yates, A. D., Harris, M. G., & Strachan, T. (2000). Functioning and well-being at 24 weeks postpartum of women with postnatal depression. *Archives of Women's Mental Health, 3,* 91-97.

Broota, A., & Dhir, R. (1990). Efficacy of two relaxation techniques in depression. *Journal of Personality and Clinical Studies, 6,* 83-90.

Brosse, A. L., Sheets, E. S., Lett, H. S., & Blumenthal, J. A. (2002). Exercise and the treatment of clinical depression in adults: Recent findings and future directions. *Sports Medicine, 32,* 741-752.

Brown, C. M., Barner, J. C., Richards, K. M., & Bohman, T. M. (2007). Patterns of complementary and alternative medicine use in African Americans. *The Journal of Alternative and Complementary Medicine, 13,* 751-758.

Brown, S., & Lumley, J. (2000). Physical health problems after childbirth and maternal depression at six to seven months postpartum. *BJOG: An International Journal of Obstetrics and Gynaecology, 107,* 1194-1201.

Burke, L. (2003). The impact of maternal depression on familial relationships. *International Review of Psychiatry, 15,* 243-255.

Butler, L. D., Waelde, L. C., Hastings, T. A., Chen, X-H., Symons, B., Marshall, J., Kaufman, A., . . . Spiegel, D. (2008). Meditation with yoga, group therapy with hypnosis, and psychoeducation for long-term depressed mood: A randomized pilot trial. *Journal of Clinical Psychology, 64,* 806-820.

Cahn, B. R., & Polich, J. (2006). Meditation states and traits: EEG, ERP, and neuroimaging studies. *Psychological Bulletin, 132,* 180-211.

Carlson, L. E., & Bultz, B. D. (2008). Mind-body interventions in oncology. *Complementary and Alternative Therapies in Oncology, 9,* 127-134.

Carson, J. W., Carson, K. M., Porter, L. S., Keefe, F. J., Shaw, H., & Miller, J. M. (2007). Yoga for women with metastatic breast cancer: Results from a pilot study. *Journal of Pain and Symptom Management, 33,* 331-341.

Chabrol, H., Teissedre, F., Armitage, J., Danel, M., & Walburg, V. (2004). Acceptability of psychotherapy and antidepressants for postnatal depression among newly delivered mothers. *Journal of Reproductive and Infant Psychology, 22,* 5-12.

Chiesa, A. (2010). Vipassana Meditation: Systematic review of current evidence. *Journal of Alternative & Complementary Medicine, 16,* 37-46.

Chuntharapat, S., Petpichetchian, W., & Hatthakit, U. (2008). Yoga during pregnancy: Effects on maternal comfort, labor pain and birth outcomes. *Complementary Therapies in Clinical Practice, 14*, 105-115.

Cisler, J. M., Barnes, A. C., Farnsworth, D., & Sifers, S. K. (2007). Reporting practices of dropouts in psychological research using a wait-list control: Current state and suggestions for improvement. *International Journal of Methods in Psychiatric Research, 16,* 34-42.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology, 100,* 316-336.

Clark, R., Tluczek, A., & Wenzel, A. (2003). Psychotherapy for postpartum depression: A preliminary report. *American Journal of Orthopsychiatry, 73*, 441-454.

Coelho, H. F., Boddy, K., & Ernst, E. (2008). Massage therapy for the treatment of depression: A systematic review. *International Journal of Clinical Practice, 62*, 325-333.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155-159.

Cohen, L. S., Viguera, A. C., Bouffard, S. M., Nonacs, R. M., Morabito, C., Collins, M.H., & Ablon, J. S. (2001). Venlafaxine in the treatment of postpartum depression.*Journal of Clinical Psychiatry,* 62, 592-596.

Cohen, L. S., Wang, B., Nonacs, R., Viguera, A. C., Lemon, E. L., & Freeman, M. P. (2010). Treatment of mood disorders during pregnancy and postpartum. *Psychiatric Clinics of North America, 33*, 273-293.

Cooper, P. J., Murray, L., Wilson, A., & Romaniuk, H. (2003). Controlled trial of the short- and long-term effect of psychological treatment of post-partum depression, 1: Impact on maternal mood. *British Journal of Psychiatry, 182,* 412-419.

Corral, M., Wardrop, A. A., Zhang, H., Grewal, A. K., & Patton, S. (2007). Morning light therapy for postpartum depression. *Archives of Women's Mental Health, 10,* 221-224.

Cuijpers, P., de Graaf, R., & van Dorsselaer, S. (2004). Minor depression: Risk profiles, functional disability, health care use and risk of developing major depression. *Journal of Affective Disorders, 79*, 71-79.

Cuijpers, P., Smit, F., & van Straten, A. (2007). Psychological treatments of subthreshold depression: A meta-analytic review. *Acta Psychiatrica Scandinavica, 115*, 434-441.

Cuijpers, P., Brannmark, J., & van Straten, A. (2008). Psychological treatment of postpartum depression: A meta-analysis. *Journal of Clinical Psychology, 64,* 103-118.

Cuijpers, P., van Straten, A., Bohlmeijer, E., Hollon, S. D., & Andersson, G. (2010). The effects of psychotherapy for adult depression are overestimated: A meta-analysis of study quality and effect size. *Psychological Medicine, 40,* 211-223.

DaCosta, D., Dritsa, M., Rippen, N., Lowensteyn, I., & Khalife, S. (2006). Health-related quality of life in postpartum depressed women. *Archives of Women's Mental Health, 9,* 95-102.

Daley, A. J., Psychol, C., MacArthur, C. & Winter, H. (2007). The role of exercise in treating postpartum depression: A review of the literature. *Journal of Midwifery & Women's Health, 52,* 56-62.

Deligiannididis, K. M., & Freeman, M. P. (2010). Complementary and alternative medicine for the treatment of depressive disorders in women. *Psychiatric Clinics of North America, 33,* 441-463.

Dennis, C. L. (2003). The effect of peer support on postpartum depression: A pilot randomized controlled trial. *Canadian Journal of Psychiatry, 48,* 61-70.

Dennis, C. L. (2004). Influence of depressive symptomatology on maternal health service utilization and general health. *Archives of Women's Mental Health, 7,* 183-191.

Dennis, C. L., & Chung-Lee, L. (2006). Postpartum depression help-seeking barriers and maternal treatment preferences: A qualitative systematic review. *Birth, 33,* 323-331.

Dennis, C. L., & Ross, L. (2006). Women's perceptions of partner support and conflict in the development of postpartum depressive symptoms. *Journal of Advanced Nursing, 56,* 588-599.

Dennis, C. L., Hodnett, E., Reisman, H. M., Kenton, L., Weston, J., Zupancic, J., . . . Kiss, A. (2009). Effect of peer support on prevention of postnatal depression among high-risk women: Multisite randomized controlled trial. *British Medical Journal, 338,* 1-9.

Desikachar, T. K. V. (1999). *The heart of yoga*: *Developing a personal practice, revised edition*. Rochester, VT: Inner Traditions International.

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49,* 71-75.

Diener, E. (2006). Understanding scores on the satisfaction with life scale. *Retrieved March, 8*, 2013.

DiMascio, V., Kent, A., Fiander, M., & Lawrence, J. (2008). Recovery from postnatal depression: A consumer's perspective. *Archives of Women's Mental Health, 11*, 253-257.

Dimidjian, S., Hollon, S. D., Dobson, K. S., Schmaling, K. B., Kohlenberg, R. J., Addis, M. E., . . . Jacobson, N. S. (2006). Randomized trial of behavioral activation, cognitive therapy, and antidepressant medication in the acute treatment of adults with major depression. *Journal of Consulting and Clinical Psychology, 74*, 658-670.

Dimidjian, S., & Goodman, S. (2009). Nonpharmacologic intervention and prevention strategies for depression during pregnancy and the postpartum. *Clinical Obstetrics and Gynecology, 52*, 498-515.

Edenfield, T. M., & Saeed, S. A. (2012). An update on mindfulness meditation as a self-help treatment for anxiety and depression. *Psychology Research and Behavior Management, 5*, 131-141.

Elkin, I., Gibbons, R. D., Shea, M. T., Sotsky, S. M., Watkins, J. T., Pilkonis, P. A., & Hedeker, D. (1995). Initial severity and differential treatment outcome in the NIMH Treatment of Depression Collaborative Research Program. *Journal of Consulting and Clinical Psychology, 63*, 841-847.

Epperson, C. N., Terman, M., Terman, J. S., Hanusa, B. H., Gren, D. A., Peindl, K. S., & Wisner, K. L. (2004). Randomized clinical trial of bright light therapy for antepartum depression: Preliminary findings. *Journal of Clinical Psychiatry, 65,* 421-425.

Feuerstein, G. (2001). *The yoga tradition: Its history, literature, philosophy and practice*. Prescott, AZ: Hohm Press.

Field, T. (2011). Yoga clinical research review. *Complementary Therapies in Clinical Practice, 17,* 1-8.

Field, T., Grizzle, N., Scafidi, F., & Schanberg, S. (1996). Massage and relaxation therapies' effects on depressed adolescent mothers. *Adolescence, 31*, 903-911.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1995). *Structured clinical interview for DSM-IV axis I disorders, patient edition (SCID-I/P), version 2.0*. New York: NY. Biometrics Research Department, New York State Psychiatric Institute.

Fitelson, E., Kim, S., Baker, A. S., & Leight, K. (2011). Treatment of postpartum depression: Clinical, psychological and pharmacological options. *International Journal of Women's Health, 3*, 1-14.

Fjorback, L. O., Arendt, M., Ørnbøl, E., Fink, P., & Walach, H. (2011). Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy – a systematic review of randomized controlled trials. *Acta Psychiatrica Scandinavica*, *124*, 102-119.

Forman, E. M., Herbert, J. D., Moitra, E., Yeomans, P. D., & Geller, P. A. (2007). A randomized controlled effectiveness trial of acceptance and commitment therapy and cognitive therapy for anxiety and depression. *Behavior Modification*, *31*, 772-799.

Freeman, M. P., Davis, M., Sinha, P., Wisner, K. L., Hibbeln, J. R., & Gelenberg, A. J. (2008). Omega-3 fatty acids and supportive psychotherapy for perinatal depression: A randomized placebo-controlled study. *Journal of Affective Disorders, 110,* 142-148.

Freeman, M. P. (2009). Complementary and alternative medicine for perinatal depression. *Journal of Affective Disorders, 112*, 1-10.

Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal depression: A systematic review of prevalence and incidence. *Obstetrics & Gynecology*, *106*, 1071-1083.

Goodman, S. H. (2009). Women's attitudes, preferences, and perceived barriers to treatment for perinatal depression. *Birth, 36,* 60-69.

Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., & Heyward, D. (2011). Maternal depression and child psychopathology: A meta-analytic review. *Clinical Child and Family Psychology Review, 14*, 1-27.

Grace, S. L., Evindar, A., & Stewart, D. E. (2003). The effect of postpartum depression on child cognitive development and behavior: A review and critical analysis of the literature. *Archives of Women's Mental Health, 6*, 263-274.

Grilley, P. (2012). *Yin yoga: Principles and practice - 10th anniversary edition*. Ashland, OR: White Cloud Press.

Grzywacz, J. G., Lang, W., Suerken, C., Quandt, S. A., Bell, R. A., & Arcury, T. A. (2005). Age, race, and ethnicity in the use of complementary and alternative medicine for health self- management: Evidence from the 2002 National Health Interview Survey. *Journal of Aging and Health, 17*, 547-572.

Hamilton, M. (1967). Development of a rating scale for primary depressive illness. *British Journal of Social and Clinical Psychology, 6*, 278-296.

Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and Commitment Therapy: An Experiential Approach to Behavior Change*. New York: Guilford Press.

Hendrick, V., Altshuler, L., Strouse, T., & Grosser, S. (2000). Postpartum and nonpostpartum depression: Differences in presentation and response to pharmacologic treatment. *Depression and Anxiety, 11*, 66-72.

Heron, J., O'Connor, T. G., Evans, J., Golding, J., & Glover, V. (2004). The course of anxiety and depression through pregnancy and the postpartum in a community sample. *Journal of Affective Disorders, 80*, 65-73.

Hintze, J. (2011). PASS 11. NCSS, LLC. Kaysville, Utah, USA. www.ncss.com.

Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 78*, 169-183.

Hofmann, S. G., Asnaani, A., Vonk, I. J., Sawyer, A. T., & Fang, A. (2012). The efficacy of Cognitive Behavioral Therapy: A review of meta-analyses. *Cognitive Therapy Research, 36*, 427-440.

Holden, J. M., Sagovsky, R., & Cox, J. L. (1989). Counseling in a general-practice setting: Controlled study of health visitor intervention in treatment of postnatal depression. *British Medical Journal, 298*, 223-226.

Hsu, C., Cherkin, D. C., Hoffmeyer, S., Sherman, K. J., & Phillips, W. R. (2011). Patient and clinician openness to including a broader range of healing options in primary care. *Annals of Family Medicine, 9*, 447-453.

Huang, F. Y., Chung, H., Kroenke, K., Delucchi, K. L., & Spitzer, R. L. (2006). Using the Patient Health Questionnaire-9 to measure depression among racially and ethnically diverse primary care patients. *Journal of General Internal Medicine, 21*, 547-552.

IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.

Iyengar, B. K. S. (1993). *Light on the yoga sutras of patanjali*. London, UK: Aquarian Press.

Iyengar, B. K. S. (2001). *Yoga: The path to holistic health*. London, UK: Dorling Kindersley.

Jacobson, N. S., & Truax, P. (1991). Clinical significance: a statistical approach to defining meaningful change in psychotherapy-research. *Journal of Consulting and Clinical Psychology, 59, 12-19.*

Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., & Schwartz, G. E. R. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavorial Medicine, 33*, 11-21.

Janakiramaiah, N., Gangadhar, B. N., Venkatesha Murthy, N., Shetty, T. K., Subbakrishna, D. K., Meti, B. L., . . . Vedamurthachar, A. (1998). Therapeutic efficacy of Sudarshan Kriya Yoga (SKY) in dysthymic disorder. *NIMHANS Journal, 17*, 21-28.

Janakiramaiah, N., Gangadhar, B. N., Murthya, V. N., Harish, M. G., Subbakrishnab, D. K., & Vedamurthachar, A. (2000). Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: A randomized comparison with electroconvulsive therapy (ECT) and imipramine. *Journal of Affective Disorders, 57*, 255-259.

Jiang, J., Elixhauser, A., Nicholas, J., Steiner, C., Reyes, C., & Bierman, A. S. (2002). *Care of women in U.S. hospitals, 2000*. HCUP Fact Book No. 3. AHRQ Publication No. 02-044, Rockville, MD: Agency for Healthcare Research and Quality.

Judd, C. M., & McClelland, G. H. (1989). Data analysis: A model comparison approach. San Diego, CA.: Harcourt Brace Jovanovich.

Kabat-Zinn, J. (1994). *Wherever you go there you are*. New York, NY: Hyperion.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*, 144-156.

Kazdin, A. E. (2008). Evidence-based treatment and practice. *American Psychologist, 63*, 146-159.

Kessler, R. C., Mcgonagle, K. A., Nelson, C. B., Hughes, M., Swartz, M., & Blazer, D. G. (1994). Sex and depression in the National Comorbidity Survey II: Cohort effects. *Journal of Affective Disorders, 30*, 15-26.

Kessler, R. C., Soukup, J., Davis, R. B., Foster, D. F., Wilkey, S. A., Van Rompay, M. I., & Eisenberg, D. M. (2001). The use of complementary and alternative therapies to treat anxiety and depression in the United States. *American Journal of Psychiatry, 158*, 289-294.

Khumar, S. S., Kaur, P., & Kaur, S. (1993). Effectiveness of shavasana on depression among university students. *Indian Journal of Clinical Psychology, 20*, 82-87.

Kinser, P. A., Bourguignon, C., Whaley, D., Hauenstein, E., & Taylor, A. G. (2013). Feasibility, acceptability, and effects of Gentle Hatha Yoga for women with major depression: Findings from a randomized controlled mixed methods study. *Archives of Psychiatric Nursing*, http://dx.doi.org/10.1016/j.apnu.2013.01.003.

Kirkwood, G., Rampes, H., Tuffrey, V., Richardson, J., & Pilkington, K. (2005). Yoga for anxiety: A systematic review of the research evidence. *British Journal of Sports Medicine, 39*, 884-891.

Klier, C. M., Muzik, M., Rosenblum, K. L., & Lenz, G. (2001). Interpersonal psychotherapy adapted for the group setting in the treatment of postpartum depression. *Journal of Psychotherapy Practice and Research, 10*, 124-131.

Knippels, H. M., & Weiss, J. J. (2000). Use of alternative medicine in a sample of HIV-positive gay men: An exploratory study of prevalence and user characteristics. *AIDS Care, 12*, 435-446.

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: A new depression and diagnostic severity measure. *Psychiatric Annals, 32*, 509-521.

LaCoursiere, Y. D., Baksh, L., Bloebaum, L., & Varner, M. W. (2006). Maternal body mass index and self-reported postpartum depressive symptoms. *Maternal and Child Health Journal, 10*, 385-390.

Li, A. W., & Goldsmith, C. A. (2012). The effects of yoga on anxiety and stress. *Alternative Medicine Review: A Journal of Clinical Therapeutic, 17*, 21.

Lin, K. Y., Hu, Y. T., Chang, K. J., Lin, H. F., & Tsauo, J. Y. (2011). Effects of yoga on psychological health, quality of life, and physical health of patients with cancer: A meta-analysis. *Evidence-Based Complementary and Alternative Medicine*, doi:10.1155/2011/659876

Logsdon, M. C., Wisner, K. L., Hanusa, B. H., & Phillips, A. (2003). Role functioning and symptom remission in women with postpartum depression after treatment with antidepressants. *Archives of Psychiatric Nursing, 17*, 276-283.

Logsdon, M. C., Wisner, K., & Hanusa, B. H. (2009). Does maternal role functioning improve with antidepressant treatment in women with postpartum depression?. *Journal of Women's Health, 18*, 85-90.

Longmore, R. J., & Worrell, M. (2007). Do we need to challenge thoughts in cognitive behavior therapy? *Clinical Psychology Review, 27*, 173-187.

Manber, R., Schnyer, R. N., Lyell, D., Chambers, A. S., Caughey, A. B., Druzin, M., Carlyle, E, . . . Allen, J. J. B. (2010). Acupuncture for depression during pregnancy: A randomized controlled trial. *Obstetrics & Gynecology, 115,* 511-520.

McCall, T. (2007). *Yoga as medicine: The yogic prescription for health and healing*. New York, NY: Bantam Dell.

Meager, I., & Milgrom, J. (1996). Group treatment for postpartum depression: A pilot study. *Australian and New Zealand Journal of Psychiatry, 30,* 852-860.

Misri, S., Kim, J., Riggs, K. W., & Kostaras, X. (2000). Paroxetine levels in postpartum depressed women, breast milk, and infant serum. *Journal of Clinical Psychiatry, 61,* 828-832.

Misri, S., Reebye, P., Corral, M., & Milis, L. (2004). The use of paroxetine and cognitive-behavioral therapy in postpartum depression and anxiety: A randomized controlled trial. *Journal of Clinical Psychiatry, 65,* 1236-1241.

Moadel, A. B., Shah, C., Wylie-Rosett, J., Harris, M. S., Patel, S. R., Hall, C. B., & Sparano, J. A. (2007). Randomized controlled trial of yoga among a multiethnic sample of breast cancer patients: Effects on quality of life. *Journal of Clinical Oncology, 25,* 4387-4395.

Moher, D., Hopewell, S., Schulz, K. F., Montori, V., Gøtzsche, P. C., Devereaux, P. J., . . . Altman, D. G. (2010). CONSORT 2010 explanation and elaboration: Updated guidelines for reporting parallel group randomised trials. *British Medical Journal, 340,* 869.

Morgan, A. J., & Jorm, A. F. (2008). Self-help interventions for depressive disorders and depressive symptoms: A systematic review. *Annals of General Psychiatry, 7,* 13.

Mottola, M. F. (2002). Exercise in the postpartum period: Practical applications. *Current Sports Medicine Reports, 1,* 362-368.

Murray, C. J., & Lopez, A. D. (1996). *The global burden of disease: A comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Cambridge, MA: Harvard School of Public Health (Global Burden of Disease and Injury Series, vol. I).

Murray, L., Cooper, P. J., Wilson, A., & Romaniuk, H. (2003). Controlled trial of the short-and long-term effect of psychological treatment of post-partum depression. 2. Impact on the mother child relationship and child outcome. *British Journal of Psychiatry, 182,* 420-427.

National Center for Complementary and Alternative Medicine (NCCAM): http://nccam.nih.gov/health/whatiscam/ 2008.

Netz, Y., & Lidor, R. (2003). Mood alterations in mindful versus aerobic exercise modes. *Journal of Psychology, 137*, 405-419.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*, 504-511.

Nonacs, R. M., & Cohen, L. S. (1998). Postpartum mood disorders: Diagnosis and treatment guidelines. *Journal of Clinical Psychiatry, 59*, 34-40.

Nonacs, R. M., Soares, C. N., Viguera, A. C., Pearson, K., Poitras, J. R., & Cohen, L. S. (2005). Bupropion SR for the treatment of postpartum depression: A pilot study. *The International Journal of Neuropsychopharmacology, 8*, 445-449.

O'Hara, M. W., Zekoski, E. M., Philipps, L. H. C., & Wright, E. J. (1990). A controlled prospective study of postpartum mood disorders: Comparison of child bearing and non-child bearing women. *Journal of Abnormal Psychology, 1*, 3-15.

O'Hara, M. W., Hoffman, J. G., Philipps, L. H. C., & Wright, E. J. (1992). Adjustment in childbearing women: The postpartum adjustment questionnaire. *Psychological Assessment, 4*, 160-169.

O'Hara, M. W. (1997). The nature of postpartum depressive disorders. In L. Murray & P. J. Cooper (Eds.), *Postpartum Depression and Child Development* (pp. 3-31). NewYork, NY: Guilford Press.

O'Hara, M. W., Stuart, S., Gorman, L. L., & Wenzel, A. (2000). Efficacy of interpersonal psychotherapy for postpartum depression. *Archives of General Psychiatry, 57*, 1039-1045.

O'Hara, M. W., & McCabe, J. E. (2013). Postpartum Depression: Current status and future directions. *Annual Review of Clinical Psychology, 9*, 379-407.

O'Higgins, M., Roberts, I. S. J., & Glover V. (2008). Postnatal depression and mother and infant outcomes after infant massage. *Journal of Affective Disorders, 109*, 189-192.

Oken, B. S., Kishiyama, S., Zajdel, D., Bourdette, D., Carlsen, J., Haas, M., Hugos, C., . . . Mass, M. (2004). Randomized controlled trial of yoga and exercise in multiple sclerosis. *Neurology, 62*, 2058-2064.

Oken, B. S., Zajdel, D., Kishiyama, S., Flegal, K., Dehen, C., Haas, M., Kraemer, D. F., . . . Leyva, J. (2006). Randomized, controlled, six-month trial of yoga in healthy

seniors: Effects on cognition and quality of life. *Alternative Therapy Health Medicine, 12,* 40-47.

O'Mahen, H. A., & Flynn, H. A. (2008). Preferences and perceived barriers to treatment for depression during the perinatal period. *Journal of Women's Health, 17,* 1301-1309.

O'Mahony, J. M., Donnelly, T. T., Bouchal, S. R., & Este, D. (2013). Cultural background and socioeconomic influence of immigrant and refugee women coping with postpartum depression. *Journal of Immigrant and Minority Health, 15,* 300-314.

Osborne, J. W. & Overbay, A. (2004). The power of outliers (and why researchers should always check for them). *Practical Assessment, Research & Evaluation, 9.* Retrieved April 23, 2013 from http://PAREonline.net/getvn.asp?v=9&n=6.

Pavot, W. & Diener, E. (1993). Review of the satisfaction with life scale. *Psychological Assessment, 5,* 164-172.

Pavot, W., & Diener, E. (2008). The satisfaction with life scale and the emerging construct of life satisfaction. *The Journal of Positive Psychology, 3,* 137-152.

Philipps, L. H., & O'Hara, M. W. (1991). Prospective study of postpartum depression: 4 1/2-year follow-up of women and children. *Journal of Abnormal Psychology, 100,* 151-155.

Powers, S. (2008). *Insight yoga*. Boston, MA: Shambhala Publications, Inc.

Prendergast, J., & Austin, M. P. (2001). Early childhood nurse-delivered cognitive behavioral counseling for post-natal depression. *Australas Psychiatry, 9,* 255-259.

Ramel, W., Goldin, P. R., Carmona, P. E., & McQuaid, J. R. (2004). The effects of mindfulness meditation on cognitive process and affect in patients with past depression. *Cognitive Therapy Research, 28,* 433-455.

Raudenbush, S. W., & Bryk, A. S. (2001). *Hierarchical linear modeling: Applications and data analysis methods* (Advanced quantitative technology in the social sciences). CA: Sage.

Raudenbush, S. W., Bryk, A. S, & Congdon, R. (2011). HLM 7 for Windows [Computer software]. Lincolnwood, IL: Scientific Software International, Inc.

Rohini, V., Pandey, R. S., Janakiramaiah, N., Gangadhar, B. N., & Vedamurthachar, A. (2000). A comparative study of full and partial Sudarshan kriya Yoga in major depressive disorder. *NIMHANS Journal, 18,* 53-57.

Ross, A., & Thomas, S. (2010). The health benefits of yoga and exercise: A review of comparison studies. *The Journal of Alternative and Complementary Medicine, 16,* 3-12.

Ross, A., Friedmann, E., Bevans, M., & Thomas, S. (2013). National survey of yoga practitioners: Mental and physical health benefits. *Complementary Therapies in Medicine*, http://dx.doi.org/10.1016/j.ctim.2013.04.001

Ross, L. E., Gilbert Evans, S. E., Sellers, E. M., & Romach, M. K. (2003). Measurement issues in postpartum depression part 1: Anxiety as a feature of postpartum depression. *Archives of Women's Mental Health, 6,* 51-57.

Ross, L. E., & McLean, L. M. (2006). Anxiety disorders during pregnancy and the postpartum period: A systematic review. *Journal of Clinical Psychiatry, 67,* 1285-1298.

Sahasi, G., Mohan, D., & Kacker, C. (1989). Effectiveness of yogic techniques in the management of anxiety. *Journal of Personality Clinical Studies, 5,* 51-55.

Sampselle, C. M., Seng, J., Yeo, S., Killion, C., & Oakley, D. (1999). Physical activity and postpartum well-being. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 28,* 41-49.

Schuster, T. L., Dobson, M., Jauregui, M., Blanks, R. H. I. (2004). Wellness lifestyles I: A theoretical framework linking wellness, health lifestyles, and complementary and alternative medicine. *The Journal of Alternative and Complementary Medicine, 10,* 349-356.

Shannahoff-Khalsa, D. S., Ray, L. E., Levine, S., Gallen, C. C., Schwartz, B. J., & Sidorowich, J. J. (1999). Randomized controlled trial of yogic meditation techniques for patients with obsessive-compulsive disorder. *CNS Spectrums, 4,* 34-47.

Shapiro, D., & Cline, K. (2004). Mood changes associated with Iyengar yoga practices: A pilot study. *International Journal of Yoga Therapy, 14,* 35-44.

Shapiro, D., Cook, I. A., Davydov, D. M., Ottaviani, C., Leuchter, A. F., & Abrams, M. (2007). Yoga as a Complementary Treatment of Depression: Effects of Traits and Moods on Treatment Outcome. *Evidence-Based Complementary and Alternative Medicine, 4,* 493-502.

Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62,* 373-386.

Shapiro, S. L., Oman, D., Thoresen, C. E., Plante, T. G., & Flinders, T. (2008). Cultivating mindfulness: Effects on well-being. *Journal of Clinical Psychology, 64,* 840-862.

Sharma, I., Azmi, S. A., & Settiwar, R. M. (1991). Evaluation of the effect of pranayama in anxiety state. *Alternative Medicine, 3,* 227-235.

Sharma, V. K., Das, S., Mondal, S., Goswampi, U., & Gandhi, A. (2005). Effect of Sahaj yoga on depressive disorders. *Indian Journal of Physiology and Pharmacology, 49,* 462-468.

Sherman, K. J., Cherkin, D. C., Erro, J., Miglioretti, D. L., & Deyo, R. A. (2005). Comparing yoga, exercise, and a self-care book for chronic low back pain: A randomized, controlled trial. *Annals of Internal Medicine, 143,* 849-856.

Sherman, K. (2006). Reflections on researching yoga. *International Journal of Yoga Therapy, 16,* 9-10.

Sherman, K. J., Wellman, R. D., Cook, A. J., Cherkin, D. C., & Ceballos, R. M. (2013). Mediators of yoga and stretching for chronic low back pain. *Evidence-Based Complementary and Alternative Medicine,* http://dx.doi.org/10.1155/2013/130818.

Sichel, D. A., Cohen, L. S., Robertson, L. M., Ruttenberg, A., & Rosenbaum, J. F. (1995). Prophylactic estrogen in recurrent postpartum affective disorder. *Biological Psychiatry, 38,* 814-818.

Stephens, M. (2010). *Teaching yoga: Essential foundations and techniques*. Berkeley, CA: North Atlantic Books.

Stowe, Z. N., Casarella, J., Landry, J., & Nemeroff, C. B. (1995). Sertraline in the treatment of women with postpartum major depression. *Depression, 3,* 49-55.

Stuart, S., & O'Hara, M. W. (1995). Interpersonal psychotherapy for postpartum depression: A treatment program. *Journal of Psychotherapy Practice and Research, 4,* 18-29.

Stuart, S., Couser, G., Schilder, K., O'Hara, M. W., & Gorman, L. (1998). Postpartum anxiety and depression: Onset and comorbidity in a community sample. *Journal of Nervous and Mental Disease, 186,* 420-424.

Stuart, S. (2005). What is IPT? The basic principles and the inevitability of change. *Journal of Contemporary Psychotherapy, 38,* 1-10.

Suri, R., Burt, V. K., Altshuler, L. L., Zuckerbrow-Miller, J., & Fairbanks, L. (2001). Fluvoxamine for postpartum depression (letter). *American Journal of Psychiatry,*

158, 1739-1740.

Taylor-Piliae, R. E., Norton, L. C., Haskell, W. L., Mahbouda, M. H., Fair, J. M., Iribarren, C., . . . Fortmann, S. P. (2006). *American Journal of Epidemiology, 164*, 598-606.

Taylor-Piliae, R. E., Fair, J. M., Haskell, W. L., Varady, A. N., Iribarren, C., Hlatky, M. A., . . . Fortmann, S. P. (2010). Validation of the Stanford Brief Activity Survey: Examining psychological factors and physical activity levels in older adults. *Journal of Physical Activity and Health, 7*, 87-94.

Teasdale, J. D., Segal, Z. V., Williams, D., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *Journal of Consulting and Clinical Psychology, 68*, 615-623.

Teasdale, J. D., Moore, R. G., Hayhurst, H., Pope, M., Williams, S., & Segal, Z. V. (2002). Metacognitive awareness and prevention of relapse in depression: Empirical evidence. *Journal of Consulting and Clinical Psychology, 70*, 275-287.

Uebelacker, L. A., Epstein-Lubow, G., Gaudiano, B. A., Tremont, G., Battle, C. L., & Miller, I. W. (2010a). Hatha yoga for depression: Critical review of the evidence for efficacy, plausible mechanisms of action, and directions for future research. *Journal of Psychiatric Research, 16*, 22-33.

Uebelacker, L. A., Tremont, G., Epstein-Lubow, G., Gaudiano, B. A., Gillette, T., Zornitsa K., & Miller, I. W. (2010b). Open trial of vinyasa yoga for persistently depressed individuals: Evidence of feasibility and acceptability. *Behavior Modification, 34*, 247-264.

Ulger, O., & Vardar Yagli, N. (2010). Effects of yoga on the quality of life in cancer patients. *Complementary Therapies in Clinical Practice, 16*, 60-63.

Veale, D., Le Fevre, K., Pantelis, C., de Souza, V., Mann, A., & Sargeant, A. (1992). Aerobic exercise in the adjunctive treatment of depression: A randomized controlled trial. *Journal of the Royal Society of Medicine, 85*, 541-544.

Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care, 30*, 473-83.

Ware, J. E., Kosinski, M., & Keller, S. (1994). SF-36 physical and mental health summary scales: A user's manual. *The Health Institute,* Boston, MA.

Watson, D. (2005). Rethinking the mood and anxiety disorders: A quantitative hierarchical model for DSM–V. *Journal of Abnormal Psychology, 114*, 522-536.

Watson, D., O'Hara, M. W., Simms, L. J., Kotov, R., Chmielewski, M., McDade-Montez, E. A., . . . Stuart, S. (2007). Development and validation of the Inventory of Depression and Anxiety Symptoms (IDAS). *Psychological Assessment, 19,* 253-268.

Watson, D., O'Hara, M. W., Chmielewski, M., McDade-Montez, E., Koffel, E., Naragon, K., & Stuart, S. (2008). Further validation of the IDAS: Evidence of convergent, discriminant, criterion, and incremental validity. *Psychological Assessment, 20,* 248-259.

Weintraub, A. (2004). *Yoga for depression: A compassionate guide to relieve suffering through yoga.* New York, NY: Broadway Books.

Weissman, M. M., & Jensen, P. (2002). What research suggests for depressed women with children. *Journal of Clinical Psychiatry, 63,* 641-647.

Wells, K. B., Stewart, A., Hays, R. D., Burman, A., Rogers, W., Daniels, M., . . . Ware, J. (1989). The functioning and well-being of depressed patients. Results from the medical outcomes study. *Journal of American Medical Association, 262,* 914-919.

Wenzel, A., Gorman, L. L., O'Hara, M. W., & Stuart, S. (2001). The occurrence of panic and obsessive compulsive symptoms in women with postpartum dysphoria: A prospective study. *Archives of Women's Mental Health, 4,* 5-12.

Wenzel, A., Haugen, E. N., Jackson, L. C., & Robinson, K. (2003). Prevalence of generalized anxiety at eight weeks postpartum. *Archives of Women's Mental Health, 6,* 43-49.

Wenzel, A., Haugen, E. N., Jackson, L. C., & Brendle, J. R. (2005). Anxiety symptoms and disorders at eight weeks postpartum. *Journal of Anxiety Disorders, 19,* 295-311.