

Maternal Anxiety and Depression Following a Premature Infants' Discharge from the NICU:

An Integrative Model of the COPE Program

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1 Abstract

2 *Background:* Understanding the processes through which interventions exert effects is
3 necessary for the translation of efficacious interventions into clinical practice
4 settings.

5 *Objective:* To test a theoretical model examining the processes through which an
6 educational-behavioral intervention program (COPE) influences maternal anxiety
7 and depression 2 months following discharge of their premature infants from the
8 neonatal intensive care unit (NICU).

9 *Methods:* Mothers (n= 246) of low-birth-weight (LBW) infants were randomized to COPE
10 or control conditions. Maternal measures included parental beliefs, trait and state
11 anxiety, stress in the NICU, and depression. Observers blind to study group rated
12 maternal-infant interaction in the NICU.

13 *Results:* Structural equation modeling suggested the model tested provided a reasonable fit
14 of the model to the data (χ^2 (64 df) = 97.67; $p = .004$; RMSEA = .046; CFI =
15 .97). Participation in the COPE program was both directly and indirectly, via
16 associations with increased parental beliefs and less maternal depression/anxiety
17 in the NICU, related to mothers' post-hospital depression/anxiety. Participation
18 in the COPE program also was directly associated with higher mother-infant
19 interaction scores.

20 *Conclusion:* Implementation of COPE could lessen post-discharge anxiety and depression for
21 mothers of LBW premature infants, which in turn, may improve outcomes for a
22 high risk population of infants.

23

- 1 *Key Words:* premature infants; parents; mental health; coping; parental beliefs; structural
- 2 equation modeling; NICU

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3 Evidence from multiple studies has supported that the birth of a low-birth-weight (LBW)
4 premature infant is a major stressor for parents (Cusson, 2003; Melnyk et al., 2006;; Pinelli,
5 2000). In addition to high stress and anxiety during the neonatal intensive care unit (NICU) stay,
6 many parents of premature infants continue to experience depression, anxiety, and altered
7 parenting patterns for years following the birth of their infants (Johnson, Ring, Anderson, &
8 Marlow, 2005; Miles, Holditch-Davis, Burchinal, & Nelson, 1999; Teti, Hess, & O'Connell,
9 2005). With more than 505,000 premature infants born every year in the United States (U.S.)
10 (Bierman & Butler, 2006; Hamilton, Ventura, Martin, & Sutton, 2004) and advances in
11 technology leading to greater survival rates of these infants, early interventions targeting parents
12 in the NICU should be standard care in order to reduce negative mental health/coping outcomes
13 and dysfunctional parenting patterns during and following hospitalization.

14 One iatrogenic effect of premature birth is the development of premature infant
15 stereotyping (i.e., parents developing the long-term perception that their infants are fragile and
16 vulnerable to multiple negative health outcomes). This parental view of their infants often leads
17 to negative parent-infant interaction trajectories, which in turn results in adverse outcomes
18 following hospitalization, such as depression and anxiety disorders, as well as dysfunctional
19 parenting patterns and child developmental delays (Anthony, Gill, & Schanberg, 2003; Halpern
20 & McLean, 1997).

21 The purpose of this study, conducted on data obtained from a full-scale randomized
22 controlled trial (RCT) that tested the effects of an educational-behavioral intervention program
23 (COPE-Creating Opportunities for Parent Empowerment) on the mental health/coping outcomes

1 of parents of 260 LBW premature infants (Melnyk et al., 2006) was to test a theoretically-driven
2 model constructed to explain the processes through which the COPE program exerted its positive
3 outcomes on maternal anxiety and depressive symptoms two months after the discharge of their
4 LBW premature infants from the NICU. In the original RCT (Melnyk et al., 2006), parents who
5 received the COPE program reported significantly less stress in the NICU as well as less
6 depression and anxiety at their infants' 2 months-corrected ages than parents who received a
7 placebo control intervention. Blinded observers also rated COPE parents as more positive in their
8 interactions with their infants in the NICU. In addition, COPE infants, on average, had a 3.8 day
9 shorter NICU length of stay (LOS) (COPE M = 31.9 days; control M = 35.6 days; $p = .05$) and
10 3.9 day shorter total hospital LOS (COPE M = 35.3; control M = 39.2 days; $p = .02$) than did
11 control family infants. For very low birth weight (VLBW) infants weighing less than 1500 grams
12 at birth, COPE infants had a 8.3 day shorter length of NICU stay (COPE M = 51.8; comparison
13 M = 60.1; $p = .05$) and a 7.9 shorter total hospital LOS (COPE M = 57.2; comparison M =
14 65.0; $p = <.05$) than did placebo control infants (Melnyk et al., 2006).

15 Furthermore, there has been a paucity of studies with parents of premature infants that
16 have sought to determine the processes through which interventions affect key outcome
17 variables. Explaining the processes through which interventions work is important for extending
18 the science in the area and helping clinicians to translate evidence-based interventions into
19 clinical practice (Melnyk, Fineout-Overholt, Stone, & Ackerman, 2000; Melnyk & Fineout-
20 Overholt, 2002; 2005).

21 *Theoretical Framework*

22 Johnson and Leventhal's self-regulation theory, and Carver and Scheier's control theory
23 guided the development of the COPE program and comprised the theoretical framework for this

1 study. Self-regulation theory (Johnson, Fieler, Jones, Wlasowicz & Mitchell, 1997; Leventhal &
2 Johnson, 1983) contends that the provision of concrete objective information to an individual
3 undergoing a stressful or intrusive procedure facilitates the formation of a cognitive schema that
4 is similar to the real life event. Knowing what to expect in the situation enables the individual to
5 cope more effectively with the stressor through increased understanding, predictability, and
6 confidence in the ability to deal with the stressful event. As a result, coping outcomes are
7 enhanced and the individual has more energy to invest in functional or problem-focused coping.

8 Melnyk (1994; 1997; 2001) extended the use of self-regulation theory to parents of
9 hospitalized/critically ill children and premature infants. Guided by this theory, one component
10 of the COPE program provided audio taped and matched written information to the parents
11 regarding their premature infants' physical and behavioral characteristics. It was expected that
12 provision of this type of information would strengthen parents' beliefs about their ability to
13 understand and predict their premature infants' cues and behaviors, which would subsequently
14 lessen their stress and anxiety (the emotional outcome of coping) and promote positive parent-
15 infant interaction (the functional outcome of coping).

16 Another component of the COPE program, parental role information and activities (e.g.,
17 identifying their infants' stress cues and performing developmentally sensitive parent role
18 interventions) was guided by control theory. Control theory contends that a discrepancy between
19 a standard or goal and a current state motivates behaviors that will enable an individual to reach
20 their goal (Carver, 1979; Carver & Scheier, 1982). When a child is born prematurely, parents
21 experience a large discrepancy between the parenting that they envisioned (i.e., providing care to
22 a healthy newborn) and the manner in which they are able to care for their infants in the NICU.
23 According to control theory, the discrepancy should motivate parents to engage in the care of

1 grams and appropriate for gestational age, (c) anticipated survival, (d) singleton birth, (e) no
2 severe handicapping conditions including Grade III or IV intraventricular hemorrhage, and (f)
3 born at the study sites.

4 The 246 mothers ranged in age from 18 to 43 years with a mean age of 27.9 years (SD =
5 6.57). The racial and ethnic composition of the mothers included: 166 (67.5%) White, not
6 Hispanic origin; 56 (22.8%) African American, not Hispanic origin; and 24 (9.7%) other
7 categories (9 Hispanic, 7 Asian, 1 American Indian, and 7 more than one race). The majority of
8 mothers (n = 210, 85.7%) completed at least high school. Household income for families was
9 less than \$20,001 for 80 (32.6%) of the families, between \$20,001 and \$40,000 for 52 (21.2%) of
10 the families, greater than \$40,000 for 103 (41.9%), and 11 (4.5%) families did not report their
11 household income. Eighty three of the mothers (33.9%) reported being on public assistance. One
12 hundred and thirty eight (56.1%) of the mothers were married, 97 (38.2%) had never been
13 married, 11 (4.4%) reported some other status (divorced or separated), and 3 (1.23%) did not
14 report their marital status. Table 1 presents sample demographic information by experimental
15 condition. As noted, there was a trend towards COPE mothers having more second marriages,
16 divorces and separations than did control mothers (χ^2 (6 df) = 12.33; p = .055). There were no
17 differences on maternal age, ethnicity, education level, or family income (including public
18 assistance).

19 The mean gestational age of the premature infants was 31.4 weeks (SD = 2.45; range =
20 26.0 to 35.0 weeks). The mean birth-weight was 1661.2 grams (SD = 474.6 grams) with 93
21 (38.1%) infants weighing less than 1500 grams, 79 (32.4%) infants in the 1500 to 1999 gram
22 range, and 72 (29.5%) infants weighing 2000 or more grams. One hundred and nineteen (48.4%)
23 of the infants were males and 127 (51.6%) were females. The mean illness severity index level

1 using the CRIB score was 1.69 (SD = 2.41; range = 0-10). Mean discharge weight from the
2 NICU was 2146.9 grams (SD = 443.8; range = 955 to 4710 grams). There were no significant
3 COPE versus control group differences on gender of the child, gestational age of the premature
4 infants, birthweight or discharge weight of the child, or illness severity levels of the premature
5 infants.

6 *Measures*

7 Socioeconomic status and other demographic variables as well as maternal trait anxiety
8 were assessed at baseline, 2-4 days post NICU admission and before any intervention activities.
9 Parental beliefs, maternal depression and state anxiety surrounding the NICU stay, and maternal
10 stress in the NICU were assessed between 4 and 8 days post NICU admission and after two of
11 the three pre-discharge phases of the intervention were completed, Mother-infant interaction
12 was assessed 1-2 days after the assessment of parental beliefs, maternal depression and anxiety,
13 and maternal stress. Finally, maternal depression and state anxiety were again assessed at 2
14 months post-discharge.

15 The Beck Depression Inventory (2nd edition) (BDI-II; Beck, Steer, & Brown, 1996), a
16 well known measure of depression with established construct validity, measured maternal
17 depressive symptoms. Subjects indicate how they feel regarding each of 21 items on a 4-point
18 Likert scale ranging from 0 to 3 in terms of severity. Cronbach's alpha reliability on the BDI-II
19 with this sample ranged from .83 to .90 (depending on measurement occasion).

20 The well known State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene,
21 1977) was used to measure maternal state and trait anxiety. Current feelings of anxiety are
22 measured with the A-State scale, while an individual's anxiety "proneness" is measured in the
23 20-item trait scale (A-Trait). A-State was used as the dependent variable to assess parents'

1 current anxiety levels. Trait anxiety was assessed at the first contact point only (baseline) to
2 measure anxiety proneness. Cronbach's alpha with this sample was: .90 to .95 for maternal state
3 anxiety (depending on measurement occasion) and .92 for maternal trait anxiety.

4 The Parental Stressor Scale: Neonatal Intensive Care (PSS: NICU; Miles, 1989) assessed
5 parental stress in the NICU arising from 4 dimensions: (a) sights and sounds, (b) infant behavior
6 and appearance, (c) parental role alteration, and (d) staff behaviors and communication. Parents
7 rate their perceptions of the stress level generated by each of the 46 items on a 5-point Likert
8 scale ranging from 1 = *non-stressful* to 5 = *extremely stressful*. Higher total scores indicate
9 greater stress levels. The PSS: NICU has established construct validity and the alpha coefficients
10 for this sample were .94 to .96 (depending on subscale).

11 The Index of Parental Behavior in the NICU (IPBN; Melnyk, Feinstein, Fairbanks, &
12 Small, 1998) measured quality of parenting in the NICU and was one indicator of mother-infant
13 interaction. The instrument is comprised of 20 statements that measure parental behavior related
14 to their infant (e.g., parent decreases stimulation for the infant at appropriate times). Observers
15 who were blind to study group rated each item on a dichotomous scale (i.e., exhibited the
16 behavior or did not) during a one half hour observation period. The scale was developed through
17 a thorough review of the literature and observations of parents in the NICU. Content validity was
18 established by 8 maternal-child experts and an expert in cultural competence. Inter-rater
19 reliability of 90 percent was established with the blinded observers and observer drift was
20 assessed and corrected for on a monthly basis. Cronbach's alphas was .85 with this sample. As a
21 second indicator of mother-infant interaction, these same observers also rated the overall parent
22 interaction with their infant on a one-item visual analogue scale ranging from 0 to 100, with 100
23 indicating a more positive interaction.

1 The 20-item Parental Belief Scale: NICU (PBS; Melnyk, 1997) measured parents' beliefs
2 about their premature infant and their parental role during hospitalization. Mothers were asked to
3 indicate agreement with each item on a 5-point Likert scale from 1= *strongly disagree* to 5=
4 *strongly agree* with higher scores indicating more positive beliefs. Eight neonatal specialists
5 established content validity of the scales. Two subscales are assessed, parental role confidence
6 (10 items; $\alpha = .85$) and parent knowledge regarding infant behaviors and characteristics (8 items;
7 $\alpha = .87$). Cronbach's alpha with this sample was .85 for the parental role subscale and .87 for
8 the parent knowledge regarding infant behaviors and characteristics.

9 *Procedure*

10 Participants were randomly assigned to receive either the COPE or placebo control
11 program by four-week blocks of time in order to decrease the probability of staff-to-parent and
12 parent-to-parent contamination (i.e., the likelihood that mothers in the NICU who were in
13 different study groups would share content that was provided to them in their experimental
14 program). To ensure treatment fidelity, both groups received an audio taped and written
15 educational-behavioral intervention program (i.e., COPE or control) delivered in a consistent
16 manner by trained interventionists in four phases: (a) Phase I: two to four days after admission of
17 their infant to the NICU; (b) Phase II: two to four days after the first intervention, (c) Phase III: 1
18 to 4 days before discharge from the hospital, and (d) Phase IV: approximately one week after
19 discharge from the hospital.

20 *The Experimental Intervention Program.* .The COPE program (COPE = Creating
21 Opportunities for Parent Empowerment) is a 4-phase manualized educational-behavioral
22 intervention program. Each phase of COPE provides parents with information on: (a) the
23 appearance and behavioral characteristics of premature infants [infant behavior information

1 (IBI)] and how parents can participate in their infants' care, meet their infants' needs, enhance
2 quality of interaction with their infant, and facilitate their infant's development [parent role
3 information (PRI)]; and (b) activities that assist parents in implementing the COPE information
4 (e.g., identifying infant stress cues and behaviors to alleviate stress; identifying the best times for
5 parent-infant interaction) An educational-behavioral intervention strategy was used so that
6 participants could practice the behaviors that they were learning about in the audio taped
7 information, which is a strategy more likely to produce desired behaviors than information alone
8 (Lorion, Price, & Eaton, 1988). It was decided to implement COPE as a series of audio tapes
9 and prescribed workbook activities so that it could be easily reproduced and administered to all
10 parents of preterms in NICUs throughout the country.

11 *The Control Program.* Mothers in the control group received a structurally equivalent
12 control program in four phases that focused on hospital policies and infant immunizations in
13 order to control for the time and attention being spent with the COPE group and to diminish the
14 likelihood that the effects of the COPE program could be attributed to Hawthorne effects. Audio
15 tapes and written materials, similar to the COPE intervention, were used to administer the control
16 information. Manipulation checks, completed by the mothers, verified that they processed their
17 group-specific information.

18 Formulation of the Integrative Model

19 The structural equation model tested outlines the underlying theoretical rationale for how
20 the intervention operates and includes eight latent constructs—three source or exogenous latent
21 constructs, four mediating constructs, and one latent outcome variable of interest, mother's post-
22 hospital depression and anxiety. Figure 1 presents the theoretical model tested (although not
23 graphically presented, we allowed the residual variances among the mediating mother's state

1 anxiety and depression in the NICU and mother's stress in the NICU to covary). As noted in the
2 figure, we hypothesized that the COPE intervention effects on mother's post-hospital adjustment
3 are not only direct, but also work via their associations with important mediating variables. That
4 is, we believed that the intervention promotes more positive beliefs in one's abilities to parent
5 their infant, reduces depression/anxiety and stress related to hospitalization, and promotes more
6 positive mother-infant interaction during the hospital stay. Each of these, in turn, were
7 hypothesized to influence mother's post-hospital adjustment. Additionally, we postulated that
8 parental beliefs mediate the relationships between the COPE intervention and stress in the NICU,
9 anxiety/depression in the NICU, and mother-infant interaction in the NICU. Furthermore, we
10 hypothesized that less stress and depression/anxiety in the NICU would be related to better
11 mother-infant interaction in the NICU. Although not shown in Figure 1, maternal trait anxiety
12 and socioeconomic status are included as important covariates in the model tested.

13 *Measurement.* The exogenous constructs of *Participation in the COPE Intervention*,
14 *Mother's Trait Anxiety*, and *Socioeconomic Status* were measured using single indicators.
15 Participation in COPE was a simple dichotomous item identifying group status (1 = COPE
16 participant; 0 = control group participant). Socioeconomic status was a single item assessing
17 family income (1 = less than \$10,000; 2 = 10,000 to \$15,000 per year; 3 = \$15,001 to \$20,000
18 per year; 4 = \$20,001 to \$30,000 per year; 5 = \$30,001 to \$40,000 per year; 6 = greater than
19 \$40,000 per year). The residual variances of these single indicators were fixed at zero. The trait
20 anxiety score was used as the indicator of *Mother's Trait Anxiety*, with the residual variance of
21 this indicator fixed at $(1 - \alpha)$ times the variance to help account for (un)reliability in the
22 measure. *Parental Beliefs* was measured using two subscales of the Parental Beliefs instrument
23 (i.e, parental beliefs about the infant's physical appearance and behaviors, and beliefs/confidence

1 about the ability to parent the infant in the NICU). *Mother-Infant Interaction* was measured
2 using two indicators (blind observers total score of the mother-infant interaction and the same
3 blind observer's general rating of the quality of the mother-infant interaction). Four subscales
4 were used as indicators of *Mother's Stress in the NICU* (stress associated with the sights and
5 sounds of the NICU, the infant's behavior and appearance, the alteration in the parental role, and
6 the behavior and communication of the NICU staff). *Mother's Depression/Anxiety during the*
7 *NICU Stay* and *Mother's Post Depression/Anxiety* were measured using the same two indicators
8 (state anxiety and depression) at both time points. The measurement loadings for these
9 indicators were constrained equal over time and the unique residuals of the respective indicators
10 were allowed to correlate across time.

11 Results

12 Table 1 presents the means, standard deviations, and correlations among the study
13 variables. The MPLUS statistical package was used in all modeling procedures (Muthen &
14 Muthen, 2006). To provide a metric for the latent constructs and to identify the measurement
15 model, the first construct loading for each of the latent variables was set to 1.00. Typical of
16 many longitudinal intervention studies, missing data was an issue as the amount and timing of
17 data collection activities was complex. The full-information maximum likelihood estimation
18 method was employed as a means of efficiently incorporating all of the available information.
19 Full information estimation has been shown to provide more realistic parameter estimates than
20 other missing data techniques (e.g., listwise, pairwise, mean imputation; Arbuckle, 1996).
21 Goodness of fit of the model was assessed using the associated chi-square, the root mean square
22 error of approximation (RMSEA; Browne & Cudeck, 1993), and the comparative fit index (CFI,
23 Bentler, 1990). The standardized coefficients and the goodness-of-fit indices (χ^2 (64 df) =

1 97.665; $p = .0043$; RMSEA = .046; 90% CI = .026 - .064; CFI = .97) suggested that this model
2 provided a satisfactory fit of the model to the data.

3 *Measurement Results.* As shown in Table 2, the standardized parameter estimates for the
4 measurement model were reasonably high and all were significant ($p < .01$)¹. It is important to
5 note that the unique residuals among state anxiety and depression indicators were allowed to
6 correlate across time. This correlation was not significant for state anxiety ($r = .02$, $p = ns$) but
7 was for depression ($r = .19$, $p < .001$). Given the fluctuation in state anxiety depending on
8 situational circumstances, this finding is to be expected.

9 While both indicators of Mother-Infant Interaction were significant, the general indicator
10 of quality of the mother-infant interaction did not load as strongly as did the more precise
11 ratings. Given the ease of administration and interpretation, it is encouraging that this general
12 measure does relate strongly to the quality of the mother-infant interaction and other outcomes
13 assessed in this model. It also is interesting to note that the stress associated with the infant's
14 behavior and appearance had the strongest loading of Mother's Stress in the NICU. Finally, both
15 beliefs about the infant and the parental role seem to be important underlying components of
16 Parental Beliefs.

17 *Structural Results.* Figure 2 presents standardized results from the structural portion of
18 the model tested. As noted, participation in the COPE intervention was associated with higher
19 parental beliefs (+.26, $p < .01$) that, in turn, were related to less mother depression and anxiety
20 while in the NICU (-.16, $p < .05$). Depression and anxiety in the NICU also were associated with
21 later post-hospital depression and anxiety (.43, $p < .01$). Thus, the COPE intervention appears to

¹ It is important to note that while the unstandardized results are constrained to equality, the standardizing of the results give the appearance that the equality constraints across time for Mother's Depression and Anxiety don't hold. This is merely the result of standardizing the results for presentation clarity.

1 prevent later anxiety and depression problems in the mothers via associations with positive
2 parental beliefs and reduced levels of parental anxiety and depression during the NICU stay. The
3 COPE intervention also works directly to affect post-hospital anxiety and depression in that
4 mothers who received the COPE intervention during the NICU stay had less anxiety and
5 depressive symptoms two months following hospitalization ($-.15; p < .05$). Participation in the
6 COPE intervention was associated with mothers' post-hospital anxiety and depression both
7 directly and indirectly, via associations with parental beliefs as well as the anxiety and
8 depression during the NICU stay.

9 Participation in the COPE intervention also was directly related to mother-infant
10 interaction in the NICU ($.17; p < .05$), with participation in COPE related to higher mother-infant
11 interaction scores. However, mother-infant interaction was not related to mother's post-hospital
12 depression and anxiety ($-.07; p = ns$). Additionally, participation in the COPE intervention was
13 indirectly associated with maternal perceived stress in the NICU, via parental beliefs. As
14 previously indicated, participation in COPE was associated with higher levels of Parental Beliefs
15 ($.26; p < .01$) which were, in turn, associated with less perceived stress in the NICU ($-.23; p <$
16 $.05$).

17 Mother's trait anxiety also was directly and indirectly related to mothers' two-month
18 post-hospital depression and anxiety symptoms. Directly, higher trait anxiety was associated
19 with higher levels of post-hospital depression/anxiety ($.24; p < .05$). Indirectly, trait anxiety was
20 associated with maternal NICU depression/anxiety ($.65; p < .05$), which was associated with
21 post-hospital depression/anxiety symptoms ($.43; p < .01$). Maternal trait anxiety also was
22 associated with parental beliefs ($-.35; p < .01$), with highly anxious mothers' reporting less
23 confidence in their parenting. Parental beliefs, in turn, were associated with maternal

1 depression/anxiety in the NICU (-.16; $p < .05$), which was associated with post-hospital
2 depression/anxiety (.43; $p < .01$). Additionally, mother's trait anxiety was directly (.25; $p < .01$)
3 and indirectly (via associations with parental beliefs) associated with maternal stress in the
4 NICU, with higher parental beliefs being associated with less perceived stress in the NICU (-.23;
5 $p < .05$).

6 Finally, socioeconomic status was found to have direct relationships with maternal post-
7 hospital depression (-.18; $p < .05$) and with mother-infant interaction (.27; $p < .01$). Here,
8 mothers' with higher SES reported less post-hospital depressive/anxiety symptoms and were
9 rated as having better mother-infant interaction. Socioeconomic status also was indirectly
10 associated with maternal post-hospital depression/anxiety, again via the association with parental
11 beliefs. However, higher SES mothers reported feeling less confident in their parenting than did
12 lower SES mothers. This was the only anomalous finding in the model tested.

13 Discussion

14 This study provides empirical evidence on how the COPE program relates to maternal
15 coping/mental health outcomes during and following their premature infants' NICU stay.
16 Participation in the COPE Program related to mothers' post-hospital depression and anxiety via
17 important mediating variables, particularly parental beliefs, maternal stress in the NICU, and
18 maternal depression and anxiety during the NICU stay. As hypothesized, the effects of the
19 COPE program on maternal stress, anxiety and depression in the NICU were indirect, via
20 associations with parental beliefs about their premature infants and their role during the NICU
21 stay. Mothers who received the COPE program had stronger beliefs about what to expect in
22 their preterms' characteristics/ behaviors and how to parent them, which was associated with less
23 maternal stress as well as less anxiety and depressive symptoms during the NICU stay. As a

1 result of less maternal anxiety and depression during the NICU stay, state anxiety and depressive
2 symptoms were lessened post hospitalization, at their infants' 2 month corrected ages. This
3 evidence supports self-regulation-theory and findings from our prior studies that indicate
4 parental beliefs mediate the effects of the COPE intervention on mothers' emotional adjustment
5 (Melnik, 1995; Melnik, Crean, Feinstein, Fairbanks, & Alpert-Gillis, in press).

6 Rather than the COPE program working indirectly through parental beliefs to positively
7 impact maternal-infant interaction, the program directly impacted maternal-infant interaction.
8 This finding supports control theory in that, through the COPE information and activities,
9 barriers that typically inhibit mothers from interacting with infants in a developmentally sensitive
10 manner in the NICU were removed (e.g., lack of knowledge about how best to interact with their
11 infants, uncertainty regarding their role). Through the parental role information in the COPE
12 program, mothers learned how best to interact with their infants in a developmentally sensitive
13 manner during hospitalization and were encouraged to be involved in their infants' care, which
14 promoted positive maternal-infant interaction.

15 Maternal trait anxiety was a potent predictor of stress, state anxiety and depressive
16 symptoms during hospitalization as well as maternal-infant interaction, which then impacted
17 depressive and anxiety symptoms 2 months following hospitalization. In addition to routinely
18 screening for postpartum depression (generally done 1-2 weeks post birth; Beck & Gable, 2002;
19 Cox, Holden, & Sagvosky, 1987), this finding has important clinical implications in that
20 assessment of maternal trait anxiety shortly after their infants' admission to the NICU could flag
21 mothers at highest risk for maternal anxiety and depression. Identification of mothers' high in
22 trait anxiety early in the NICU stay could lead to earlier targeted interventions to improve
23 maternal emotional outcomes following the birth of a premature infant.

1 While the associations between SES and mother's post-hospital depression/ anxiety and
2 mother infant interaction were perhaps expected (i.e., low SES was associated with increased
3 levels of depression/anxiety; U.S. Department of Health and Human Services, 1999; Zahn-
4 Waxler, Duggal, & Gruber, 2002; low SES was associated with lower mother-infant interaction
5 scores; Olds, 2006; Schiffman, Omar, & McKelvey, 2003), the most surprising finding was the
6 negative association found between SES and parental beliefs. Here, mothers from lower SES
7 families reported stronger beliefs in their ability to parent their infants than did mothers from
8 higher SES families. However, caution must be used in interpretation of this finding as the
9 measure of family income used in this study was capped at "greater than \$40,000." Therefore,
10 this measure may only be differentiating poor mothers from others. Despite this measure of
11 SES, we, like others (e.g., Lagerberg, Magnusson, & Sundelin, 2005) are trying to find a
12 plausible explanation for this finding. It may be that there are clear qualitative differences in
13 how poor, middle class, and higher SES mothers perceive their parental role and have different
14 parenting expectations for themselves. For instance, it may be that higher SES mothers have
15 stricter and more demanding cognitive schemas for their own beliefs/confidence in how they
16 should parent their preterm infants, while lower SES mothers may have schemas that are less
17 rigid. Further, optimistic parental beliefs regarding their roles and abilities may serve a protective
18 function for poor mothers (Garmezy, 1991). It may be that such beliefs are necessary internal
19 motivations for parents with limited resources. The findings in the field of education appear
20 relevant. Here, parents' expectations for their children's eventual educational attainment have
21 been shown to be related to the child's current educational achievement and to later achievement
22 (Marjoribanks, 1988; Seiginer, 1983). However, an interesting finding is that low-income
23 African-American parents have high expectations for their children's future success in spite of

1 the children's low levels of current achievement (Graham, 1994; Mickelson, 1990). Whether
2 this finding is specific to the African-American culture, to poverty, or is an interaction between
3 ethnicity and socioeconomic status has yet to be determined. Nevertheless, our finding of an
4 inverse relationship between socioeconomic status and parental beliefs deserves further attention.
5 as does further research examining the stability and changes in parental beliefs across differing
6 developmental stages (infancy, toddler, school-age, adolescence).

7 The unique contribution of this study is that it provides further understanding of the
8 processes through which a theoretically-guided intervention impacts maternal anxiety and
9 depressive symptoms 2 months following their infants' NICU hospitalization. The COPE
10 intervention provides mothers with a cognitive schema of their premature infants' characteristics,
11 which enables them to have stronger beliefs about their ability to understand and predict their
12 infants' behaviors. As a result, they have less anxiety and depressive symptoms during the NICU
13 stay, which leads to less negative emotions following hospitalization. The COPE program also
14 removes barriers that typically inhibit mothers from being actively involved in the care of their
15 infants, allowing them to interact with their infants in a developmentally sensitive manner.

16 Despite overall support for the model tested, limitations to this study exist. With the
17 exception of the blinded ratings of mothers' interaction with their infants, all other study
18 measures were completed by the mothers. As a result, shared method variance may account for
19 some of the relationships found in the model tested. Future studies should include additional
20 measures from non-biased objective observers (e.g., clinical interviews by a trained mental
21 health professional to determine levels of depression and anxiety). Similar findings from such
22 studies would add to the robustness of the current findings. Another limitation of this study is
23 that a number of competing models could exist that might fit the data equally well. While we

1 believe that the model tested does capture important processes regarding how the COPE
2 intervention impacts maternal mental health outcomes, other models should be tested
3 (MacCallum, Wegener, Uchino, & Fabrigar, 1993). Furthermore, other variables outside of
4 those tested (e.g., fathers' emotional adjustment) could influence maternal mental health
5 outcomes, but were not examined in this model (Phares & Compas, 1992). Future research
6 should include them as well as other important parenting variables.

7 Because it is well documented that parents of prematurely born children experience
8 adverse mental health outcomes both during and following the hospitalization of their infants,
9 routine implementation of the COPE program could prevent parents from depressive and anxiety
10 disorders that are a substantial emotional and cost burden to families and society. The
11 relationship between maternal depression/anxiety and the emergence of behavioral and
12 developmental problems in children also is well substantiated (Beck, 2001; Georgiopoulos,
13 Bryan, Wollan, & Yawn, 2001; O'Hara, Stuart, Gorman, & Wenzel, 2000; Zlotnick, Johnson,
14 Miller, Pearlstein, & Howard, 2001). Therefore, the COPE program might prevent more long-
15 term negative developmental and emotional outcomes for prematurely born children. Prevention
16 of mental/behavioral problems in this high-risk population is especially important as there is a
17 documented lack of mental health screening and early intervention services for children and
18 mothers throughout the U.S. (Melnyk & Moldenhauer, 2006; Melnyk, Brown, Jones, Novak, &
19 Kreipe, 2003).

20 Since COPE is a theory-driven, reproducible intervention program, it could be easily
21 translated into clinical practice settings to improve outcomes for this high risk population of
22 mothers and infants. Further study is now needed to determine the effectiveness of the COPE

- 1 intervention in preventing more long-term negative outcomes in mothers and children as well as
- 2 to examine how it can be most effectively translated into clinical practice settings.

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Table 1. Demographic characteristics of sample by experimental condition.

	COPE	Control	
Maternal Demographics	n (%)	n (%)	<i>p</i>
<i>Race</i>			0.27
White, not Hispanic	96 (70.1)	70 (64.2)	
Black, not Hispanic	31 (22.6)	25 (22.9)	
American Indian/Alaskan Native	0 (0)	1 (.9)	
Asian/Pacific Islander	4 (2.9)	3 (2.8)	
Hispanic	5 (3.6)	4 (3.7)	
Other	1 (.7)	6 (5.5)	
<i>Marital Status</i>			0.06
Married (1 st time)	64 (46.7)	61 (56.0)	
Never married	50 (36.5)	44 (40.4)	
Separated	4 (2.9)	0 (0)	
Divorced	4 (2.9)	2 (1.8)	
Widowed	1 (.7)	0 (0)	
Married (2 nd time)	11 (8.0)	2 (1.8)	
Not reported	3 (2.2)	0 (0)	
<i>Education Level</i>			0.21
Junior high school or less	6 (4.4)	4 (3.7)	
Partial high school	16 (11.7)	9 (8.3)	
High school graduate	32 (23.4)	18 (16.5)	
Partial college	30 (21.9)	33 (30.3)	

Table 1 (continued). Demographic characteristics of sample by experimental condition.

	COPE	Control	
Maternal Demographics	n (%)	n (%)	<i>p</i>
College/University graduate	38 (27.7)	25 (22.9)	
Graduate/Profession training	14 (10.2)	20 (18.3)	
Not reported	1 (.7)	0 (0)	
<i>Yearly Income for Baby's Household</i>			0.64
Less than \$10,000	14 (10.2)	16 (14.7)	
\$10,000 - \$15,000	15 (10.9)	11 (10.1)	
\$15,001 - \$20,000	15 (10.9)	9 (8.3)	
\$20,001 - \$30,000	17 (12.4)	10 (9.2)	
\$30,001- \$40,000	15 (10.9)	10 (9.2)	
Greater than \$40,000	53 (38.7)	50 (45.9)	
Not reported	8 (5.8)	3 (2.8)	
<i>On Public Assistance</i>			0.59
Yes	48 (35.0)	35 (32.1)	
No	88 (64.2)	74 (67.9)	
Not reported	1 (.7)	0 (0)	
<i>Gender of Infant</i>			0.14
Female	65 (47.4)	62 (56.9)	
Male	72 (52.6)	47 (43.1)	

Note: Probability values (*p*) are based on chi-square analyses.

Table 2. Means, standard deviations, and correlations of study variables.

Variable	N	Mean	SD	1.	2.	3.	4.	5.	6.	7.
1. Group	246	0.56	0.50	1.00						
2. Trait Anxiety	246	36.39	9.75	0.02	1.00					
3. Family Income	235	4.28	1.87	-0.01	-0.11	1.00				
4. Parental Beliefs – SS1	245	36.35	6.45	0.18**	-0.27***	-0.25***	1.00			
5. Parental Beliefs – SS2	245	27.96	5.12	0.27***	-0.25***	-0.13	0.74***	1.00		
6. Stressors – Sights & Sounds	246	2.07	0.77	0.03	0.15*	0.15*	-0.21***	-0.17**	1.00	
7. Stressors – BR	246	1.87	0.86	-0.16*	0.23***	-0.06	-0.16*	-0.18**	0.46***	1.00
8. Stressors – RR	246	2.86	1.03	-0.04	0.33***	-0.05	-0.28***	-0.24***	0.30***	0.52***
9. Stressors – SBR	246	1.39	0.70	-0.10	0.09	-0.10	-0.12	-0.15*	0.24**	0.47***
10. Beck Depression Inventory – T2	246	10.26	7.37	-0.00	0.55***	-0.00	-0.25***	-0.24***	0.28***	0.34***
11. State Anxiety – T2	246	38.23	11.97	0.06	0.50***	0.03	-0.27***	-0.29***	-0.28***	0.34***
12. IPBNM7T	211	8.82	3.71	0.11	-0.22**	0.22***	-0.03	0.00	-0.03	-0.10
13. INTACT1M	211	65.77	23.59	0.10	-0.15*	0.27***	-0.14*	-0.06	0.00	-0.03
14. Beck Depression Inventory – T6	226	6.52	6.11	-0.09	0.40***	-0.18**	-0.13	-0.10	0.02	0.12
15. State Anxiety – T6	226	29.84	9.30	-0.08	0.40***	-0.18**	-0.05	-0.01	0.09	0.09

Table 2 (continued). Means, standard deviations, and correlations of study variables.

Variable	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
8. Stressors – RR	1.00									
9. Stressors – SBR	0.30***	1.00								
10. Beck Depression Inventory – T2	0.42***	0.15*	1.00							
11. State Anxiety – T2	0.38***	0.19**	0.61***	1.00						
12. IPBNM7T	-0.09	-0.08	-0.15*	-0.17*	1.00					
13. INTACT1M	-0.06	-0.05	-0.08	-0.10	0.60***	1.00				
14. Beck Depression Inventory – T6	0.15*	0.04	0.50***	0.28***	-0.15*	-0.15*	1.00			
15. State Anxiety – T6	0.09	-0.01	0.34***	0.31***	-0.24***	-0.20**	0.72***	1.00		

Note: * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3. Standardized measurement loadings for the latent constructs. All measurement loadings significant at the $p < .01$ level.

		Mother's							
		Mother's		Mother's Anxiety & Stress		Mother/Infant Interaction		Mother's Post-Hospital Anxiety & Depression	
	Group	Trait Anxiety	Family Income	Parental Beliefs	in the NICU	Surrounding Hospital Stay	Interac- tion	Anxiety & Depression	Residual Variance
COPE INTERVENTION									
Group	1.00 ^a								0.00 ^b
MOTHER'S TRAIT ANXIETY									
Trait Anxiety		0.96 ^a							0.08 ^c
FAMILY INCOME									
Family Income		1.00 ^a							0.00 ^b
PARENTAL BELIEFS									
Parental Beliefs – SS1				0.81 ^a					0.30
Parental Beliefs – SS2				0.90					0.23
MOTHER'S STRESS IN THE NICU									
Stressors – Sights & Sounds					0.52 ^a				0.73

Table 3 (continued). Standardized measurement loadings for the latent constructs. All measurement loadings significant at the $p < .01$ level.

Group	Mother's				Mother's				Residual Variance
	Trait Anxiety	Family Income	Parental Beliefs	NICU	Stress in the NICU	Anxiety & Depression Surrounding Hospital Stay	Mother/Infant Interaction	Mother's Post-Hospital Anxiety & Depression	
Stressors – BR					0.82				0.33
Stressors – RR					0.65				0.57
Stressors – SBR					0.52				0.73
MOTHER'S ANXIETY & DEPRESSION									
SURROUNDING HOSPITAL STAY									
Beck Depression Inventory – T2						0.79 ^{a,d}			0.38 ^f
State Anxiety – T2						0.78 ^e			0.39 ^g
MOTHER/INFANT INTERACTION									
IPBNM7T							0.77 ^a		0.41
INTACT1M							0.79		0.38

Table 3 (continued). Standardized measurement loadings for the latent constructs. All measurement loadings significant at the $p < .01$ level.

		Mother's							
		Mother's		Mother's Anxiety & Depression		Mother/Infant Interaction		Mother's Post-Hospital Anxiety & Depression	
Group	Trait	Family Income	Parental Beliefs	Stress in the NICU	Surrounding Hospital Stay	Interac- tion	Anxiety & Depression	Residual Variance	
MOTHER'S POST-HOSPITAL ANXIETY & DEPRESSION									
	Beck Depression Inventory – T6						0.82 ^{a,d}	0.34 ^f	
	State Anxiety – T6						0.88 ^e	0.22 ^g	

^a Parameter fixed at 1.00 (unstandardized) to identify construct and establish metric for the latent construct.

^b Parameter fixed at 0.00.

^c Parameter fixed at $[(1 - \alpha) * \text{variance}]$ to adjust for measurement error in the construct.

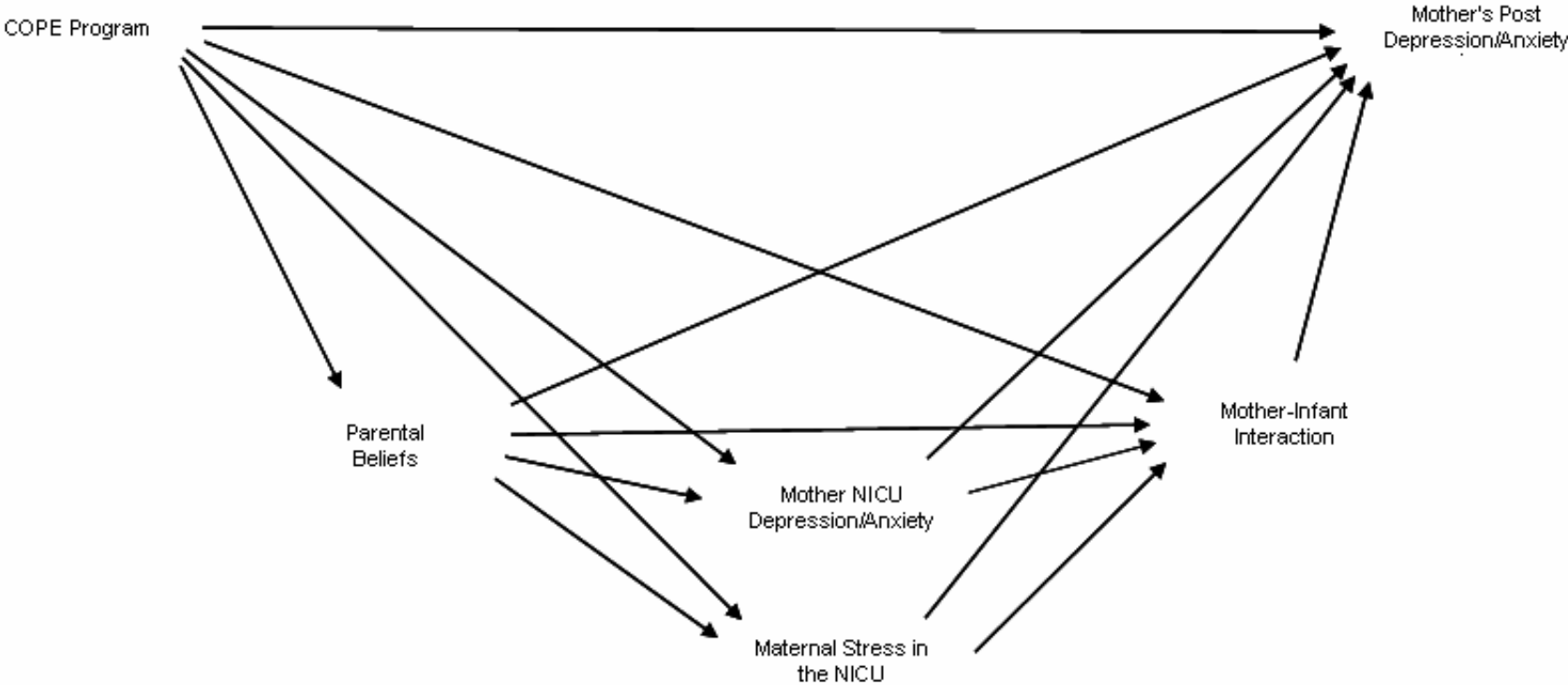
^d Parameters constrained equal across time.

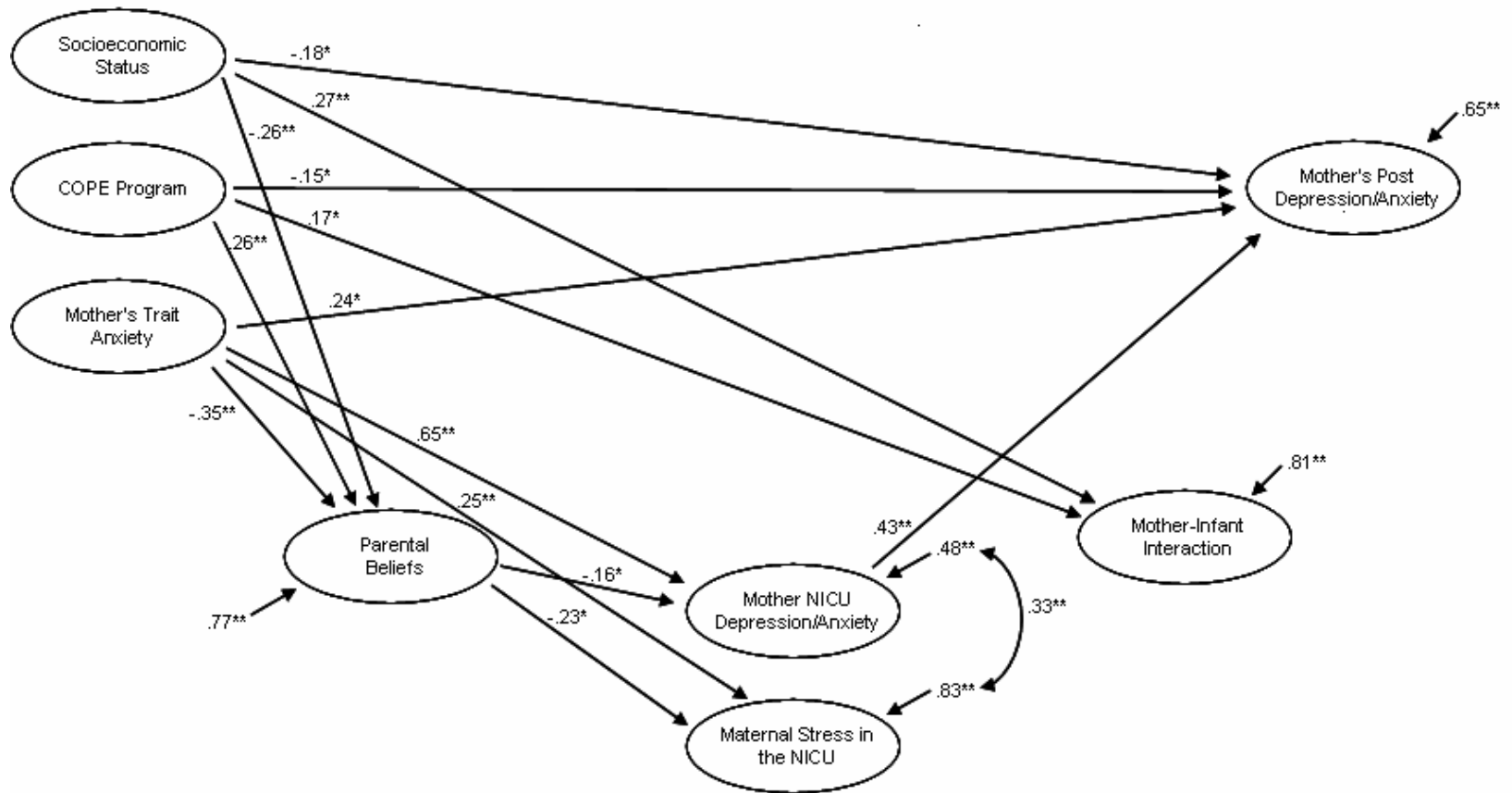
^e Parameters constrained equal across time.

^f Unique residuals allowed to correlate.

^g Unique residuals allowed to correlate.

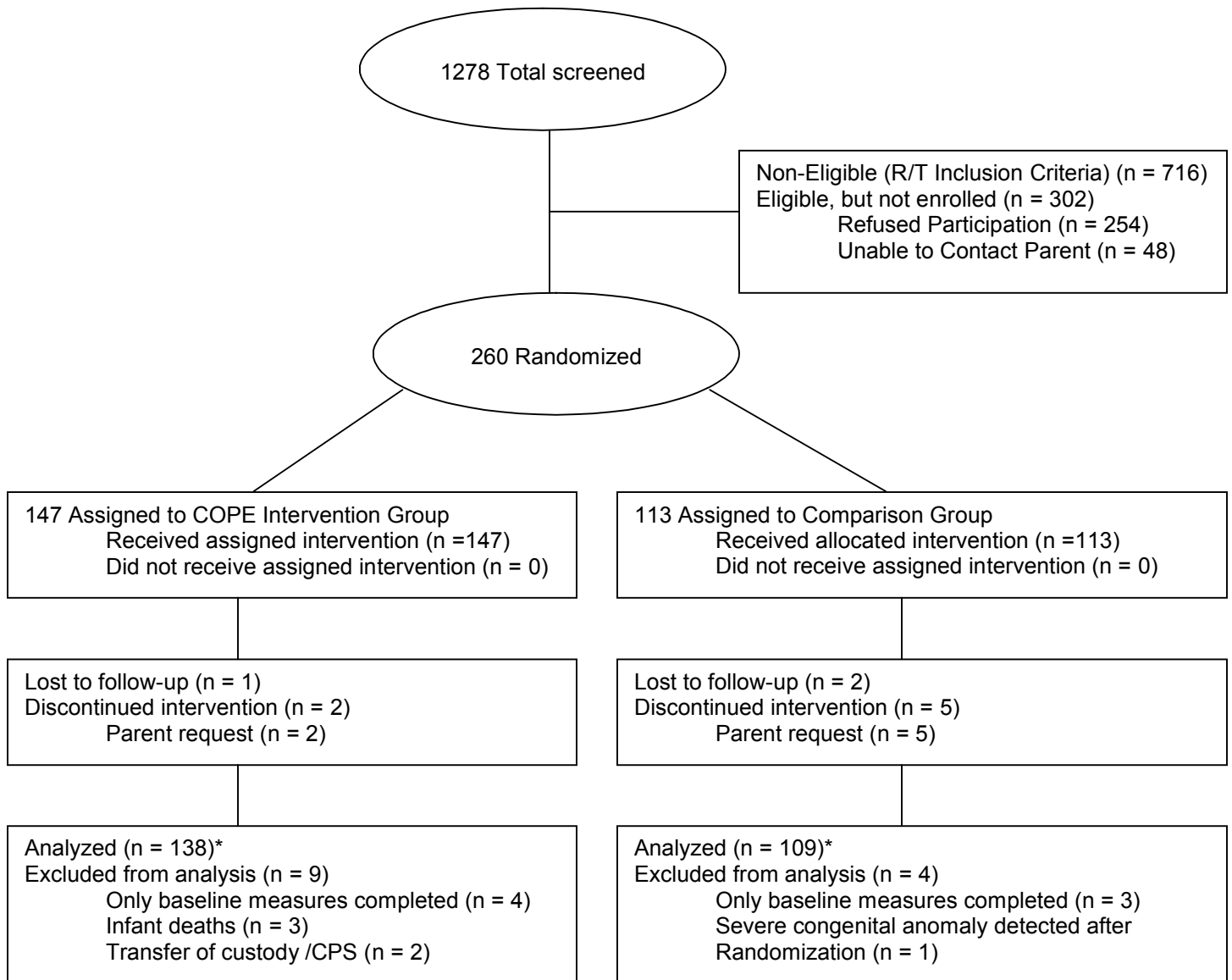
Figure 1. Theoretical model of COPE intervention effects. Figure 2. Standardized results of structural equation model predicting post-hospital maternal depression/anxiety. The unlabeled arrows pointing to the endogenous latent variables show the residual (unaccounted for) variance for each of these variables. Note: * $p < .05$; ** $p < .01$. The following non-significant, though tested, paths have been omitted for clarity: path from mother-infant interaction to mother's post depression/anxiety; path from maternal stress in the NICU to mother's post depression/anxiety; path from parental beliefs to mother's post depression/anxiety; path from mother NICU depression/anxiety to mother-infant interaction; path from maternal stress in the NICU to mother-infant interaction; path from parental beliefs to mother-infant interaction; path from mother's trait anxiety to mother-infant interaction; path from COPE program to mother NICU depression/anxiety; path from socioeconomic status to mother NICU depression/anxiety; path from COPE program to maternal stress in the NICU; path from socioeconomic status to maternal stress in the NICU; and the correlations among socioeconomic status, the COPE program, and mother's trait anxiety.





Chi Square (64df) = 97.67; $p = .004$
 RMSEA = .046
 90% RMSEA Confidence Interval = .026 - .064
 CFI = .97

Figure 1. Study Flowchart



*Subjects were analyzed in the groups to which they were randomized. We used all available data for subjects that completed evaluation of at least one phase of the intervention. Removal of subjects from analysis that began the intervention, but did not match criteria (false inclusions, $n = 6$) was applied equally to groups (3 non-survival situations unrelated to the intervention, 2 transfers of custody, and 1 congenital anomaly).³⁴