2017

Feasibility of a Relaxation Guided Imagery Intervention to Reduce Maternal Stress in the NICU

Lois C. Howland
University of San Diego

Nancy Jallo
Virginia Commonwealth University

Cynthia D. Connelly
University of San Diego

Rita H. Pickler
Ohio State University

JOGNN

RESEARCH

Feasibility of a Relaxation Guided Imagery Intervention to Reduce Maternal Stress in the NICU

Lois C. Howland, Nancy Jallo, Cynthia D. Connelly, and Rita H. Pickler

Correspondence
Lois C. Howland, DrPH, MSN, RN, University of San Diego Hahn School of Nursing and Health Science, Beyster Institute for Nursing Research, 5998 Alcalá Park, San Diego, CA 92110-2492.
lhowland@sandiego.edu

Keywords
guided imagery
maternal stress
postpartum depression symptoms
prematurity
salivary cortisol
state anxiety

ABSTRACT

Objective: To test the feasibility of a relaxation guided imagery (RGI) intervention for mothers of hospitalized preterm infants and to explore the biobehavioral effects of RGI on their distress, responsiveness, and physiological stress.

Design: Single sample, pretest–posttest design.

Setting: A large Level III NICU in Southern California.

Participants: Twenty mothers of hospitalized preterm infants (24–32 weeks gestational age).

Methods: Correlational analyses of RGI use with self-reported measures of distress (perceived stress, state anxiety, and depression symptoms), awakening salivary cortisol level, and salivary cortisol awakening response collected from mothers at baseline and after 8 weeks of an RGI intervention.

Results: Nineteen mothers completed the study. Average use of RGI varied from 1.7 to 7.4 times per week (mean = 4.46, standard deviation = 2.7). Greater average use of RGI was correlated with lower awakening cortisol levels ($r = -.38$), greater cortisol awakening response ($r = .36$), and lower levels of distress (perceived stress [$r = -.38$], anxiety [$r = -.43$], and depression [$r = -.41$]).

Conclusion: Relaxation guided imagery may be a feasible and acceptable intervention to reduce mental and physiologic stress and improve responsiveness in mothers of hospitalized preterm infants.

JOGNN, 46, 532–543; 2017. http://dx.doi.org/10.1016/j.jogn.2017.03.004

Accepted March 2017

Lois C. Howland, DrPH, MNS, RN, is an associate professor (retired), Hahn School of Nursing and Health Science, Beyster Institute for Nursing Research, University of San Diego, San Diego, CA.

Nancy Jallo, PhD, FNP-BC, WHNP-BC, CNS, is an associate professor in the School of Nursing, Virginia Commonwealth University, Richmond, VA.

(Continued)

The authors report no conflict of interest or relevant financial relationships.

Mothers of hospitalized preterm infants are at risk for high levels of mental distress (stress, anxiety, and depression). The preterm birth rate in the United States has increased 21% since 1990 and remains high at approximately 11.7%; each year, an estimated 550,000 infants are born prematurely (Hamilton, Hoyert, Martin, Strobino, & Guyer, 2013). At the same time, medical advances have increased survival rates of all but the most extremely preterm infants (Mandy, 2011). After preterm birth, the stress of postpartum recovery is compounded by the psychological distress of having an infant hospitalized in a NICU. During the infant's hospitalization, the mother may experience additional psychological trauma related to the infant's repeated and unexpected medical crises (Miles, Holditch-Davis, Schwartz, & Scher, 2007; Shaw et al., 2013), which gives rise to high levels of stress, anxiety, and depression (Muller-Nix et al., 2004). These mothers are at risk for physiologic problems, including poor sleep quality (Dorheim, Bondevik, Eberhard-Gran, & Bjorvatn, 2009), neurohormonal disruption (Howland, Pickler, McCain, Glaser, & Lewis, 2011), and decreased maternal responsiveness (Muller-Nix et al., 2004). The identification of effective interventions to reduce this stress is critical to the long-term health and well-being of mothers and infants.

Nonpharmacologic mind–body interventions can be effective to reduce psychological stress. Relaxation guided imagery (RGI) is a mind–body intervention in which mental images are used to produce a relaxed mental state, lowering the physiologic stress response (Jallo, Bourguignon, Taylor, Ruiz, & Goehler, 2009). In a study on the effects of RGI in pregnancy, Janke (1999) found that women were receptive to this strategy, and there was some evidence of improved outcomes for women with preterm labor, including reduced daily stress, state anxiety, and increased infant birth weight. As a low-cost, easily used strategy,

RGI may be effective to help mothers better cope with the stress related to a preterm birth.

Maternal Stress and Prematurity

With the birth of a child, a woman experiences stress related to major physical changes (Groer et al., 2005) and role transitions (Mercer, 2004). The birth of a preterm infant initiates significantly greater stress for the woman as she attempts to cope with the uncertainty of her infant's health. New mothers, particularly mothers of preterm infants, have been shown to experience greater levels of psychological stress that lead to anxiety and depression (Miles, Burchinal, Holditch-Davis, Brunssen, & Wilson, 2002; Singer et al.,1999), less attentional capacity toward the infant (Wahler & Dumas, 1989), and fatigue (Groer et al., 2005). These untoward outcomes increase the risk for poor child health outcomes such as diminished physical health and language and behavior problems (Kahn, Zuckerman, Bauchner, Homer, & Wise, 2002), increased child stress hormone levels (Ashman, Dawson, Panagiotides, Yamada, & Wilkinson, 2002), child maltreatment (Bugental & Happaney, 2004; Sachs, Hall, Lutenbacher, & Rayens, 1999), and increased child health care use (Mandl, Tronick, Brennan, Alpert, & Homer, 1999). In previous animal (Levine et al., 2005; Walker et al., 2004) and human (Pruessner, Hellhammer, & Kirschbaum, 1998) studies, investigators linked stress with disruption of the mother–infant relationship.

The Physiologic Stress Response

When an individual perceives psychological threat, a physiologic stress response is activated and causes a psychoneuroimmunology cascade designed to ensure survival (Sapolsky, Romero, & Munch, 2000). The psychoneuroimmunology response becomes counterproductive when an individual persists in a heightened state of perceived threat (McEwen, 1998), and it interferes with cognitive functioning and causes an inability to focus attention and retrieve information from memory (Vedhara, Shanks, Anderson, & Lightman, 2000). A mother's ability to accurately attend and respond to her infant's cues is critical to infant health, growth, and development (Wahler & Dumas, 1989). Thus, a heightened and chronic state of stress may interfere with a mother's ability to provide optimal care to her infant. Physiologically prolonged heightened stress can be observed in altered hypothalamic–pituitary–adrenal axis functioning as greater awakening cortisol levels (Tu, Lupien, & Walker, 2006) and lower cortisol awakening response (CAR), the difference in cortisol levels between awakening and 30 minutes after awakening (Clow, Hucklebridge, Stalder, Evans, & Thorn, 2010). In preliminary research we found that mothers of hospitalized preterm infants who had high levels of depression symptoms also had greater awakening salivary cortisol levels and diminished CAR (Howland et al., 2011).

Identification of effective interventions to reduce stress in mothers of hospitalized preterm infants is critical to long-term health and well-being of mothers and newborns.

Relaxation Guided Imagery

Relaxation guided imagery is a mind–body intervention defined conceptually as a mental representation of reality that creates a healing relationship within the body and mind. Relaxation guided imagery represents a basic principle of psychophysiology (Reed, 2007). When the mental image is experienced, there is an associated emotion that links the feeling state with the mind and body, which can then lead to a physiologic change (Achterberg, Kenner, & Lawlis, 1988). Thus, RGI is a process that moderates communication between perception, emotion, and physiologic change (Kwekkeboom, 2001). During the past several decades, the use of RGI or relaxation alone has been reported to reduce stress, anxiety, and depression (Broadbent et al., 2012; Greene & Greene, 2012; Kwekkeboom, 2001; Mizrahi et al., 2012). Researchers who study women in the perinatal setting, including women in preterm labor, have suggested a positive influence of relaxation interventions on pregnancy prolongation and birth weight (Janke, 1999; Omer, Friedlander, & Palti, 1986), as well as state anxiety (Chuang et al., 2012) and stress (Jallo, Cozens, Smith, & Simpson, 2013). Relaxation interventions resulted in reduced levels of anxiety and perceived stress among primigravida women with high anxiety levels (Holmes, Arntz, & Smucker, 2007), a reduced rate of low birth weight, and decreased anxiety during the third trimester (Bastani, Hidarnia, Kazemnejad, Vafaei, & Kashanian, 2005). Daily RGI for 12 weeks starting in the second trimester lowered anxiety, daily stress, and depression scores in African American women (Jallo et al., 2009).

Although RGI has been tested during pregnancy, the use of RGI with mothers of hospitalized

Cynthia D. Connelly, PhD, RN, FAAN, is a professor and Director of Nursing Research in the Hahn School of Nursing and Health Science, Beyster Institute for Nursing Research, University of San Diego, San Diego, CA.

Rita H. Pickler, PhD, RN, FAAN, is a FloAnn Sours Easton Professor and Director of PhD and MS Nursing Science Programs, College of Nursing, Ohio State University, Columbus, OH.

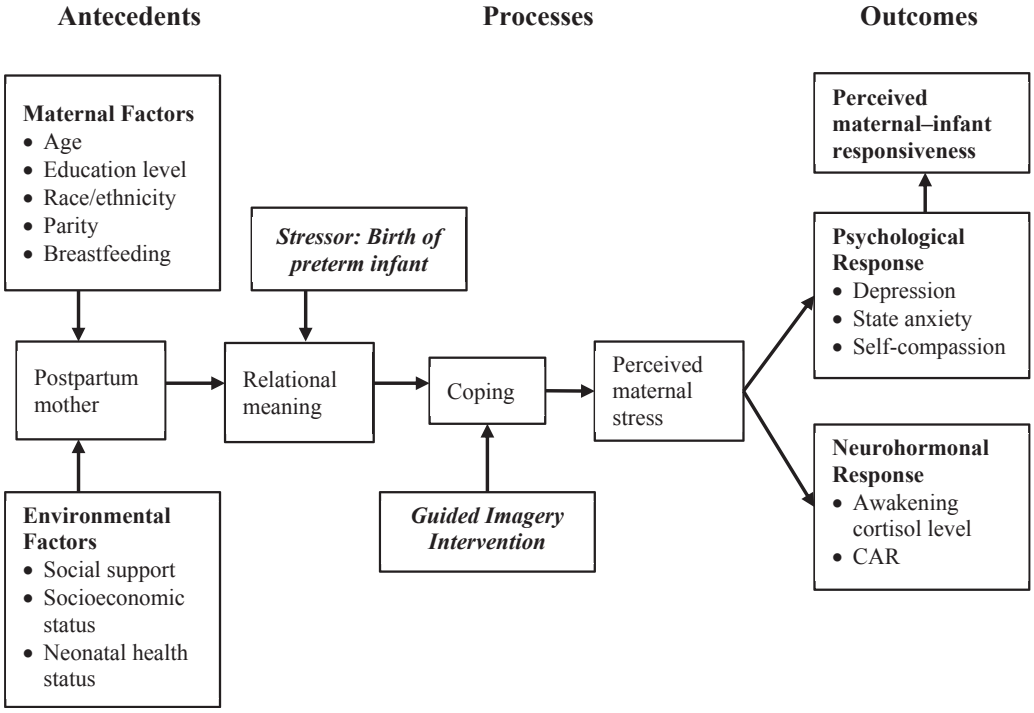

Figure 1. Conceptual model describing the proposed role of relaxation guided imagery intervention in supporting maternal coping. CAR = cortisol awakening response.

preterm infants has not been studied. The primary aim of this study was to test the feasibility of an RGI intervention for mothers of hospitalized preterm infants. A secondary aim was to explore the biobehavioral effects of RGI on maternal distress, maternal responsiveness, and physiologic stress.

Methods

Study Design

This was a single sample, pretest–posttest feasibility study to evaluate the delivery of an 8-week RGI intervention for the reduction of stress among mothers of hospitalized preterm infants. The cognitive theory of stress and coping developed by Lazarus and Folkman (1984) and later revised by Lazarus (1999) was used to guide the design of conceptual model for this study (see Figure 1). Emphasized in this theory are the critical roles of stress appraisal and resources needed to facilitate an individual's ability to optimally cope with the stressful event (Folkman et al., 1991). Depending on the effectiveness of the coping process, an individual's stress response may activate a psychoneuroimmunology process with subsequent biologic outcomes with RGI serving to enhance the individual's coping capacity. All procedures were approved by the participating hospital and university institutional review boards for the protection of human subjects, and participants gave informed written consent.

Setting and Sample

Mothers of preterm infants currently hospitalized in a tertiary-level NICU in a metropolitan hospital in Southern California were recruited for the study. To be included, participants had to be at least 18 years of age, have one or more infants currently hospitalized in the NICU, speak or read English, be willing to complete three study visits over 8 weeks, and be able to collect early morning saliva samples at home twice during the study. Mothers were not eligible for study if they used systemic corticosteroids, were receiving treatment for a chronic disease or psychiatric disorder, or were currently using other guided imagery techniques. Approximately 50% of the eligible mothers invited to participate in the study signed the informed consent. There were no demographic differences between mothers who volunteered to participate and those who declined.

Table 1: Description of Self-Report Behavioral Measures

Behavioral Measure	Instrument and Study	Number of Items	Response Level	Possible Range	Cronbach's α
Stress	Perceived Stress Scale (PSS) Cohen and Williamson (1988)	10	5	0–40	.79
Depression	Center for Epidemiologic Studies Depression Scale (CES-D) Radloff (1977)	20	4	0–60	.89
Anxiety	State–Trait Anxiety Inventory for Adults (STAI-AD) Spielberger, Gorsuch, Lushene, Vagg, and Jacobs (1983)	20	4	20–80	.94
Maternal–infant responsiveness	Maternal–Infant Response Instrument (MIRI) Amankwaa, Pickler, and Boonmee (2007)	22	5	22–110	.87

Procedures

Intervention. The intervention involved listening to a 20-minute RGI recording at least once daily for 8 weeks. The design called for daily practice for 8 weeks based on prior research on the use of RGI in which authors found that the capacity for imagery was consciously enhanced and strengthened through daily practice (Kruck, 2002; Sheikh et al., 2002), that an increase in the effect size of guided imagery on physiologic and/or psychological measures occurred at 5 to 7 weeks (Van Kuiken, 2004), and that stress-related symptoms and the individual's appraisal of stress improved within 8 to 12 weeks of relaxation-based programs (Mandle, Jacobs, Arcari, & Domar, 1996; Wynd, 1992; Zahourek, 2009).

The recording scripts were developed and professionally recorded by a co-investigator (Jallo) who is certified in RGI. The scripts focused on three themes: developing a relaxed state, working with difficult feelings, and developing a friendlier feeling toward self. Participants were instructed to listen to one track for 2 weeks before they switched to the next track. During the last 2 weeks of study, participants could choose to listen to whichever track they most preferred. Intervention fidelity was monitored with a short, scripted weekly phone call by a research assistant who asked each participant for a categoric recall to approximate how many times she had listened to the CD in the preceding week (e.g., none, 1–2 times, 3–4 times, 5–6 times, daily, or more). During the call, the research assistant also asked if the participant had encountered any barriers to listening, including problems with the CD player, which allowed the study team the opportunity to replace batteries or defective equipment.

Study visits. The two study visits at study entry (T1) and at 8 weeks (T2) took place in a private area adjacent to the NICU, at the infant's bedside, or in the participant's home, depending on her preference. Before each study visit, the participant collected two saliva samples at home; the first sample was collected immediately upon awakening, and the second was collected 30 minutes later. Participants were instructed not to eat, drink, smoke, or brush their teeth until after the second sample was collected; they could rinse their mouth with plain water if desired. To collect saliva samples, each participant chewed on a small cotton roll for 1 minute, after which she placed the cotton roll in a Salivaette, a saliva collection device (Sarstedt, Inc., Nümbrecht, Germany). Participants refrigerated the saliva samples until they could be brought to the study visit or collected by study personnel. Written and verbal instructions were given to the participants at enrollment, and a research assistant phoned the participant the night before the scheduled collection day to review the instructions. Collected samples were stored in a −70°C freezer and shipped on dry ice overnight to the laboratory for batch processing.

In addition to the saliva samples, study participants completed self-report questionnaires to measure perceived stress, depression symptoms, anxiety, and social support. On the first visit they also completed a demographic questionnaire, and on the last visit they

Table 2: Descriptive Characteristics of Study Sample ($N = 20$)

Characteristic	*n*	%
Race		
American Indian	1	5
Asian	1	5
Black, non-Hispanic	1	5
Native Hawaiian, Pacific Islander	1	5
White	12	60
Other	4	20
Ethnicity		
Hispanic	10	50
Non-Hispanic	10	50
Education level		
Completed high school only	3	15
Some college or technical training	10	50
College graduate or higher	7	35
Marital status		
Married	10	50
Single, never married	10	50
Employment status		
Employed	6	30
Not employed	14	70
Family income		
>$50,000	8	40
$30,000–50,000	2	10
$10,000–30,000	6	30
<$10,000	4	20
Parity		
Primipara	13	65
Multipara	7	35

	M (*SD*)	Range
Maternal age in years	27.3 (6.4)	18–37
Infant length of stay in days	62.3 (22.3)	26–99
Gestational age at birth in weeks	28 (2.3)	24–32
Neonatal Morbidity Index score	4 (1.1)	2–5

Note. M = mean; SD = standard deviation.

completed an instrument to measure maternal–infant responsiveness. On the last visit participants were interviewed to qualitatively evaluate the RGI recordings and provide suggestions about how to make the recordings more effective.

Measures

Several self-report measures were used to evaluate maternal mental distress (stress, state anxiety, and depression symptoms) and maternal–infant responsiveness. The 10-item Perceived Stress Scale (Cohen & Williamson, 1988) was used to evaluate level of perceived stress, the Center for Epidemiologic Studies Depression Scales (Radloff, 1977) were used to assess depression, and the State–Trait Anxiety Inventory for Adults (Spielberger, Gorsuch, Lushene, Vagg, and Jacobs, 1983) was used to measure current state anxiety. A relatively new instrument, the Maternal–Infant Response Instrument (Amankwaa, Pickler, & Boonmee, 2007), was used at the second study visit (T2) to assess each participant's perception of her infant's responsiveness. We collected data from the Maternal–Infant Response Instrument only on the second visit because of each participant's very limited time with her newborn at baseline (T1; shortly after birth). The reliability and validity of these instruments has been evaluated in a variety of clinical populations, including postpartum women and mothers of preterm infants. Further description of the instruments including internal consistency reliability for the study sample is reported in Table 1.

We measured maternal age, race, ethnicity, marital status, household income, and education level as well as parity and current breastfeeding status to describe the study sample. Infant characteristics included birth weight, gestational age, NICU length of stay, and severity of illness as measured by the Neonatal Medical Index (Korner et al., 1993). The Neonatal Medical Index is an ordinal rating scale of chart-reported clinical features (e.g., birth weight greater or less than 1,000 g, history of apnea or bradycardia) developed to predict mental and motor development of preterm infants. The score ranges from 1 to 5; higher scores indicate greater risk for compromised mental and/or motor development in later life.

We examined the effects of the intervention on physiologic stress by exploring two markers of hypothalamic–pituitary–adrenal axis activation: awakening salivary cortisol level and CAR. These two biomarkers are associated with postpartum depression (Taylor, Glover, Marks, & Kammerer, 2009) and early life adversity (Gonzales, Jenkins, Steiner, & Fleming, 2008). Other researchers have collected additional saliva samples throughout the day to assess diurnal

Table 3: Mean Values for Outcome Variables Baseline ($n = 20$) and Week 8 ($n = 19$)

	Baseline		Week 8	
Variable	*M* (*SD*)	Range	*M* (*SD*)	Range
Perceived stress	19.55 (5.75)	10–28	17.79 (5.80)	9–28
Depression symptoms	18.45 (11.89)	1–45	14.61 (11.79)	0–38
State anxiety	42.05 (13.40)	21–67	39.42 (12.79)	20–62
Maternal–infant responsiveness	NA	NA	91.47 (11.64)	67–110
First morning cortisol level[a]	0.23 (0.24)	0–1.13	0.19 (0.17)[b]	0–0.53
Cortisol awakening response[a]	0.03 (0.12)	−0.17 to 0.20	0.05 (0.14)[b]	−0.06 to 0.40

Note. *M* = mean; NA = not applicable because not measured at baseline; *SD* = standard deviation.
[a]Level expressed in µg/dl. [b]$n = 12$ for reported cortisol levels on Week 8.

variation; however, to do so in this study would have added a significantly greater burden for the participants and potentially reduced reliability of our results.

Data Analysis

Between T1 and T2, one participant dropped out of the study, two participants were unable to return Salivettes because of long distances from the hospital for the T2 visit, and samples from five additional participants were mislabeled by the participant or had insufficient sample volume for analysis. We therefore had usable saliva samples at T1 and T2 for 12 of 20 participants (60%) and complete self-report measures for 19 of 20 participants (95%).

Descriptive statistics were used to describe the demographic and clinical characteristics of the participants. Study variables were also summarized and examined for measures of central tendency. The reported number of times a participant listened to the CD for each of the 8 weeks was averaged as "listening times per week" and was used as the continuous predictor variable to represent *dose,* or average amount of exposure to the intervention. We used Pearson correlations to evaluate the association of reported average weekly use of the RGI intervention and the continuous outcome variables of maternal distress (perceived stress, anxiety, and depression), maternal responsiveness, and physiologic stress (awakening cortisol level and CAR) at T2.

Qualitative information was gathered during the final study visit using a Likert scale approach to assess the participants' preferences for RGI content and how useful (1 = *not useful at all,* 5 = *extremely useful*) they believed the recordings were in *handling difficult feelings*. We further asked for additional suggestions to improve the intervention that we summarized.

Results

Key maternal and infant characteristics are summarized in Table 2. Approximately 60% of participants identified themselves as White, and 50% reported their ethnicity as Hispanic. Eighty-five percent reported at least some post–high school education or training. Fifty percent of the sample was married, and 60% had annual family household incomes of less than $50,000. More than two thirds (65%) were primiparas. The gestational age of the infants varied from 24 to 32 weeks with high average morbidity levels, as evidenced by an average Neonatal Medical Index score of 4 (actual range = 2–5). Throughout the duration of the study, all participants used a breast pump to provide breast milk for their infants.

Assessment of RGI Through Biobehavioral Outcomes

The change in outcome scores from T1 to T2 is shown in Table 3. Over time, average mental distress scores (perceived stress, anxiety, and depression symptoms) decreased, average awakening cortisol level decreased, and average CAR level increased. Mean intervention exposure varied widely with a range of average weekly CD use of two to seven times (20 minutes per recording) and an overall average weekly use of 4.46 (standard deviation = 1.1). When we compared mean weekly use of the CD of RGI recordings with the outcome measures (Table 4), we found more frequent CD use was associated with lower stress, anxiety, and depression

Relaxation guided imagery may reduce mental distress and improve the biological stress response among mothers of preterm infants.

symptoms scores; greater maternal–infant responsiveness scores; lower awakening cortisol level; and greater CAR level at T2, although none of these relationships were statistically significant.

Assessment of Feasibility of RGI

Participants overall had few problems using the intervention, and they reported that the intervention was on average moderately useful in *handling difficult feelings* (3.6 on a scale of 1 = *not useful* to 5 = *very useful*). Most (15/19) participants preferred the recording track in which relaxation was emphasized compared with images in which working with difficult feelings was emphasized (3/19) or self-compassion was encouraged (1/19). Several participants reported that they preferred to listen to the recordings while using a breast pump because they said it helped them relax, and several others reported that they used the recordings to help them fall asleep.

Discussion

The primary purpose of this single sample, pretest–posttest study was to examine the feasibility of the use of an RGI intervention in mothers with preterm infants in the NICU. Although other studies have examined similar interventions during pregnancy (Jallo et al., 2009; Jallo et al., 2013), this is the first study to test RGI in this vulnerable population. We further explored possible effects of the intervention on specific biobehavioral outcomes related to maternal stress. The results indicate that this intervention is feasible and that its use has the potential to positively affect measures of maternal mental distress.

Feasibility

At entry into the study, participants reported elevated levels of perceived stress, state anxiety, and depression symptoms consistent with earlier research in which heightened mental distress among mothers of hospitalized preterm infants was documented (Garfield et al., 2015; Holditch-Davis et al., 2015; Mew, Holditch-Davis, Belyea, Miles, & Fishel, 2003; Miles et al., 2007; Rogers, Kidokoro, Wallendorf, & Inder, 2013; Yurdakul et al., 2009). As an intervention designed to reduce mental distress in this vulnerable population, the RGI intervention examined in this study showed a feasible approach for use in real world conditions of everyday clinical practice. Participants were recruited in the NICU setting, a known high-stress environment for mothers of preterm infants (Grosik, Snyder, Cleary, Breckenridge, & Tidwell, 2013; McGrath, 2001; Raeside, 1997; Woodward et al., 2014). All participants reported that they used the intervention without difficulty and found that it was moderately helpful in stress reduction.

Table 4: Pearson Correlations Comparing Average Reported Weekly Use of Relaxation Guided Imagery Recordings With Biobehavioral Outcomes at Week 8

	Week 8		
Variable	*n*	*r*	*p*
Perceived stress	19	−.38	.11
Depression symptoms	19	−.41	.09
State anxiety	19	−.43	.07
Maternal–infant responsiveness	19	.39	.10
First morning cortisol level	12	−.23	.38
Cortisol awakening response	12	.33	.19

In other studies, researchers tested interventions to reduce maternal stress and/or improve mood; however, most of these involved significant constraints in the clinical setting. Interventions developed to address maternal mental distress among mothers of preterm infants often consist of multiple individual or group sessions conducted in the hospital or home. Consequently, the interventions often require implementation by mental health professionals or individuals specifically trained to administer the intervention (Benzies, Keown, & Magill-Evans, 2009; Browne & Talmi, 2005; Chertok, McCrone, Parker, & Leslie, 2014; Segre, Chuffo-Siewert, Brock, & O'Hara, 2013; Shaw et al., 2013; Silverstein et al., 2011). Although feasible, these interventions have significant potential limitations. For example, required class attendance and/or scheduled meeting times can be burdensome to a mother while the infant is hospitalized, posing a barrier to use in the NICU setting (Reilly-Spong, Reibel, Pearson, Koppa, & Gross, 2015). Interventions that require additional costs in terms of

personnel, training, time, and material can strain institutional resources (Lagomasino, Zick, & Chambers, 2010). Use of an RGI intervention, such as the one tested in this study, demonstrates ease in implementation and requires limited health care resources (Kubes, 2015). RGI recordings can be inexpensively and easily provided in a variety of formats to parents of infants hospitalized in the NICU.

Assessment of RGI Through Biobehavioral Measures

We explored the relationship between intervention dose and several biobehavioral measures of stress and found that more frequent RGI use was associated with lower stress, anxiety, and depression symptoms and greater maternal–infant responsiveness. Despite the lack of statistical significance in these relationships, the directionality and magnitude of the correlations suggests important preliminary positive trends of the intervention on the study outcomes despite the limited sample size. For instance, the positive association between intervention dose and maternal responsiveness is important; maternal responsiveness has been linked with positive neurocognitive outcomes in very preterm infants (Rahkonen et al., 2014).

Cortisol is an important biomarker of hypothalamic–pituitary–adrenal activation (Huang, Taylor, Howie, & Robinson, 2012; Kunz-Ebrecht, Kirschbaum, Marmot, & Steptoe, 2004). The awakening cortisol levels seen in our study are somewhat lower than those in a nonpostpartum population. However, these levels are consistent with the observed fall in cortisol that occurs immediately after birth. Cortisol levels gradually rise to prepregnancy levels approximately 12 weeks postpartum in nondepressed women (Carter, Altemus, & Chrousos, 2001). In our study, more frequent intervention use was associated with lower awakening cortisol level and greater CAR between T1 and T2. Authors of prior research showed that a greater reduction in cortisol was associated with more frequent relaxation and/or guided imagery intervention practice in HIV-seropositive men (Cruess, Antoni, Kumar, & Scheiderman, 2000) and women (Jones, Owens, Kumar, Cook, & Weiss, 2014). Heightened cortisol levels in mothers of hospitalized preterm infants may have negative effects on maternal physical and mental health, potentially affecting parenting skills (Corwin & Pajer, 2008; Ohashi & Katsura, 2015; Skalkidou, Hellgren, Comasco, Sylven, & Sundstrom-Poromaa, 2012).

Relaxation guided imagery shows promise as a feasible and acceptable low-cost intervention to help mothers cope with the stress of a hospitalized preterm infant.

Evaluation of the Intervention

The participants in our study provided insightful feedback on the intervention. Generally they preferred the length of the recordings, but some suggested an option be offered for recordings that include additional sounds such as ocean surf or music. Participants would have preferred to listen to each of the recordings when first given the CD and then decide which recording to use on a given day rather than have the listening order predetermined. Two participants stated they were less likely to use the intervention if the infant became sick ("I was too stressed to listen!"), suggesting that the use of RGI may be more feasible for a mother when the infant is more stable. To allow mother to decide when, how often, and which track to listen to may be an important consideration in adaptation of RGI use to the clinical setting. The range of use in our study is reflective of the variation in individual preferences, which implies that RGI may be of greater value to some mothers than to others. RGI may be a significant addition to strategies available to neonatal clinicians working to help mothers cope with the stress of a preterm infant.

Limitations

The results of our analyses must be viewed in the context of study limitations. In keeping with the design of a feasibility study, the study used a nonexperimental approach with a small sample, which limits examination of the effects of RGI intervention. A larger sample size with a control group would allow for evaluation of intervention effectiveness and control for other influencing variables. The loss of saliva data on eight participants requires cautious interpretation of the cortisol measures. We found that once infants were discharged from the hospital, it was more difficult to contact and meet with the participants, especially those who lived a great distance from the hospital. The use of salivary cortisol as a biomarker of stress in this population requires researchers to establish a reliable means of sample retrieval, preferably by research personnel. We found that calling participants the night before sample collection was a valuable approach to encourage participation and more reliably collect samples. Finally, a further

limitation may be the approach we used to measure intervention dose. There are numerous methods to assess dose (Reed et al., 2007); however, we chose self-report to reduce participant burden. Despite these limitations, this study provided preliminary evidence that the RGI intervention was feasible and acceptable overall in a sample of mothers of high-risk newborns.

Research Implications

Neonatal nurses are well aware of the high levels of mental distress experienced by mothers of hospitalized preterm infants. Identification and use of feasible and effective approaches to reduce maternal stress during this difficult time may improve a mother's ability to take in new information and increase her capacity to care for the infant after discharge to home. The intervention we assessed in this report requires more rigorous testing before it can be recommended for clinical care. Future research should evaluate the intervention using a randomized clinical trial that follows the mother–infant dyad prospectively for a longer period of time after hospital discharge. The sample size should be more adequately powered to identify significant effects of the intervention on key clinical indicators of maternal distress and maternal–infant responsiveness.

We used salivary biomarkers (CAR and awakening cortisol level) of stress activation to validate self-report measures of maternal mental distress. Future research that uses these biomarkers should include a more rigorous approach for retrieval of the samples from participants. For example, having participants send text messages when samples were collected and having research personnel retrieve the samples from each participant's home may ensure more accurate recording of sample collection time and reduce loss of samples.

The use of the intervention was monitored only by self-report and recall. Using a diary to record when the RGI was used would be an alternative approach to track intervention use. Moreover, given the variation in use of the intervention in our sample, we recommend that future researchers explore personal or situational factors that may identify mothers who are more or less likely to use or benefit from the intervention. Further, we recommend measurement of other factors that may affect biobehavioral measures of stress such as level of social support, comorbid maternal health considerations, and situational factors that occur during the course of the study. We were encouraged by our ability to recruit participants from the NICU and to collect data in that setting if participants preferred. Most participants appreciated being able to remain close to their infants while meeting with study personnel, making this approach a strength of the study.

Conclusion

Mothers of hospitalized preterm infants experience high levels of stress, anxiety, and depression symptoms. In this small study, we found RGI to be a feasible and acceptable stress reduction intervention for use by mothers of preterm infants in the NICU. RGI shows promise as an easily delivered, low-cost intervention to help mothers cope with the significant stress of having a preterm infant hospitalized in a NICU.

REFERENCES

Achterberg, J., Kenner, C., & Lawlis, G. F. (1988). Severe burn injury: A comparison of relaxation, imagery and biofeedback for pain management. *Journal of Mental Imagery, 12*(1), 71–87.

Amankwaa, L., Pickler, R., & Boonmee, J. (2007). Maternal responsiveness in mothers of preterm infants. *Newborn and Infant Nursing Reviews, 7*(1), 25–30. http://dx.doi.org/10.1053/j.nainr.2006.12.001

Ashman, S. B., Dawson, G., Panagiotides, H., Yamada, E., & Wilkinson, C. W. (2002). Stress hormone levels of children of depressed mothers. *Development and Psychopathology, 14*(2), 333–349. http://dx.doi.org/10.1017/S0954579402002080

Bastani, F., Hidarnia, A., Kazemnejad, A., Vafaei, M., & Kashanian, M. (2005). A randomized controlled trial of the effects of applied relaxation training on reducing anxiety and perceived stress in pregnant women. *Journal of Midwifery and Women's Health, 50*(4), e36–40. http://dx.doi.org/10.1016/j.jmwh.2004.11.008

Benzies, K., Keown, L. A., & Magill-Evans, J. (2009). Immediate and sustained effects of parenting on physical aggression in Canadian children aged 6 years and younger. *The Canadian Journal of Psychiatry, 54*(1), 55–64.

Broadbent, E., Kahokehr, A., Booth, R. J., Thomas, J., Windsor, J. A., Buchanan, C. M., … Hill, A. G. (2012). A brief relaxation intervention reduces stress and improves surgical wound healing response: A randomised trial. *Brain, Behavior, and Immunity, 26*(2), 212–217. http://dx.doi.org/10.1016/j.bbi.2011.06.014

Browne, J. V., & Talmi, A. (2005). Family-based intervention to enhance infant-parent relationships in the neonatal intensive care unit. *Journal of Pediatric Psychology, 30*(8), 667–677. http://dx.doi.org/10.1093/jpepsy/jsi053

Bugental, D. B., & Happaney, K. (2004). Predicting infant maltreatment in low-income families: The interactive effects of maternal attributions and child status at birth. *Developmental Psychology, 40*(2), 234–243. http://dx.doi.org/10.1037/0012-1649.40.2.234

Carter, C. S., Altemus, M., & Chrousos, G. P. (2001). Neuroendocrine and emotional changes in the post-partum period. *Progress in Brain Research, 133*, 241–249.

Chertok, I. R., McCrone, S., Parker, D., & Leslie, N. (2014). Review of interventions to reduce stress among mothers of infants in the NICU. *Advances in Neonatal Care, 14*(1), 30–37. http://dx.doi.org/10.1097/anc.0000000000000044

Chuang, L. L., Lin, L. C., Cheng, P. J., Chen, C. H., Wu, S. C., & Chang, C. L. (2012). Effects of a relaxation training programme on immediate and prolonged stress responses in women with preterm labour. *Journal of Advanced Nursing, 68*(1), 170–180. http://dx.doi.org/10.1111/j.1365-2648.2011.05765.x

Clow, A., Hucklebridge, F., Stalder, T., Evans, P., & Thorn, L. (2010). The cortisol awakening response: More than a measure of HPA axis function. *Neuroscience & Biobehavioral Reviews, 35*(1), 97–103. http://dx.doi.org/10.1016/j.neubiorev.2009.12.011

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapam & S. Oskamp (Eds.), *The social psychology of health: Claremont Symposium on applied social psychology.* Newbury Park, CA: Sage.

Corwin, E. J., & Pajer, K. (2008). The psychoneuroimmunology of postpartum depression. *Journal of Women's Health, 17*(9), 1529–1534. http://dx.doi.org/10.1089/jwh.2007.0725

Cruess, D. G., Antoni, M. H., Kumar, M., & Schneiderman, N. (2000). Reductions in salivary cortisol are associated with mood improvement during relaxation training among HIV-seropositive men. *Journal of Behavioral Medicine, 23*(2), 107–122. http://dx.doi.org/10.1023/A:1005419917023

Dorheim, S. K., Bondevik, G. T., Eberhard-Gran, M., & Bjorvatn, B. (2009). Subjective and objective sleep among depressed and non-depressed postnatal women. *Acta Psychiatrica Scandinavica, 119*(2), 128–136. http://dx.doi.org/10.1111/j.1600-0447.2008.01272.x

Folkman, S., Chesney, M. A., McKusick, L., Ironson, G., Johnson, D. S., & Coates, T. J. (1991). Translating coping theory into an intervention. In J. Eckenrode (Ed.), *The social context of stress* (pp. 239–260). New York, NY: Plenum Press.

Garfield, L., Holditch-Davis, D., Carter, C. S., McFarlin, B. L., Schwertz, D., Seng, J. S., … White-Traut, R. (2015). Risk factors for postpartum depressive symptoms in low-income women with very low-birth-weight infants. *Advances in Neonatal Care, 15*(1), E3–E8. http://dx.doi.org/10.1097/anc.0000000000000131

Greene, C., & Greene, B. A. (2012). Efficacy of guided imagery to reduce stress via the Internet: A pilot study. *Holistic Nursing Practice, 26*(3), 150–163. http://dx.doi.org/10.1097/HNP.0b013e31824ef55a

Gonzales, A., Jenkins, J. M., Steiner, M., & Fleming, A. S. (2008). The relation between early life adversity, cortisol awakening response and diurnal salivary cortisol levels in postpartum women. *Psychoneuroendocrinology, 34*, 76–86.

Groer, M., Davis, M., Casey, K., Short, B., Smith, K., & Groer, S. (2005). Neuroendocrine and immune relationships in postpartum fatigue. *American Journal of Maternal/Child Nursing, 30*(2), 133–138.

Grosik, C., Snyder, D., Cleary, G. M., Breckenridge, D. M., & Tidwell, B. (2013). Identification of internal and external stressors in parents of newborns in intensive care. *The Permanente Journal, 17*(3), 36–41. http://dx.doi.org/10.7812/tpp/12-105

Hamilton, B. E., Hoyert, D. L., Martin, J. A., Strobino, D. M., & Guyer, B. (2013). Annual summary of vital statistics: 2010–2011. *Pediatrics, 131*(3), 548–558. http://dx.doi.org/10.1542/peds.2012-3769

Holditch-Davis, D., Santos, H., Levy, J., White-Traut, R., O'Shea, T. M., Geraldo, V., & David, R. (2015). Patterns of psychological distress in mothers of preterm infants. *Infant Behavior and Development, 41*, 154–163. http://dx.doi.org/10.1016/j.infbeh.2015.10.004

Holmes, E. A., Arntz, A., & Smucker, M. R. (2007). Imagery rescripting in cognitive behaviour therapy: Images, treatment techniques and outcomes. *Journal of Behavior Therapy and Experimental Psychiatry, 38*(4), 297–305. http://dx.doi.org/10.1016/j.jbtep.2007.10.007

Howland, L. C., Pickler, R. H., McCain, N. L., Glaser, D., & Lewis, M. (2011). Exploring biobehavioral outcomes in mothers of preterm infants. *American Journal of Maternal/Child Nursing, 36*(2), 91–97. http://dx.doi.org/10.1097/NMC.0b013e318205587e

Huang, W., Taylor, A., Howie, J., & Robinson, N. (2012). Is the diurnal profile of salivary cortisol concentration a useful marker for measuring reported stress in acupuncture research? A randomized controlled pilot study. *Journal of Alternative and Complementary Medicine, 18*(3), 242–250. http://dx.doi.org/10.1089/acm.2010.0325

Jallo, N., Bourguignon, C., Taylor, A. G., Ruiz, J., & Goehler, L. (2009). The biobehavioral effects of relaxation guided imagery on maternal stress. *Advances in Mind-Body Medicine, 24*(4), 12–22.

Jallo, N., Cozens, R., Smith, M. W., & Simpson, R. I. (2013). Effects of a guided imagery intervention on stress in hospitalized pregnant women: A pilot study. *Holist Nursing Practice, 27*(3), 129–139. http://dx.doi.org/10.1097/HNP.0b013e31828b6270

Janke, J. (1999). The effect of relaxation therapy on preterm labor outcomes. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 28*(3), 255–263. http://dx.doi.org/10.1111/j.1552-6909.1999.tb01990.x

Jones, D., Owens, M., Kumar, M., Cook, R., & Weiss, S. M. (2014). The effect of relaxation interventions on cortisol levels in HIV-seropositive women. *Journal of the International Association of Providers of AIDS Care, 13*(4), 318–323. http://dx.doi.org/10.1177/2325957413488186

Kahn, R. S., Zuckerman, B., Bauchner, H., Homer, C. J., & Wise, P. H. (2002). Women's health after pregnancy and child outcomes at age 3 years: A prospective cohort study. *American Journal of Public Health, 92*(8), 1312–1318.

Korner, A. F., Stevenson, D. K., Kraemer, H. C., Spiker, D., Scott, D. T., Constantinou, J., & Dimiceli, S. (1993). Prediction of the development of low birth weight preterm infants by a new neonatal medical index. *Journal of Developmental & Behavioral Pediatrics, 14*(2), 106–111.

Kruck, J. S. (2002). Imagery techniques. In A. A. Sheikh (Ed.), *Therapeutic imagery techniques* (pp. 175–192). New York, NY: Baywood Publishing.

Kubes, L. F. (2015). Imagery for self-healing and integrative nursing practice. *The American Journal of Nursing, 115*(11), 36–43. http://dx.doi.org/10.1097/01.naj.0000473313.17572.60

Kunz-Ebrecht, S. R., Kirschbaum, C., Marmot, M., & Steptoe, A. (2004). Differences in cortisol awakening response on work days and weekends in women and men from the Whitehall II cohort. *Psychoneuroendocrinology, 29*(4), 516–528. http://dx.doi.org/10.1016/S0306-4530(03)00072-6

Kwekkeboom, K. L. (2001). Outcome expectancy and success with cognitive-behavioral interventions: The case of guided imagery. *Oncology Nursing Forum, 28*(7), 1125–1132.

Lagomasino, I. T., Zatzick, D. F., & Chambers, D. A. (2010). Efficiency in mental health practice and research. *General Hospital Psychiatry, 32*(5), 477–483. http://dx.doi.org/10.1016/j.genhosppsych.2010.06.005

Lazarus, R. S. (1999). *Stress and emotion: A new synthesis.* New York, NY: Springer.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping.* New York, NY: Springer.

Levine, S. (2005). Developmental determinants of sensitivity and resistance to stress. *Psychoneuroendocrinology, 30*(10), 939–946. http://dx.doi.org/10.1016/j.psyneuen.2005.03.013

Mandl, K. D., Tronick, E. Z., Brennan, T. A., Alpert, H. R., & Homer, C. J. (1999). Infant health care use and maternal depression. *Archives of Pediatrics and Adolescent Medicine, 153*(8), 808–813.

Mandle, C. L., Jacobs, S. C., Arcari, P. M., & Domar, A. (1996). The efficacy of relaxation response interventions with adult patients: A review of the literature. *Journal of Cardiovascular Nurse, 10*, 4–26.

Mandy, G. T. (2011). *Incidence and mortality of the preterm infant.* UpToDate. Retrieved from http://www.uptodate.com/contents/incidence-and-mortality-of-the-preterm-infant

McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *The New England Journal of Medicine, 338*, 171–179. http://dx.doi.org/10.1056/NEJM199801153380307

McGrath, J. M. (2001). Building relationships with families in the NICU: Exploring the guarded alliance. *The Journal of Perinatal & Neonatal Nursing, 15*(3), 74–83.

Mercer, R. T. (2004). Becoming a mother versus maternal role attainment. *Journal of Nursing Scholarship, 36*(3), 226–232. http://dx.doi.org/10.1111/j.1547-5069.2004.04042.x

Mew, A. M., Holditch-Davis, D., Belyea, M., Miles, M. S., & Fishel, A. (2003). Correlates of depressive symptoms in mothers of preterm infants. *Neonatal Network, 22*(5), 51–60. http://dx.doi.org/10.1891/0730-0832.22.5.51

Miles, M. S., Burchinal, P., Holditch-Davis, D., Brunssen, S., & Wilson, S. M. (2002). Perceptions of stress, worry, and support in Black and White mothers of hospitalized, medically fragile infants. *Journal of Pediatric Nursing, 17*(2), 82–88. http://dx.doi.org/10.1053/jpdn.2002.124125

Miles, M. S., Holditch-Davis, D., Schwartz, T. A., & Scher, M. (2007). Depressive symptoms in mothers of prematurely born infants. *Journal of Developmental & Behavioral Pediatrics, 28*(1), 36–44. http://dx.doi.org/10.1097/01.DBP.0000257517.52459.7a

Mizrahi, M. C., Reicher-Atir, R., Levy, S., Haramati, S., Wengrower, D., Israeli, E., & Goldin, E. (2012). Effects of guided imagery with relaxation training on anxiety and quality of life among patients with inflammatory bowel disease. *Psychology & Health, 27*(12), 1463–1479. http://dx.doi.org/10.1080/08870446.2012.691169

Muller-Nix, C., Forcada-Guex, M., Pierrehumbert, B., Jaunin, L., Borghini, A., & Ansermet, F. (2004). Prematurity, maternal stress and mother–child interactions. *Early Human Development, 79*(2), 145–158. http://dx.doi.org/10.1016/j.earlhumdev.2004.05.002

Ohashi, J., & Katsura, T. (2015). The effects of coaching on salivary cortisol stress marker in mothers with young children, a randomized controlled trial. *Journal of Rural Medicine, 10*(1), 20–28. http://dx.doi.org/10.2185/jrm.2891r

Omer, H., Friedlander, D., & Palti, Z. (1986). Hypnotic relaxation in the treatment of premature labor. *Psychosomatic Medicine, 48*(5), 351–361.

Pruessner, J., Hellhammer, D., & Kirschbaum, C. (1998). Low self-esteem, induced failure and the adrenocortical stress response. *Personality and Individual Differences, 27*(3), 477–489. http://dx.doi.org/10.1016/S0191-8869(98)00256-6

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385–401. http://dx.doi.org/10.1177/014662167700100306

Raeside, L. (1997). Perceptions of environmental stressors in the neonatal unit. *British Journal of Nursing, 6*(16), 914–916, 918, 920–923. http://dx.doi.org/10.12968/bjon.1997.6.16.914.

Rahkonen, P., Heinonen, K., Pesonen, A. K., Lano, A., Autti, T., Puosi, R., … Räikkönen, K. (2014). Mother-child interaction is associated with neurocognitive outcome in extremely low gestational age children. *Scandinavian Journal of Psychology, 55*, 311–318. http://dx.doi.org/10.1111/sjop.12133

Reed, D., Titler, M. G., Dochterman, J. M., Shever, L. L., Kanak, M., & Picone, D. M. (2007). Measuring the dose of nursing intervention. *International Journal of Nursing Terminologies and Classifications, 18*(4), 121–130. http://dx.doi.org/10.1111/j.1744618X.2007.00067.x

Reed, T. (2007). Imagery in the clinical setting: A tool for healing. *Nursing Clinics of North America, 42*(2), 261–277. http://dx.doi.org/10.1016/j.cnur.2007.03.006

Reilly-Spong, M., Reibel, D., Pearson, T., Koppa, P., & Gross, C. R. (2015). Telephone-adapted mindfulness-based stress reduction (tMBSR) for patients awaiting kidney transplantation: Trial design, rationale and feasibility. *Contemporary Clinical Trials, 42*, 169–184. http://dx.doi.org/10.1016/j.cct.2015.03.013

Rogers, C. E., Kidokoro, H., Wallendorf, M., & Inder, T. E. (2013). Identifying mothers of very preterm infants at-risk for postpartum depression and anxiety before discharge. *Journal of Perinatology, 33*(3), 171–176. http://dx.doi.org/10.1038/jp.2012.75

Sachs, B., Hall, L. A., Lutenbacher, M., & Rayens, M. K. (1999). Potential for abusive parenting by rural mothers with low-birth-weight children. *Journal of Nursing Scholarship, 31*(1), 21–25. http://dx.doi.org/10.1111/j.1547-5069.1999.tb00415.x

Sapolsky, R. M., Romero, L. M., & Munck, A. U. (2000). How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocrine Reviews, 21*(1), 55–89. http://dx.doi.org/10.1210/edrv.21.1.0389

Segre, L. S., Chuffo-Siewert, R., Brock, R. L., & O'Hara, M. W. (2013). Emotional distress in mothers of preterm hospitalized infants: A feasibility trial of nurse-delivered treatment. *Journal of Perinatology, 33*(12), 924–928. http://dx.doi.org/10.1038/jp.2013.93

Shaw, R. J., St John, N., Lilo, E. A., Jo, B., Benitz, W., Stevenson, D. K., & Horwitz, S. M. (2013). Prevention of traumatic stress in mothers with preterm infants: A randomized controlled trial. *Pediatrics, 132*(4), e886–e894. http://dx.doi.org/10.1542/peds.2013-1331

Sheikh, A. A., Sheikh, K. S., & Moleski, L. M. (2002). Techniques to enhance imaging ability. In A. A. Sheikh (Ed.), *Therapeutic imagery techniques* (pp. 383–399). New York, NY: Baywood Publishing.

Silverstein, M., Feinberg, E., Cabral, H., Sauder, S., Egbert, L., Schainker, E., … Beardslee, W. (2011). Problem-solving education to prevent depression among low-income mothers of preterm infants: A randomized controlled pilot trial. *Archives of Women's Mental Health, 14*(4), 317–324. http://dx.doi.org/10.1007/s00737-011-0222-6

Singer, L. T., Salvator, A., Guo, S., Collin, M., Lilien, L., & Baley, J. (1999). Maternal psychological distress and parenting stress after the birth of a very low-birth-weight infant. *Journal of the American Medical Association, 281*(9), 799–805. http://dx.doi.org/10.1001/jama.281.9.799

Skalkidou, A., Hellgren, C., Comasco, E., Sylven, S., & Sundstrom Poromaa, I. (2012). Biological aspects of postpartum depression. *Women's Health, 8*(6), 659–672. http://dx.doi.org/10.2217/whe.12.55

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists Press.

Taylor, A., Glover, V., Marks, M., & Kammerer, M. (2009). Diurnal pattern of cortisol output in postnatal depression. *Psychoneuroendocrinology, 34*(8), 1184–1188. http://dx.doi.org/10.1016/j.psyneuen.2009.03.004

Tu, M. T., Lupien, S. J., & Walker, C. D. (2006). Diurnal salivary cortisol levels in postpartum mothers as a function of infant feeding choice and parity. *Psychoneuroendocrinology, 31*(7), 812–824. http://dx.doi.org/10.1016/j.psyneuen.2006.03.006

Van Kuiken, D. (2004). A meta analysis of the effects of guided imagery practice on outcomes. *Journal of Holistic Nursing, 22*(2), 164–179. http://dx.doi.org/10.3181/0902-MR-78

Vedhara, K., Shanks, N., Anderson, S., & Lightman, S. (2000). The role of stressors and psychosocial variables in the stress process: A study of chronic caregiver stress. *Psychosomatic Medicine, 62*(3), 374–385. http://dx.doi.org/10.1097/00006842-200005000-00011

Wahler, R. G., & Dumas, J. E. (1989). Attentional problems in dysfunctional mother–child interactions: An interbehavioral model. *Psychological Bulletin, 105*(1), 116–130. http://dx.doi.org/10.1037//0033-2909.105.1.116

Walker, C. D., Deschamps, S., Proulx, K., Tu, M., Salzman, C., Woodside, B., … Richard, D. (2004). Mother to infant or infant to mother? Reciprocal regulation of responsiveness to stress in rodents and the implications for humans. *Journal of Psychiatry & Neuroscience, 29*(5), 364–382.

Woodward, L. J., Bora, S., Clark, C. A., Montgomery-Honger, A., Pritchard, V. E., Spencer, C., & Austin, N. C. (2014). Very preterm birth: Maternal experiences of the neonatal intensive care environment. *Journal of Perinatology, 34*(7), 555–561. http://dx.doi.org/10.1038/jp.2014.43

Wynd, C. (1992). Relaxation imagery used for stress reduction in the prevention of smoking relapse. *Journal of Advanced Nursing, 17*, 294–302. http://dx.doi.org/10.1111/j.1365-2648.1992.tb01907.x

Yurdakul, Z., Akman, I., Kuscu, M. K., Karabekiroglu, A., Yaylali, G., Demir, F., & Ozek, E. (2009). Maternal psychological problems associated with neonatal intensive care admission. *International Journal of Pediatrics, 2009*, 591359. http://dx.doi.org/10.1155/2009/591359

Zahourek, R. P. (2009). Holistic nursing research: Challenges and opportunities. In B. M. Dossey & L. Keegan (Eds.), *Holistic nursing: Handbook for practice* (5th ed., pp. 675–694). Boston, MA: Jones and Bartlett.