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ORIGINAL ARTICLE

Interactions between mothers and their moderate preterm babies during hospitalization

Interacciones entre las madres y sus bebés prematuros moderados durante la hospitalización

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What do we know about the subject matter of this study?

Preterm birth is a traumatic and stressful event. This, plus the physical and emotional distance that occurs during hospitalization, could affect the interaction between the dyad, which could have a relevant impact on developmental trajectories. Most of the studies that address these issues have been conducted with a population of extremely preterm newborns.

What does this study contribute to what is already known?

Mothers of moderate preterm newborns may experience significant mental health impacts during hospitalization. This study shows that these mothers may experience high levels of depressive symptomatology and parental stress. The main source of stress is related to the parental role. Higher levels of stress are related to less contact and interaction of the dyad.

Abstract

Moderately preterm infants are physiologically immature, their brains must mature and adapt to the extrauterine environment, which can affect their neurological development. Interaction with their caregivers is crucial for their development, however, these may show mental health problems such as depressive symptoms and parental stress. **Objective:** to evaluate how depressive symptomatology and stress perception of mothers of moderately preterm infants during hospitalization may affect dyad interaction. **Patients and Method:** 85 dyads participated. During the second and third weeks of hospitalization, mothers answered a sociodemographic questionnaire, the parental stress scale, and the Edinburgh postnatal depression scale. Mother-infant interaction was assessed and coded with the Hospitalized Mother-Infant Bonding Observation Scale. **Results:** mothers of moderately preterm infants hospitalized in a neonatology unit may present significant depressive symptomatology which correlate with the stress experienced by the mother. Parental stress and being small for gestational age showed a negative association with dyad interactions. **Conclusions:** Having a moderately preterm baby can impact the mental health of mothers and this, at the same time, is related to the interactions they have with their children. Likewise, variables related to the babies were detected that can also decrease the interactions and contact between the dyad.

Keywords:
Preterm Birth;
Depressive Symptoms;
Parental Stress;
Mother-Infant Interaction

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Introduction

Preterm birth can be a stressful and traumatic event for both parents and newborns born in a highly vulnerable condition[1,2]. Preterm newborns are at higher risk of morbidity and mortality than term newborns, and those who survive may present alterations in their cognitive, motor, and/or social development[3-4]. Even in conditions of low medical risk, preterm birth increases the probability that children may present difficulties in their cognitive and social development[5].

In addition to this increased vulnerability, a significant number of preterm newborns must stay hospitalized in neonatal units, where they are exposed to various stimuli and stressful experiences such as procedures by the health care team, use of tubes and lines, ventilatory support, exposure to light and noise, and separation from their parents[6-8]. Even moderate and late preterm newborns (born between 32 and 36 gestational weeks), who account for about 75% of preterm deliveries, are physiologically immature, and their brains must grow, mature, and adapt to the extrauterine environment, which may adversely affect their neurological development[9-11].

Several investigations have studied the high levels of stress experienced by parents during the hospitalization of their premature newborn[12-14]. During the hospital stay, they not only have to deal with the stressors of the neonatal unit environment but also face complications or uncertainties regarding the health status of their child, physical and emotional separation from their baby, and the stress of parenting[12,14-15]. Furthermore, mothers of preterm newborns show a postpartum depression rate twice as high as mothers of term newborns (28%-40%), especially in the early postpartum period, when their newborns are still hospitalized[16]. Similarly, mothers of moderate and late preterm newborns evidence a rate of depression around 22% and 18%, respectively, one month after discharge[17].

Maternal mental health problems have been significantly associated with difficulties in the relationship with their newborns[18-19]. This is particularly relevant for premature newborns whose interactions with their mothers (and other caregivers) are affected by the newborn's difficulties in regulating their physiological states and maintaining an optimal level of alertness[20]. Premature newborns give signals that are often subtle and unclear because of their difficulty in organizing their responses in visual, affective, and motor modalities which, at the same time, affects the parents' ability to read and respond to their newborn's signals[21]. In addition, this relationship develops initially within the neonatal units, which makes physical and emotional proximity between the dyads difficult[22]. These aspects become very relevant since how the relationship between the baby and its caregivers develops has a significant impact on its developmental trajectory and can reduce or exacerbate certain conditions[23].

Currently, some research has addressed the implications of maternal stress and depression in the mother-child relationship in the context of prematurity. Still, few studies have observed these problems in moderate preterm newborns. However, it is relevant to study the population of moderate preterm newborns because they are a vulnerable group and present possible neurodevelopmental risks[10].

The objective of this study is to evaluate how depressive symptomatology and stress perception of mothers of moderate preterm newborns during hospitalization in a neonatal unit could affect the interaction of the dyad. Both depressive symptoms and stress were expected to evidence a negative effect on the interaction. In addition, we looked for associations between the characteristics of the babies and the mental health of the mothers.

Patients and Method

Mothers and their moderate preterm newborns hospitalized in the neonatology service were included. Participants had to meet the following criteria: 1) be mothers of babies born between 32 and 34 weeks of gestation, 2) be older than 18 years, 3) moderate preterm newborn hospitalized in the neonatology unit, 4) newborn without congenital malformations, cardiac or neurological pathologies, or genetic syndrome, 5) mother with a sufficient Spanish language proficiency (writing and speaking), 6) mother without problematic alcohol and/or drug use, and 7) mother without severe psychiatric disorders such as schizophrenia or psychosis.

This research was conducted at the *Hospital Dr. Luis Tisné Brousse* from the public health network of the Metropolitan Region, Chile. Data were collected between May 2019 and February 2020. The study was approved by the Ethics Committees of the *Universidad del Desarrollo* and the hospital. Participants signed an informed consent form before joining the study.

Instruments

Clinical History

The following perinatal, neonatal, and maternal data were collected from the clinical history at the time of recruitment and during hospitalization: weight, height, gestational age at birth, and hospital stay length (in days).

Sociodemographic questionnaire

A questionnaire was prepared to request information on the mother's level of education, occupation, family income, family group composition, type of household, support network, and obstetric characteristics.

Parental Stress Scale for Neonatal Intensive Care Unit (PSS: NICU)[24]

This instrument measures parental perception of stressors from the physical and psychological environment of neonatal units. The PSS: NICU scale has 34 questions that parents must answer on a Likert scale from 1 (not stressful) to 5 (extremely stressful). The questions are organized into three subscales: 1) visual and sound aspects of the unit, 2) appearance and behavior of the newborn, and 3) parental role disturbance[25]. This scale has been used in Chile[26] and has shown good validity and reliability in different countries with a Cronbach's alpha ranging from 0.77 to 0.96[27-28]. In our study, it showed high reliability with α of 0.79.

Edinburgh Postnatal Depression Scale (EPDS)[29-30]

This scale is a self-report questionnaire with 10 items, which have four possible answers within a range of 0 to 3. A score equal to or greater than 13 is considered a risk indicator for presenting postpartum depression four to six weeks postpartum[31]. This scale has been validated in Chile for use during pregnancy and puerperium. The researchers report high reliability with a Cronbach's alpha of 0.77 and specificity (67%) for identifying women with depressive symptoms. In this study, Cronbach's alpha value was 0.76.

Observation scale of the mother-newborn bonding process hospitalized to the NICU (N-EOV-INC)[32]

This scale is composed of 21 items of interactive behaviors between mother and baby, divided into six contact registers or functions: 1) Approach Function; 2) Incubator Contact Function; 3) Body Function; 4) Visual Function; 5) Verbal Function; 6) Postural Function. This scale should be applied during the hospitalization period. The observation begins the moment the mother approaches the incubator where her baby is, until the end of the visit or until five minutes have elapsed. The natural interaction of the dyad is observed and recorded in the protocol. The dyads are classified into three categories of mother-child bonding: 1) Adequate bonding situation; 2) Poorly adequate bonding situation; 3) Inadequate bonding situation (bonding risk situation). For the detection of a bonding risk situation, the cut-off point is the 25th percentile and the Z-score of -0.68. In the original observational study, the interobserver reliability evidenced a high correlation of the scores with an r not less than 0.95 ($p < 0.001$). In this investigation, the evaluators were two health professionals trained in newborn and dyad observation and who were also trained in the use of this scale. The degree of agreement between the evaluators was evaluated in 10 observations of mother-newborn dyads, the Kappa index was 0.78, which shows a significant agreement.

Procedure

This study is the first phase of a longitudinal research project involving 85 mother-child dyads of moderate preterm newborns from birth to 12 months of corrected age. During the second and third week of hospitalization (phase one of this study), women who agreed to participate completed the sociodemographic and obstetric questionnaire (e.g., birth experience and type, skin-to-skin contact, and breastfeeding), the NICU parental stress scale, and the EPDS. Mother-newborn interaction was assessed and coded with the N-EOV-INC.

Analysis

Preliminary analyses were performed to evaluate descriptive information and univariate distributions of the variables for normality and outliers. Due to the non-normality of the data, nonparametric analyses such as the Mann-Whitney U test were used to assess differences between groups. In addition, we used Spearman's correlation analysis to assess associations between variables. All analyses were performed with the IBM SPSS 25 statistical software.

Results

Data from 85 dyads were analyzed. Table 1 describes the age, nationality, and education of the mothers, and Table 2 describes the characteristics of the preterm newborns at birth, duration of hospitalization, skin-to-skin contact, and type of feeding.

During the hospitalization of the preterm newborn, 38.8% of mothers reported EDPE scores above the cut-off score. Overall perceived stress during hospitalization, assessed by the PSS: NICU, showed a mean score of 4.1 (SD = 1.10), and the total mean scale score was 3.2 (SD = 0.72). According to maternal reports, "parental role" was the most stressful area (M = 3.89, SD = 0.81), and experiences assessed with the "visual and sound aspects" subscale appeared as the least stressful aspect (M = 2.83, SD = 1.04). The PSS: NICU total score correlated significantly with maternal EDPE scores during hospitalization (rho = 0.31, $p < 0.01$). In addition, the subscales "appearance and behavior" and "visual and sound" had a positive and significant correlation with the EDPE score, rho = 0.30, $p < 0.01$ and rho = 0.22, $p < 0.05$, respectively.

Table 1. Sociodemographic characteristics of the sample

	% (N)
Maternal age	
18-24	22.4 (19)
25-34	58.8 (50)
> 35	18.8 (16)
Nationality	
Chile	81.2 (69)
Venezuela	9.4 (8)
Perú	8.2 (7)
Other countries in Latin America	1.2 (1)
Marital Status	
Married or lives with partners	77.7 (66)
Single	11.8 (10)
Other (divorced, doesn't live with partners)	10.6 (9)
Maternal education	
Incomplete schooling	8.3 (7)
Completed high school	31.8 (27)
Incomplete university or technical studies	21.2 (18)
Completed technical studies	14.4 (12)
Completed university studies	24.7 (21)

Table 2. Neonatal variables

Gestational age	33.20 (DS = 0.88) semanas
Birth weight	2.089.60 (DS = 428.48) g
Size at birth	44.14 (DS = 2.69) cm
Length of stay	18.87 (DS = 12.64) días
	% (N)
Small for gestational age	28.2 (24)
Immediate skin to skin	34.1 (29)
Skin-to-skin during hospitalization	60 (51)
Baby feeding	% (N)
Breast milk	4.7 (4)
Formula	9.4 (8)
Breast milk and formula	85.9 (73)

The stress experienced by the mothers related to their baby's appearance and behavior was associated with how the mothers related to their babies; thus, the score of this subscale presented a negative and significant correlation with the total score of the N-EOV-INC scale (rho = -0.24, $p < 0.05$). Similarly, negative and significant correlations were observed in this subscale (appearance and behavior) with the subscales that evaluate the interaction of mother and baby through the incubator, body function (body and tactile contact between both), visual (visual contact between the dyad), and verbal and postural (modification of posture in the interaction, approaching, or moving away) (Table 3). On the other hand, the duration time of skin-to-skin experiences between mother and newborn was positively correlated with the total score of the interaction scale (rho = 0.28, $p < 0.01$) and with the subscales of approach function (rho = 0.30, $p < 0.01$), contact through the incubator (rho = 0.31; $p < 0.01$), body (rho = 0.23; $p < 0.05$), and postural (rho = 0.31; $p < 0.01$).

When analyzing in greater depth the differences between the group of mothers who had skin-to-skin contact during hospitalization and those who did not, the Mann-Whitney test showed significant differences in the total score of the interaction scale (U = 457.50; z = -3.69; p = 0.00), where the mothers who had skin-to-skin showed greater contact and interaction with their babies (Mdn = 18, N = 34) than those who did not (Mdn = 14, N = 51). Similarly, dyads that had skin-to-skin contact showed a higher score on reciprocity in both the mother (U = 461.50, z = -3.67, p = 0.00) and the newborn (U = 503.50, z = -3.28, p = 0.01) interaction. In all subscales of the interaction assessment, except for the "verbal function", the skin-to-skin group dyads showed greater interaction (Table 4).

Finally, the group was divided between small for gestational age (SGA) and appropriate for gestational age (AGA) to assess whether this variable could affect the interaction. The Mann-Whitney U test showed a significant difference in the total score of the interaction scale (U = 473.00, z = -2.54, p = 0.01), where the group of mothers of SGA newborns presented a lower interaction with their children (Mdn = 14.5; N = 24) than the other group (Mdn = 17; N = 61). Reciprocity was also lower for mothers (Mdn = 12, N = 24) and newborns (Mdn = 10.5; N = 24) of the SGA group (U = 516.00, z = -2.12, p = .03; U = 472.50, z = -2.55, p = 0.01, respectively). Also, through this test, significant differences were identified in the visual function (U = 501.00, z = -2.37, p=0.02) and in the postural function (U = 427.00, z = -3.32, p = 0.00), where the group of dyads whose children were SGA showed lower interaction behaviors in these subscales (Table 4).

Table 3. Correlation between parental stress, depressive symptomatology, and dyads interactions

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Skin to skin during hospitalization													
2. Edimburg	-0.01												
3. PSS:NICU general score	0.05	0.17											
4. PSS:NICU total score	0.00	0.31**	0.51**										
5. Sights and sounds subscale	0.08	0.22*	0.47**	0.70**									
6. Infant behavior and appearance subscale	-0.10	0.30**	0.34**	0.81**	0.26*								
7. Parentak role subscale	0.11	0.14	0.30**	0.66**	0.18	0.49**							
8. Neovinc total	0.28**	-0.02	0.15	-0.10	0.19	-0.24*	-0.15						
9. Approach subscale	0.30**	-0.06	-0.12	-0.21	-0.02	-0.27*	-0.20	0.53**					
10. Incubator contact subscale	0.31**	0.11	-0.03	-0.10	0.04	-0.13	-0.10	0.40**	0.70**				
11. Corporal subscale	0.23*	-0.19	0.01	-0.06	0.14	-0.20	-0.10	0.70**	0.42**	0.41**			
12. Visual Subscale	0.21	0.00	0.22*	-0.02	0.19	-0.17	-0.17	0.86**	0.39**	0.27*	0.46**		
13. Verbal Subscale	0.02	-0.04	0.10	-0.13	0.11	-0.28*	-0.17	0.54**	0.13	-0.11	0.19	0.38**	
14. Postural subscale	0.31**	-0.04	0.10	-0.06	0.15	-0.24*	-0.10	0.75**	0.44**	0.33**	0.41**	0.54**	0.41**

Note: *p < 0.05, **p < 0.01, ***p < 0.001; N = 85. PSS:NICU: Parental Stressor Scale: Neonatal Intensive Care Unit.

Table 4. Mann Whitney test to assess differences in mother- baby interaction

Variables	Skin-to-skin during hospitalization					Small for gestational age				
	Yes *Mdn (Ranking)* N = 34	No *Mdn (Ranking)* N = 51	*U*	*z*	*p*	Yes *Mdn (Ranking)* N = 24	No *Mdn (Ranking)* N = 61	*U*	*z*	*p*
Total score (Neovinc)	18 (51.03)	14 (30.96)	457.50	-3.69	0.00	14.5 (32.21)	17 (47.25)	473.00	-2.54	0.01
Mother reciprocity	14 (50.95)	11.5 (31.07)	461.50	-3.67	0.00	12 (34.00)	13 (46.54)	516.00	-2.12	0.03
Baby reciprocity	13 (50.13)	10 (32.31)	503.50	-3.28	0.01	10.5 (32.19)	13 (47.25)	472.50	-2.55	0.01
Approach	2 (46.56)	2 (37.66)	685.50	-2.70	0.01	2 (38.63)	2 (44.72)	627.00	-1.70	0.09
Incubator contact	2 (45.43)	2 (39.35)	743.00	-2.20	0.03	2 (41.83)	2 (43.46)	704.00	-0.54	0.58
Corporal	2 (34.26)	2 (48.82)	570.00	-2.77	0.01	2 (38.35)	2 (44.83)	620.50	-1.13	0.26
Visual	6 (49.29)	5 (33.56)	546.00	-3.02	0.00	4.5 (33.38)	6 (46.79)	501.00	-2.37	0.02
Verbal	1 (45.69)	1 (38.97)	730.00	-1.33	0.19	1 (40.42)	1 (44.02)	670.00	-0.65	0.51
Postural	4 (49.63)	3 (33.06)	529.00	-3.38	0.00	3 (30.29)	4 (48.00)	427.00	-3.32	0.00

Note: results are statistically significant when p es < 0.05

Discussion

This study examined how having a moderate preterm newborn hospitalized in a neonatal unit may impact maternal mental health and dyad interaction. The results of this research show that mothers of moderate preterm newborns hospitalized in a neonatal unit may have significant depressive symptomatology, which is consistent with other studies in the area[17,33]. However, it is important to note that maternal depressive symptomatology during pregnancy has a positive association with preterm delivery, with having small for gestational age or low birth weight newborns, and with the continuity of symptomatology after delivery[34].

A positive correlation was observed between depressive symptomatology and stress experienced by the participants concerning the hospitalization. Although this relationship had already been described in studies conducted during hospitalization in mothers of preterm newborns, the results of this research confirm the relevance of evaluating and observing these variables in mothers of moderate preterm newborns, especially because of the implications that this may have in the long term on the interactions of the dyads[35-37].

Regarding the sources of stress, coinciding with our findings, a study in Chile showed that variables related to the parental role (i.e., not being able to care for, touch, and protect their babies) are associated with significant levels of stress; however, it was carried out with mothers of very low birth weight babies, which is a population at higher risk and vulnerability than the one involved in this study[26]. Research carried out in other countries coincides with the correlation between the alteration of the parental role and the well-being of the caregivers, which may be due to not being able to be with their babies, feed, support, and protect them[38].

The negative emotional experiences and stress experienced by caregivers, in addition to the characteristics of their premature newborns, can hinder the construction and development of the dyad's interactions[39]. Thus, as in this research, higher stress levels were associated with less interaction with their newborns. Mothers of preterm newborns may have difficulty recognizing and responding to their newborns' cues, leading to decreased interactions through touch, vocalizations, and gazes[40]. A study by Iono et al. (2017) evidenced that a sample of mothers of premature newborns had a greater tendency to withdraw from interaction with their newborns and was quieter[41]. This is relevant since parental emotional closeness with the hospitalized preterm newborn may be crucial for the newborn's well-being, the development of mutual regulation, the establishment of a positive affective relationship, and for parents to develop a greater sense of efficacy in caring for their newborn[42].

The results of this research show the importance of skin-to-skin contact as it could favor better interaction between mothers and their preterm newborns. Skin-to-skin contact has important benefits for the well-being and development of preterm newborns and their parents[43-46]. Longer periods of use of this strategy stimulate communication, interaction, and physical contact between the newborn and the mother, suggesting higher alertness of the newborn and better availability for interactions with the mother[47]. The use of the skin-to-skin strategy in neonatal units could be an effective intervention to reduce parental and neonatal stress, which at the same time could favor greater responsiveness and synchrony in the interaction of the dyad[48].

As this study shows, the interaction between mothers and their preterm newborns is affected by various factors. Thus, in the case of SGA babies, there is less interaction and reciprocity between the two, which could be related to the reciprocal influences between the baby's characteristics and the mother's emotional state. Studies have related depressive symptomatology in pregnancy with SGA childbirths, so these mothers could face emotional difficulties that could also impact their relationship with their baby[49]. Newborns within the SGA group are a more vulnerable group[50], so it is important to pay attention to the difficulties they may present in the interaction with their caregivers since a positive parenting environment can moderate some adversity in their development but also negative parenting can amplify the effect of the adversity[51].

This research allows us to come closer to understanding the implications of having a moderate preterm newborn. However, certain limitations are evident that can be considered in future studies. For example, the size and homogeneity of the sample and the fact that it only includes interactions between mothers and their babies and not those of the fathers. Therefore, to favor a complete understanding, it is relevant to include the father or the mother's partner. On the other hand, depressive symptomatology and stress were evaluated with self-report instruments, and a new observation scale was used for the interaction of the dyad. The participants correspond to a community and non-clinical sample and from the same health center. However, this study presents strengths such as using an observational instrument during hospitalization and having addressed a population that has been little studied.

In conclusion, we can point out that mothers of moderate preterm newborns also show an important emotional impact, especially at the level of depressive symptoms and high levels of parental stress, which can affect the interaction of the dyad. However, some elements could favor greater interaction and contact between mother and baby, such as skin-to-skin contact, which is a strategy that can bring benefits for both.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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