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Ethnic/racial diversity, maternal stress, lactation and very low birthweight infants

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Abstract

Objective—(1) To compare maternal characteristics and psychological stress profile among African-American, Caucasian and Hispanic mothers who delivered very low birthweight infants. (2) To investigate associations between psychosocial factors, frequency of milk expression, skin-to-skin holding (STS), and lactation performance, defined as maternal drive to express milk and milk volume.

Study Design—Self-reported psychological questionnaires were given every 2 weeks after delivery over 10 weeks. Milk expression frequency, STS, and socioeconomic variables were collected.

Result—Infant birthweight, education, and milk expression frequency differed between groups. Trait anxiety, depression and parental stress in a neonatal intensive care unit (PSS:NICU) were similar. African-American and Caucasian mothers reported the lowest scores in state anxiety and social desirability, respectively. Maternal drive to express milk, measured by maintenance of milk expression, correlated negatively with parental role alteration (subset of PSS:NICU) and positively with infant birthweight and STS. Milk volume correlated negatively with depression and positively with milk expression frequency and STS.

Conclusion—Differences between groups were observed for certain psychosocial factors. The response bias to self-reported questionnaires between groups may not provide an accurate profile of maternal psychosocial profile. With different factors correlating with maintenance of milk expression and milk volume, lactation performance can be best enhanced with a multi-faceted intervention program, incorporating parental involvement in infant care, close awareness and management of maternal mental health, and encouragement for frequent milk expression and STS.

Keywords

prematurity; milk expression; milk production; maternal stress; depression; anxiety; social desirability

Introduction

The profound benefits of mother's own milk feeding^{1–3} and the increased survival of preterm infants^{4–6} have generated much attention on how to optimize the lactation performance of mothers who deliver prematurely. Mothers of preterm infants frequently do not provide sufficient milk to meet the needs of their infant because they stop expressing milk and/or have low volume.^{7–10} A number of anatomical, physiologic/hormonal and stress factors may be implicated in hindering successful lactation, for example, immature mammary development

resulting from shortened gestation (lactogenesis I), decreased milk production (lactogenesis II), and/or stress.^{8,11–15} Stress, be it physical or psychological, may hinder lactation via physiologic/hormonal responses that inhibit milk synthesis (for example, prolactin), milk release (for example, oxytocin) and/or maternal behavior.¹⁶ The stress that mother's experience, following a premature delivery, may include not only maternal concerns over infant's health,^{8,17,18} but also their own health, lifestyle (for example, employment, family responsibilities), lack of social support and/or limited socioeconomic resources, just to name a few.^{19,20} These difficult situations may lead to maternal psychological distress that can be manifested as depression, anxiety and/or post-traumatic stress.^{9,19–27} Thus, maternal well-being would appear to be an important attribute if lactation is to be successful. Interventions, such as encouraging frequent milk expression, skin-to-skin holding (STS), as well as various support groups can enhance lactation, but compliance with these practices is often difficult to achieve for many mothers and their benefits cannot be generalized.^{28–38}

In recent years, awareness of ethnic/racial impact on health has grown due to the increasing heterogeneity of the American population. Ethnic diversity has been a factor in issues such as pathophysiology, responses to stress, psychological issues and communication between healthcare professionals and patients.³⁹ In particular, a higher incidence of preterm births among African- Americans and Hispanics as compared with Caucasians has been observed.^{6,40} Potential reasons for such disparity are differing genetic factors,^{41,42} socioeconomic status,^{43,44} psychosocial stressors/risks, for example, racism, home and neighborhood violence, depression, pregnancy-related anxiety.^{24,45,46}

In view of the fact that socioeconomic and psychosocial stressors likely will be unchanged following a premature delivery, one may reasonably presume that maternal stress brought on by these factors will remain following a premature delivery and be further intensified by concerns over a preterm infant's health. As mentioned above, studies have shown that these issues can hinder lactation, while ethnic/racial disparity can lead to differing responses to stress and psychological issues. Taken together, the combined effects of maternal stress on lactation and the differing ethnic/racial responsiveness to stress deserve further exploration. A deeper understanding of how ethnic/racial diversity may differentially affect maternal stress, which, in turn, is known to alter lactation, could lead to the development of efficacious interventions to improve maternal psychological well being as well as to enhance lactation for all mothers.

Therefore, the purpose of our study was to determine whether, after the birth of a preterm infant, maternal stress differs between ethnic/racial groups and which aspect(s) of maternal psychological status may be correlated with lactation performance. The following hypotheses were advanced. First, maternal distress after the birth of a very low birthweight (VLBW) infant differs between mothers of diverse ethnicity/race. Second, such distress affects their lactation performance. We defined lactation performance as comprising behavioral and physiologic elements, namely the maternal drive to maintain milk expression and milk production, respectively. The distinction made between these two factors does not imply that they are independent of each other, as it is well known that frequency of milk expression is correlated with milk production.²⁹ However, this approach was used to study the impact that each 'component' may have on the overall lactation performance. Therefore, we are working from the premise that lactation only exists if mothers initiate and maintain milk expression and is successful if the ensuing milk production is sufficient to meet the needs of the infant.

Materials and methods

Subjects

Mothers of 'healthy' infants born between 26 and 29 weeks gestation were recruited from the nurseries of Texas Children's Hospital, Houston, TX, USA. The recruitment of these mothers

was based on their infants being appropriate for gestational age, as determined by obstetric dating and clinical examination, and having no major congenital malformations. Consent was obtained from eligible subjects. The study was approved by the Baylor College of Medicine Institutional Review Boards for Human Research.

Study design/methodology

Mothers who intended to breastfeed and/or express milk were asked to visit the General Clinical Research Center (GCRC) at Texas Children's Hospital beginning 2 weeks postpartum and every 2 weeks thereafter for a total of five visits. Income and education along with maternal characteristics were collected from a form distributed to mothers when they signed on with the study. Infants' characteristics were tabulated from their medical charts. Figure 1 depicts the overall study design and protocol.

Lactation performance

The two components we defined, maintenance of milk expression and milk production, were monitored as follows. Maternal drive to maintain milk expression was measured as a function of the percent mothers who maintained milk expression for the duration of their infant's hospitalization as opposed to those who did so only partially. Milk production was estimated by the 24-h milk volume immediately following each visit to the GCRC.

Lactation-enhancing interventions

The practice of milk expression and STS are an integral part of the protocols instituted by the hospital Lactation Program.^{47,48} Caretakers and lactation consultants routinely encourage all lactating mothers to express their milk and, when visiting, to hold their infant skin-to-skin. For our study, daily frequency of milk expression was estimated by the number of times mothers expressed milk during the 24-h milk collection following each GCRC visit. Total duration of STS during an infant's hospitalization was collected from a form taped by the bedside of each infant. Fathers and mothers were asked to write down the duration of STS carried out at each visit. Only maternal records were utilized.

Assessment of maternal psychological distress

Subjects completed the following self-reported psychological questionnaires at various visits. At their *first* visit, the level of anxiety of the subjects dependent upon their trait was measured using the Spielberger Trait Anxiety Inventory⁴⁹ and Social Desirability used the Marlowe–Crowne Social Desirability test;⁵⁰ (see details below). At each visit, the following tests were administered: (1) Spielberger State Anxiety Inventory to measure anxiety at the time of each testing (Consulting Psychologists Press, Redwood City, CA, USA); (2) Beck Depression Inventory (BDI, Psychological Corp., San Antonio, TX, USA⁵¹), a scale developed for the general population and (3) Parental Stressor Scale: Neonatal Intensive Care Unit (PSS:NICU)⁵² to evaluate the stress of having one's infant in an NICU. It assesses the stress level (1, not stressful to 5, extremely stressful) perceived by subjects in five categories specifically pertaining to the NICU: the Sight and Sound of the NICU, Baby's Looks/Behavior, Parental Role Alteration or the inability to act as a parent, Staff Behavior/Communication and one general stress question. The stress occurrence level (Metric 1) defined by Miles *et al*⁵² was used for scoring. This is the level of stress experienced by mothers as it related to their individual situation; namely, only items experienced received a stress score.

As subjects' responses to self-reported psychological questionnaires may be influenced by their 'social desirability' attribute, that is, the need for social approval or the avoidance of social disapproval,⁵³ the Marlowe–Crowne Social Desirability scale was administered at the first visit.⁵⁰ In assessing subjects' level of Social Desirability, this test provided a measure of their

response bias to self-reported psychological questionnaires; namely, the higher the score, the more likely the subject's response towards social acceptability. This measure was used as a covariate in the analyses of the psychological factors that correlated with this particular trait.

Statistical analyses

Comparison between groups used the one-way analysis of variance and Kruskal–Wallis for parametric and non-parametric outcomes, respectively. Proportionate data were compared using the χ^2 method. Within each group, associations between lactation outcomes, that is, maintenance of milk expression and 24-h milk volume and individual variables (maternal age, infants' gestational age, daily frequency of milk expression, total duration of STS and psychological scores) were conducted in two steps. First, significant associations ($P \leq 0.05$) between maintenance/no maintenance of milk expression (dichotomous outcome) and the individual variables were identified using a univariate binary logistic regression analysis. For 24-h milk volume (continuous outcome), the Pearson correlation was used. *Only* variables demonstrating significance were included in the subsequent regression analyses. Multivariate binary logistic regression was used to examine their relationships with maintenance of milk expression and the general linear model analysis was used for milk volume. Significance was based on a P -value of ≤ 0.05 .

Results

Subjects' study compliance

There was a substantial variation in maternal compliance to the study (Figure 2). Only 163 of 234 mothers (70%) participated in ≥ 1 visit. Of those 163 mothers, 143 initiated milk expression (88%). Three mothers were dropped from the study when their infants died. Sixteen mothers only came for one visit and 124 participated in ≥ 2 visits. Table 1 shows the distribution of lactating mothers who came for 1 to 5 visits.

Inasmuch as we were interested in potential temporal changes in maternal outcomes, only the subjects who returned for ≥ 2 visits were included in subsequent data analyses. When maternal and infant characteristics were examined with regard to the number of participated visits, there were no differences in maternal age, parity, infant birthweight, income, education, daily frequency of milk expression and 24-h milk volume. Only gestational age ($P < 0.001$), age at hospital discharge ($P = 0.023$) and total duration of STS ($P = 0.011$) were significant. Infants whose mothers came for only three out of five visits were less premature. Mothers who came for five visits had infants who stayed the longest in the hospital and their total duration of STS was greatest.

When comparing between mothers who came for 1 vs ≥ 2 visits, significant differences were noted in STS (1.5 ± 3.1 vs 15.9 ± 22.9 h for 1 vs ≥ 2 visits, $P < 0.001$, respectively) and ethnic/racial background, that is, 47% were African-American, 24% Caucasian, 29% Hispanic and 0% Asian vs 32.0% African-Americans, 45.6% Caucasians, 19.2% Hispanics and 3.2% Asians ($P = 0.002$, respectively). No differences were observed in maternal age, infants' gestational age and birth weight, 24-h milk volume, daily frequency of milk expression, maternal education, income, and psychological scores. For mothers who came for only 1 visit, it was not possible to identify whether lactation was maintained or not during their infant's hospitalization.

Data analyses

Maternal-infant demographics—The ethnic/racial distribution of subjects who came for ≥ 2 visits was representative of the ethnic/racial distribution of Harris County, Texas. Owing to the small number of Asians who participated ($n = 4$), only Caucasian ($n = 58$), African-

American ($n = 38$) and Hispanic ($n = 24$) subjects were included in the data analyses. Table 2a shows differences between ethnic/racial groups in infant's birthweight ($P = 0.025$), but not in maternal age, parity, infants' gestational age and postnatal age at hospital discharge.

Socioeconomic measures—No difference in income was noted between groups, but educational attainment was significantly higher in African-Americans and Caucasians than Hispanics ($P = 0.002$) (Table 2b).

Measures of lactation-enhancing interventions—Daily frequency of milk expression was significantly different between groups ($P = 0.002$), but total duration of STS was not. Of interest to mention, no significant correlation was noted between daily frequency of milk expression and 24-h milk volume (Table 2c).

Measures of lactation performance—The percent mothers who did and did not maintain lactation were similar between groups. As 24-h milk volume did not change over time, the average 24-h milk volume was computed and used as a measure of milk production. No difference in the latter was seen between groups. Insofar as no correlations were observed between ethnic/racial groups for the two components of lactation performance, that is, maintenance of milk expression and 24-h milk volume, data from all subjects were combined for subsequent analyses (Table 2d).

Measures of maternal psychological stress profile—Anxiety, Depression and PSS:NICU scores were averaged over time as no change was detected over the duration of the study for each group. Table 3 shows their scores along with that of Social Desirability. Only State Anxiety and Social Desirability were significantly different between groups with the lowest scores in State Anxiety for African-Americans ($P = 0.009$) and in Social Desirability for Caucasians ($P = 0.004$). In addition, Social Desirability was negatively correlated with the following self-reported information: education ($P = 0.005$), income ($P = 0.010$), total duration of STS ($P = 0.045$) and the following psychological tests: Trait/State Anxiety ($P = 0.044$), Depression ($P = 0.007$), Infant's looks/behavior ($P = 0.040$) and Staff Communication ($P = 0.001$). It was not correlated with frequency of milk expression ($P = 0.058$), Sight and Sound in the NICU ($P = 0.107$) or Parental Role Alteration ($P = 0.374$).

With no differences observed in the average scores for Trait Anxiety, Depression and PSS:NICU between ethnic/racial groups, they were combined for all mothers. Trait Anxiety scores in our subjects averaged 36 ± 9 . Its distribution was similar to that of the general population of women between the ages of 19 and 39 years monitored by Spielberger.⁴⁹

To examine further the distribution of maternal levels of depression (Table 4), we distinguished between two levels, that is, minimal and notably depressed, based on the diagnostic definitions of Beck and Steers.⁵¹ Comparisons of the percent mothers falling into these two levels were analyzed using a binary logistic regression for dichotomous variable. As depression was significantly associated with Social Desirability, the analysis was conducted with and without introducing the Social Desirability factor as a covariate. There was a significantly larger percentage of mothers who 'exhibited' minimal level vs notable level of depression when this covariate was not included ($P = 0.015$). However, when it was entered into the regression analysis, the difference between mothers with and without depression was no longer significant (Table 4). The percent distribution of mothers, who fell into the minimal and notably depressed levels when their scores were not corrected for Social Desirability, was significantly different between groups ($P = 0.012$). Approximately, 75% of African-American and Hispanic subjects were minimally depressed as compared with 56% Caucasian counterparts.

Figure 3 shows the percent of all mothers who scored at various levels (1–5) in the five subsets of the PSS:NICU for the items experienced. Overall, scores on all subsets of the PSS:NICU were rated at some level of stressfulness (score ≥ 2), with the Parental Role Alteration subgroup and the General Stress question rated as very stressful (score = 4). Of interest to note is the significant difference in Parental Role Alteration between mothers who did and did not maintain milk expression during their infant's hospitalization (3 ± 1 vs 4 ± 1 , respectively, $P < 0.008$).

Maternal psychosocial factors and lactation performance—To evaluate the effect (s) of psychosocial factors on maintenance/no maintenance of milk expression, the following significant variables were identified first by univariate binary logistic regression: maternal age, infant birth weight, daily frequency of milk expression, 24-h milk volume, STS, education, income and parental role alteration. Table 5a shows the variables that remained significantly correlated when all these factors were entered collectively into a multivariate binary logistic regression. Maintenance of milk expression was negatively correlated with Parental Role Alteration and positively with infant birthweight and total duration of STS.

To assess the effect of psychosocial factors on milk production, the following significant variables associated with 24-h milk volume were identified by Pearson correlation: maintenance/no maintenance of milk expression, infant birth weight, daily frequency of milk expression, STS, income, State Anxiety, Depression and Social Desirability. Table 5b shows the variables that remained significant when all these factors were entered into a General Linear Model analysis. A negative association was observed between milk production and Depression and a positive one with daily frequency of milk expression and total duration of STS. Insofar as Social Desirability was negatively correlated with Depression ($P = 0.007$), it was entered as a covariate in the analysis.

Discussion

The two hypotheses advanced in this study were the following. First, ethnic/racial diversity differentially affects maternal psychological stress profile of mothers of VLBW infants. Second, this, in turn, is correlated with their lactation performance, defined as maintenance/no maintenance of milk expression and milk production.

Subjects' compliance

The first observation made of interest/concern is the subject's compliance with the study protocol, which was not as high as expected. It is conceivable that mothers most affected psychologically self-selected out of the study. This was the reason given by some mothers who refused to participate at the time of recruitment. If these were correct, our observations would not have included the population at highest risk. Although we may not have been able to recruit the most 'stressed' subjects, the present study, rather than negate our results, further emphasizes the deleterious effect that psychological distress can have on the lactation of preterm mothers. The difficulty in recruiting these mothers is a complex issue that is not easily resolved. Indeed, the first contact that recruiters have with potential subjects is when mothers are experiencing the most difficult moments shortly after a premature delivery.

Ethnic/racial diversity differentially affects maternal psychological stress profile

Our first aim was to compare maternal characteristics and psychological stress profile between the different ethnic/racial groups of lactating mothers who delivered VLBW infants. Differences in characteristics between groups were in infant birthweight, daily frequency of milk expression and education. We speculate that these differences likely resulted from a combined effect of differing educational level, potential differences in dietary habits, familial/

social support, cultural environment and genetics.^{20,40,41,43,54–56} However, we did not assess the potential contribution of each of these factors.

Maternal psychological stress profile differed among groups for State Anxiety and Social Desirability. Although all mothers demonstrated similar Trait Anxiety, African-American mothers reported less anxiety than their Caucasian and Hispanic counterparts regarding their hospitalized infants. It is conceivable that Caucasian mothers, with lower Social Desirability scores, were not as likely as their counterparts to give responses that were more socially acceptable.⁵⁷ If this is correct, their scores would be more representative of their true emotions. The accuracy of such responses raises concern over the need for careful interpretation of self-reported psychological tests in a heterogeneous population. Indeed, under- or over-scoring tests by individuals with elevated Social Desirability scores may potentially obscure true differences. This may be the reason for which we did not discern any difference between groups in average Depression scores. The percent mothers who were minimally or notably depressed further support such possibility. Indeed, when uncorrected for Social Desirability, there was a significant majority of mothers (66%) who were minimally depressed vs 34% who were notably depressed. However, when Social Desirability was taken into consideration, this significance was no longer detected, suggesting that the actual number of mothers who were truly depressed may have been underestimated. Despite the above, the ‘uncorrected’ percentile of notably depressed mothers (34%) remains greater than the 8–15% reported for all women of similar age in the United States and mothers who delivered healthy full-term infants.^{58–60} It is evident that the stress of having a sick VLBW infant is unique and likely more intense than delivering a healthy full-term infant.^{18,22,25,61} This is supported by our observations that our subjects were stressed by their NICU experience (PSS:NICU), particularly by their inability to act as a parent (Parental Role Alteration). These observations concur with earlier studies suggesting that maternal postpartum depression may be further exacerbated by the infant’s ill health.^{17,62,63}

Maternal stress is correlated with their lactation performance

Our second aim investigated the associations that may exist among various psychosocial factors, lactation-enhancing interventions and lactation performance. Studies have addressed these issues.^{64,65} However, to our knowledge, this is the first study that investigated such associations with separate components of lactation, that is, a behavioral (maintenance/no maintenance of milk expression) and physiologic (milk production) component, while taking into account the potential influence of ethnic/racial disparity. We reasoned that for lactation to occur and to be sustained, mothers must first maintain an interest in expressing milk. It is only after this is achieved that milk production becomes germane. Insofar as no significant associations were observed between groups, maintenance of milk expression and milk production do not appear to be influenced by differing maternal ethnic/racial background. However, our observations suggest that differing factors affect these two components of lactation. As summarized schematically in Figure 4, the behavioral component (maintenance/no maintenance of milk expression) is inversely correlated to Parental Role Alteration; the higher the stress induced by the inability to be a parent, the more likely a mother will stop expressing her milk. However, the more STS (a parental function) is practiced, the more likely she will maintain milk expression. Along the same line, the physiologic component (milk production) is inversely correlated with depression; the more depressed a mother is, the more likely her milk volume will decrease. However, the more she practices STS and frequent daily milk expression, the more likely her milk production will increase.

In summary, our results confirm the well-acknowledged detrimental effects of maternal psychological distress and benefits of lactation-enhancing interventions on lactation. However, the importance of these data resides in the realization that these factors act on different aspect

(s) of lactation. Therefore, based on this new information, we advance that the overall lactation performance of mothers of preterm infants can be best enhanced with a multifaceted intervention program supporting both maternal behavior and lactation physiology. More specifically, to maintain interest in milk expression and enhance milk production, such a program needs to incorporate increased parental involvement in the care of their infant beginning early on in the NICU,⁶⁶ close awareness and management of potential maternal mental health, for example, depression, anxiety,^{27,61,67} and availability and encouragement for frequent milk expression schedules and STS.^{68–70} In addition, in a multi-ethnic/racial environment, it is important to remember that the differing Social Desirability trait may not provide an accurate profile of self-reported maternal psychosocial characteristics. This potentially may lead to an inaccurate measure of a mother's true emotions.

In this study, the focus was placed on the effects of psychological factors and lactation-enhancing interventions on lactation performance of mothers from different ethnic/racial background. In an earlier work,⁷¹ we compared, within the same subject population, similar outcomes between mothers of premature singletons ($n = 87$) vs multiples ($n = 37$). In brief, we observed that mothers of singletons and multiples had similar characteristics, socioeconomic status, psychological stress scores and interest in maintaining milk expression. However, milk production (24-h milk volume) was reduced in singleton mothers when compared with their multiple counterparts. In addition, factors correlated with maintenance of milk expression and milk production differed.

In conclusion, we confirmed our first hypothesis that maternal stress differs between VLBW mother of diverse background, but with an important caveat. Given that Social Desirability trait differs between ethnic/racial origins, differences observed in psychosocial measures may not reflect true responses. Therefore, consideration of this potential confounding factor needs to be taken into account in studies involving a heterogeneous population when self-reported tests are utilized. Our second hypothesis was also verified, as we observed associations between specific psychological stress measures and the behavioral and physiologic components of lactation performance that we defined, namely maternal drive to maintain/not maintain milk expression and milk production, respectively.

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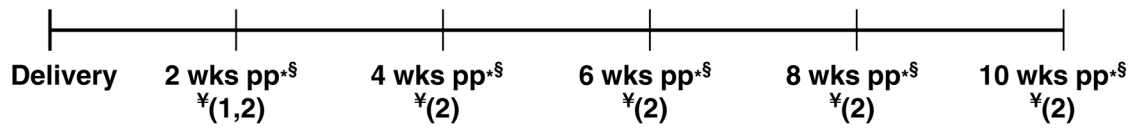
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wks pp: weeks postpartum

[§] Frequency of milk expression and milk production collected over 24 hours immediately following each visit

[¥] psychological tests administered:

- (1) - Spielberger Trait Anxiety
 - Marlowe-Crowne Social Desirability, a measure of subjects' response bias to self-reported questionnaires (the higher the score, the more bias the response)
- (2) - Spielberger State Anxiety
 - Beck Depression Inventory
 - Parental Stressor Scale: NICU (PSS:NICU)

Cumulative duration of skin-to skin holding (STS) recorded at end of study

Figure 1.
Summary of study design and protocol.

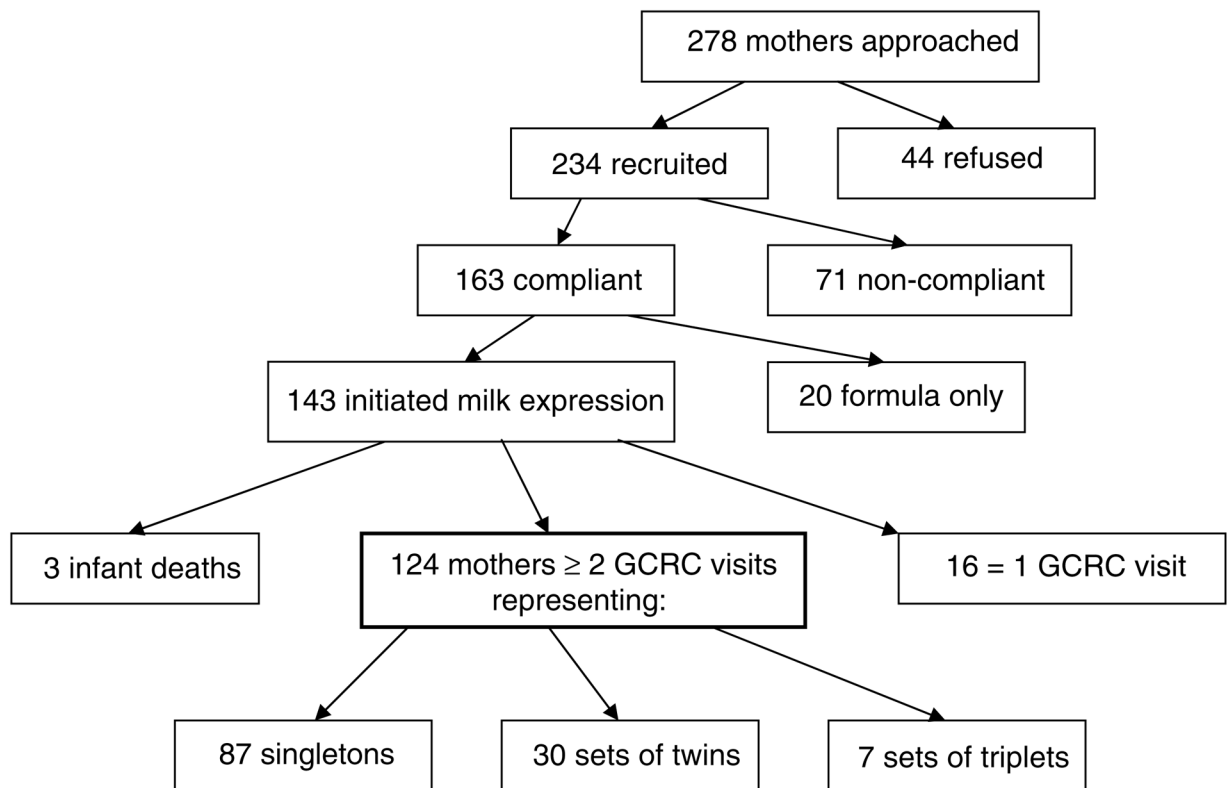


Figure 2.
Subjects' distribution.

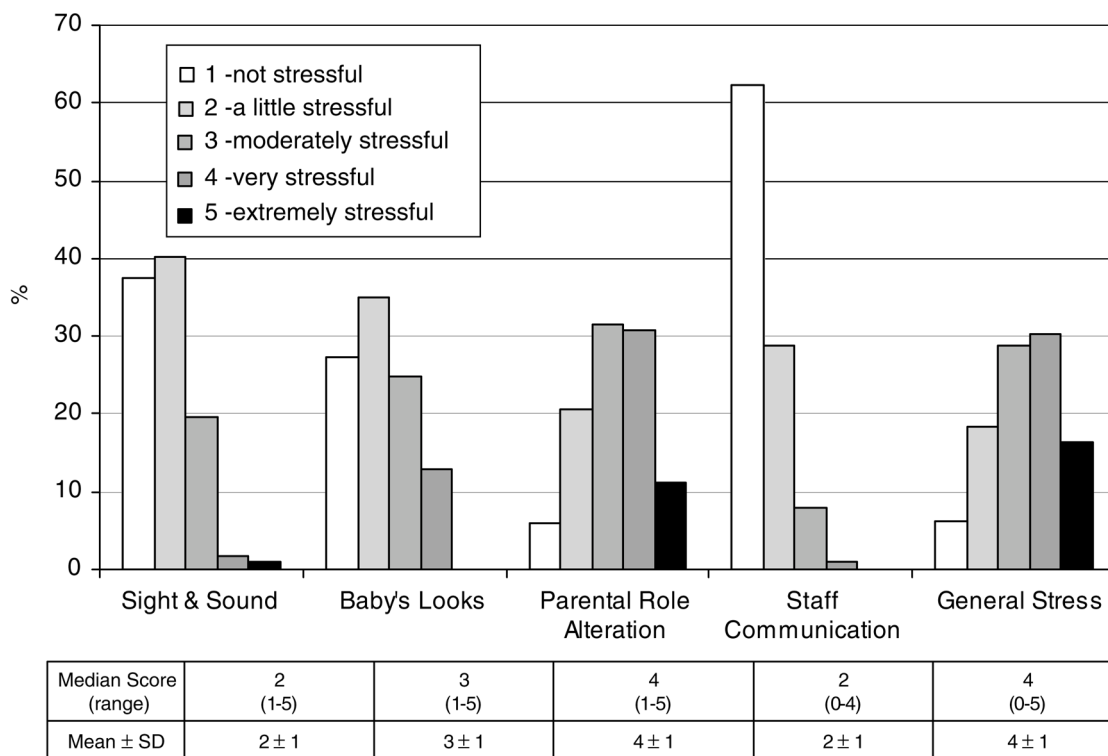


Figure 3. Percent of all mothers who scored at various levels (1–5) in the five subsets of the PSS:NICU test.

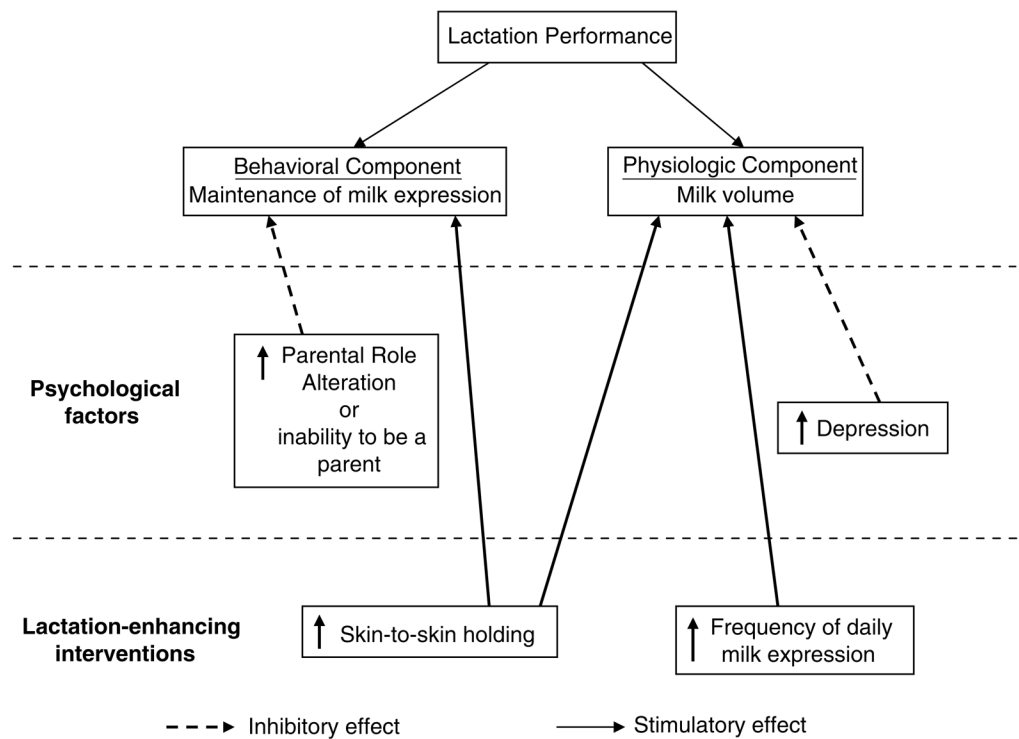


Figure 4. Differential effects of psychological and lactation-enhancing interventions on maintenance of milk expression and milk volume.

Table 1
Number and percent of subjects who came for 1 to 5 visits

Number of visits	Number of subjects (%)
1	16 (11.2)
2	18 (12.5)
3	30 (21.0)
4	29 (20.3)
5	50 (35.0)

Table 2

Subjects characteristics by ethnic/racial groups

	African-American	Caucasian	Hispanic	P-value
<i>(a) Maternal-infant demographics</i>				
<i>n</i> (%)	38 (31.7)	58 (48.3)	24 (20.0)	
Maternal age (years)	28.0±6.4 ^a	29.9±6.9	27.4±6.2	0.208 ^b
Parity	1.9±0.9	2.2±1.2	2.0±1.2	0.296 ^b
Infant gestation (weeks)	26.9±1.7	27.3±1.5	26.9±1.7	0.263 ^b
Infant birth weight (kg)	0.882±0.224 [#]	1.013±0.246 [#]	0.930±0.222	0.025^b
Age @ discharge (days)	92±67	96±63	89±44	0.914 ^b
<i>(b) Socioeconomic Income^e</i>				
Mean±s.d.	2.6±0.9	2.6±0.8	2.1±0.7	0.058 ^b
Median (range)	3 (1–4)	2.5 (1–4)	2 (1–4)	
<i>Education^f</i>				
Mean±s.d.	3.0±0.6*	3.1±0.7 [#]	2.4±0.6 ^{#,*}	0.002^b
Median (range)	3 (2–4)	3 (2–3)	2 (2–4)	
<i>(c) Lactation-enhancing interventions</i>				
Daily frequency milk expression (no/ days)	4.6±1.3, ^{#a}	5.7±1.2 [#]	5.2±1.4	0.002^b
Total duration of skin-to-skin holding	11±15	19±25	17±29	0.180 ^c
<i>(d) Lactation performance</i>				
Maintenance of milk expression/ partial milk expression (<i>n</i> , %) ^g	20/20 (50/50)	37/20 (65/35)	15/8 (65/35)	0.261 ^d
24 h milk volume (l/day)	0.522±0.425	0.498±0.357	0.436±0.378	0.664 ^c

^{#,*} *Post hoc* Fisher LSD, $P \leq 0.05$ between same symbols.

^a Mean±s.d.

^b One-way ANOVA for parametric measures.

^c Kruskal–Wallis for non-parametric measures.

^d χ^2 .

^e Income levels: (1) <\$10 000, (2) \$10 000–\$49 999, (3) \$50 000–\$99 999, (4) ≥ \$100 000.

^f Education levels: (1) <6th grade, (2) 6–8th grades, (3) 9–12th grades, (4) >12th grade.

^g Subjects who maintained milk expression during infant's hospitalization/subjects who maintained partial milk expression during infant's hospitalization.

Table 3
Maternal psychological scores by ethnicity/race of mothers who came ≥ 2 visits

Psychological tests	African-American	Caucasian	Hispanic	P-value
Trait anxiety	34.9±8.1 ^a	36.7±10.0	35.9±10.5	0.758 ^b
State anxiety	33.3±9.3 ^{#,*}	39.6±10.0 [#]	40.1±13.3 [*]	0.009 ^c
Depression	7.3±5.4	10.1±6.5	8.1±7.7	0.076 ^b
PSS:NICU scores				
Sight and sound	2.3±0.9	2.4±0.7	2.2±0.9	0.609
Baby's looks	2.7±1.2	2.7±0.9	2.5±1.1	0.929
Parental role alteration	3.7±1.1	3.5±0.9	3.5±1.2	0.712
Staff communication	1.7±0.7	1.8±0.8	1.5±1.1	0.333
General stress	3.6±1.2	3.6±1.0	3.7±1.3	0.852
Social desirability	21.7±5.8 [*]	17.7±6.6 ^{#,*}	23.1±5.5 [#]	0.004 ^c

Abbreviations: PSS:NICU, Parental Stressor Scale; Neonatal Intensive Care Unit.

^{#,*} *Post hoc*: Fisher LSD, $P \leq 0.05$ between same symbols.

^a Mean±s.d.

^b Kruskal-Wallis for non-parametric measures.

^c One-way ANOVA.

Table 4
Percentile of mothers exhibiting minimal or notably depressed levels as defined by Beck and Steer^a

Depression level	Minimal (0–9) ^{a,b}	Notably depressed (10–29) ^a	<i>P</i> -value	<i>P</i> -value
All mothers	66% ^f	34%	0.015 ^c	0.115 ^d
African-American	74%	26%		
Caucasian	56%	44%	0.012 ^e	
Hispanic	72%	28%		

^aDiagnostic ranges of depression (Beck and Steer, 1993⁵¹).

^bRaw BDI scores

^cBinary logistic regression uncorrected for Social Desirability.

^dBinary logistic regression corrected for Social Desirability.

^e χ^2 between ethnic/racial groups.

Table 5

Table 5a Factors affecting maintenance of milk expression (yes/no)

Table 5b Factors affecting milk production (l/day)

Significant factors affecting maintenance of milk expression	<i>P</i> -value ^a	OR	95% CI (lower-upper)
Parental role alteration score	0.036 (-) ^b	0.41	0.18–0.94
Birth weight (kg)	0.034 (+)	27.05	1.27–575.06
Skin-to-skin holding (h)	0.048 (+)	1.05	1.00–1.10
Significant factors affecting 24-h milk volume	<i>P</i> -value ^a		
Depression	0.021 (-), ^{bc}		
Daily frequency of milk expression	0.001 (+)		
Skin-to-skin holding (h)	0.020 (+)		

Abbreviations: CI, confidence interval; OR, odd ratio.

^a All significant factors identified by univariate binary logistic regression ($P \leq 0.05$) were entered into the multiple logistic regression model. Only those significant are presented.

^b (-) negatively correlated; (+) positively correlated.

^a General Linear Model for continuous variables. All significant factors identified by Pearson correlation ($P \leq 0.05$) were entered into the equation. Only those significant are presented.

^b Social Desirability entered into equation, as it was correlated with Depression ($P < 0.007$).

^c (-) negatively correlated; (+) positively correlated.