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Original Article

Stress levels and dimensions among mothers of newborns in Neonatal Intensive Care Units

Nível e dimensões do estresse de mães de recém-nascidos em Unidades de Terapia Intensiva Neonatal

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ABSTRACT

Objective: to assess the level and dimensions of stress among mothers of newborns admitted to neonatal intensive care units. **Methods:** this cross-sectional, analytical, exploratory study included 81 mothers. Data were collected using the *Parental Stress Scale: Neonatal Intensive Care Unit*, which had been translated, adapted, and validated for use with the Brazilian population. The scale comprises three dimensions: "Sights and Sounds," "Infant Appearance and Behaviour," and "Parental Role Alteration." Descriptive and inferential analyses were performed. **Results:** the "Sights and sounds" dimension showed the lowest levels of maternal stress, with means of 2.46 and 2.40 and a classification of low stress. The "Infant appearance and behavior" dimension indicated moderate stress (means: 3.40 and 3.21). Conversely, the "Parental role alteration" dimension showed the highest scores (means: 4.32 and 4.31), which indicates high stress. Overall, the mean was 3.43 (metric 1) and 3.32 (metric 2), which indicates moderate stress. **Conclusion:** mothers experienced high levels of stress, particularly related to parental role alteration. **Contributions to practice:** such findings highlight the need for strategies to identify and reduce maternal stress, which should promote greater parental involvement, improve communication, and provide emotional support within the neonatal intensive care environment.

Descriptors: Mothers; Stress, Psychological; Intensive Care Units, Neonatal; Infant, Newborn; Psychological Tests.

RESUMO

Objetivo: mensurar o nível e as dimensões do estresse de mães de recém-nascidos em Unidades de Terapia Intensiva Neonatal. **Métodos:** trata-se de um estudo transversal, de caráter analítico e exploratório, realizado com 81 mães. Os dados foram coletados a partir da *Parental Stress Scale: Neonatal Intensive Care Unit*, traduzida, adaptada e validada para a população brasileira, composta por três dimensões: sons e imagens, aparência e comportamento do bebê e alteração do papel parental. Utilizaram-se análises descritivas e inferenciais. **Resultados**: "Sons e imagens" apresentou os menores níveis de estresse materno (médias: 2,46 e 2,40), classificados como pouco estressantes. "Aparência e comportamento do bebê" indicou estresse moderado (médias: 3,40 e 3,21). Já "Alteração do papel parental" obteve os maiores escores (médias: 4,32 e 4,31), indicando estresse elevado. A média total foi de 3,43 (métrica 1) e 3,32 (métrica 2), caracterizando estresse moderado. **Conclusão:** as mães apresentaram estresse elevado, especialmente devido à alteração do papel parental. **Contribuições para a prática:** achados reforçam a necessidade de estratégias para identificar e reduzir o estresse materno, ampliando a participação dos pais, aprimorando a comunicação e oferecendo apoio emocional no ambiente da terapia intensiva neonatal.

Descritores: Mães; Estresse Psicológico; Unidades de Terapia Intensiva Neonatal; Recém-Nascido; Testes Psicológicos.

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Introduction

Pregnancy is generally a period of expectation for the family, particularly for the woman, who develops projections and plans centred on the forthcoming newborn[1]. These expectations help strengthen the initial bond and support preparation for the child's arrival. However, the birth of a high-risk newborn, often associated with complications during delivery, may require admission to a neonatal intensive care unit (NICU), an environment designed to provide specialised care and clinical stabilisation. The idealised image of a healthy child may be gradually disrupted, confronting parents with a reality characterised by uncertainty, vulnerability, and specific care demands[2].

Following admission, the NICU aims to provide intensive and specialised care to newborns in critical condition or at imminent risk of death. Such care requires appropriate infrastructure, advanced technology, and a qualified healthcare team. Admission to this unit is based on clinical criteria, including gestational age < 30 weeks, birth weight under 1,000 grams, acute respiratory failure, the need for mechanical ventilation, complex surgical procedures or immediate postoperative care, parenteral nutrition, and the use of essential life-support technologies such as monitoring systems, thermoregulation equipment, continuous infusion pumps, as well as diagnostic and therapeutic resources[2].

Worldwide, approximately 20-30 million newborns develop severe conditions each year that require hospital admission. Prematurity accounts for around half of these cases[3]. The leading causes of admission to the NICU are prematurity, followed by low birth weight, neonatal infections, respiratory disorders, perinatal asphyxia and congenital malformations[4].

The hospitalisation of a newborn, particularly in a NICU, can cause significant stress for families[5], as parents are often unprepared for early admission and separation from their child. This can lead to feelings of insecurity and helplessness[6]. Parental stress can be caused by several factors, such as prematurity, the technical nature of the unit, complex equipment, changes in parental roles, poor communication, and fear of negative outcomes[7].

In addition, environmental factors such as constant noise, intense lighting, and the circulation of unfamiliar health professionals further increase tension, as does the newborn's exposure to painful procedures. Physical separation from the mother, an inability to perform essential caregiving activities such as breastfeeding and skin-to-skin contact, and the transfer of basic care responsibilities to health care staff can lead to a sense of loss of control and increased stress[6-7].

Although advances in the care of premature newborns have significantly reduced morbidity and mortality, the support provided to families is still insufficient. Despite the implementation of family-centred care initiatives, using broader, interdisciplinary follow-up extending beyond the neonatal period is still needed, as are consistent support strategies to reduce parental distress[8].

Structured instruments are essential for measuring parental stress during a newborn's hospitalisation in a NICU. Although widely studied in other countries, maternal stress in NICU remains underexplored in Brazil using validated scales. The focus on mothers is justified by their greater presence alongside the hospitalised newborn and their increased exposure to the emotional and care-related demands of the NICU. Therefore, this study aimed to assess the level and dimensions of stress among mothers of newborns admitted to neonatal intensive care units.

Methods

Study design

This was a cross-sectional, analytical, exploratory study conducted in accordance with the recommendations of the STrengthening the Reporting of OBservational studies in Epidemiology statement.

Population, sample, and eligibility criteria

The study population comprised mothers of newborns admitted to a NICU. Eligible participants were those aged ≥ 18 years, literate, Portuguese-speaking as their first language, and who had visited their child in the unit at least once. Mothers with a prior diagnosis of emotional disorders, those using anxiolytic or antidepressant medication on a continuous basis, and/or those reporting use of drugs were excluded. No participants were excluded after data collection.

A non-probabilistic convenience sample was used, covering the period from November 2022 to March 2023. During this period, 92 mothers of newborns admitted to the unit met the eligibility criteria and were invited to participate at times of greater maternal presence in the unit, coinciding with the daily medical briefing. Of these, 81 mothers agreed to participate and comprised the final sample.

Study setting

The study was conducted in the NICU of a public referral maternity hospital located in the capital of the state of Piauí, Brazil. The institution provides high-complexity care to pregnant women, postpartum women, and newborns from both the capital and surrounding regions and is the largest maternity hospital in the state. It has a total capacity of 248 obstetric beds and 167 neonatal beds, accounting for approximately 63% of births in Teresina. The facility includes two NICUs with 30 beds, one Conventional Neonatal Intermediate Care Unit with 20 beds, and one Kangaroo Neonatal Intermediate Care Unit with 19 beds[9].

In the unit, parents have unrestricted access. Medical updates are provided daily from 16:00, when updated clinical information is communicated to family members. Between 16:00 and 17:00, one relative at a time, such as grandparents, is allowed to enter, while the presence of additional family members is subject to prior authorisation from the department of social services.

Measurement instrument

The Brazilian version of the Parental Stress Scale: Neonatal Intensive Care Unit (PSS:NICU) was used. This version was translated, adapted, and validated in 2009[10] based on the original instrument developed in 1993[11], which assesses parental stress in NICU settings. PSS:NICU comprises 26 items distributed across three subscales: Sights and Sounds (6 items), Infant Appearance and Behaviour (13 items), and Parental Role Alteration (7 items). It follows a Likert format ranging from 1 (not stressful) to 5 (extremely stressful) and includes the option "NA" (not applicable) when the situation was not experienced.

The scale can be analysed using three metrics: metric 1 (level of experienced stress), which calculates the mean only for experienced items; metric 2 (overall stress level), which considers all items and assigns a score of 1 to those marked as "NA"; and metric 3 (total number of experiences), corresponding to the number of experienced items across the three subscales[10]. In this study, responses were analysed using metrics 1 and 2.

Mean scores were interpreted according to their proximity to Likert scale points and classified as follows: not stressful (1.00-1.49), mildly stressful (1.50-2.49), moderately stressful (2.50-3.49), very stressful (3.50-4.49), and extremely stressful (4.50-5.00).

Data collection

After providing informed consent, participants were directed to a private room adjacent to the unit in order to ensure confidentiality. Data collection was conducted by the principal researcher and began with a structured interview to obtain sociodemographic and clinical characteristics. Subsequently, participants completed the Brazilian version of the PSS:NICU through self-administration, which took approximately 10 minutes. The researcher remained available for clarification without interfering with responses.

Data analysis

Data were entered and analysed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, N.Y., USA), with independent double data entry. Sample characteristics were analysed using descriptive statistics. Categorical variables were presented as absolute and relative frequencies, and quantitative variables as means and standard deviations (SDs).

PSS:NICU scores were described using means and standard deviations and analysed as continuous variables, as they represent aggregated scores from multiple items of a psychometric scale. Differences in stress levels between subscales and metrics were assessed using repeated-measures analysis of variance (ANOVA), with Bonferroni correction for multiple comparisons. Mean differences were estimated along with their respective 95% confidence intervals. A significance level of $p < 0.05$ was adopted.

Ethical considerations

Participation was conditional upon signing an informed consent form. The study is part of the broader project entitled "Perceived Parental Stress in Neonatal Units of a Public Referral Maternity Hospital". All ethical requirements were followed, and the study was approved by the Human Research Ethics Committee of the Universidade Federal do Piauí under Certificate of Presentation for Ethical Appraisal No. 63779522.9.0000.5214 and opinion No. 5,706,056/2022.

Results

A total of 81 mothers participated in the study, with a mean age of 28.1 years (standard deviation: SD = 6.5). Regarding sociodemographic characteristics, 59 (72.8%) were married or in a stable relationship, 60 (74.2%) identified as mixed race, 51 (63.0%) had completed secondary education, and 52 (64.2%) reported being Catholic. In terms of income, 36 (44.5%) reported having no income or earning up to one minimum wage. Additionally, 53 (65.4%) lived in a city different from that in which the study was conducted, 61 (75.3%) were not staying in their own homes during their child's hospitalisation, and 64 (79.0%) had no previous experience with admission to a NICU.

With regards to obstetric characteristics, 43 (53.1%) participants attended up to six antenatal consultations, and 52 (64.2%) were multiparous. The pregnancy had not been planned for 37 (45.7%) mothers. Caesarean section was the most frequent mode of delivery, occurring in 53 (65.4%) cases. Most births were preterm, accounting for 65 (80.2%) cases, with a mean gestational age of 32.1 weeks (SD = 4.4). Regarding reproductive history, 33 (40.7%) mothers had only one living child, who was hospitalised in the Neonatal Intensive Care Unit, while 60 (74.1%) reported no previous foetal losses.

Among the newborns, 41 (50.6%) were female. Birth weight below 1,500 grams was identified in 42 (51.9%) cases. Regarding birth conditions, 32 (39.5%) newborns had an Apgar score above 7 at the first minute and 59 (72.8%) at the fifth minute. During hospitalisation, 27 (33.3%) were receiving phototherapy, 36 (44.4%) were on invasive mechanical ventilation, and 48 (59.2%) were receiving exclusive parenteral nutrition or combined with enteral feeding.

Table 1 presents the descriptive analyses of the PSS:NICU items. In the "Sights and Sounds" subscale, most participants classified the situations as not stressful. The exception was the item "Seeing a machine (ventilator) breathe for my baby", which showed the highest proportion of responses classified as extremely stressful.

Table 1 – Distribution of maternal stress levels according to items of the Parental Stress Scale: Neonatal Intensive Care Unit (n = 81). Teresina, PI, Brazil, 2023

Items	1*	2†	3‡	4§	5‖	NA¶
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Sights and sounds						
The presence of monitors and equipment	37 (45.7)	11 (13.6)	8 (9.9)	12 (14.8)	13 (16.0)	–
The constant noise of monitors and equipment	27 (33.3)	16 (19.8)	11 (13.6)	11 (13.6)	15 (18.5)	1 (1.2)
The sudden noise of monitor alarms	24 (29.6)	15 (18.5)	11 (13.6)	10 (12.3)	21 (25.9)	–
Other sick babies in the room	54 (66.7)	7 (8.6)	5 (6.2)	8 (9.9)	6 (7.4)	1 (1.2)
The large number of people working in the unit	59 (72.8)	8 (9.9)	4 (4.9)	4 (4.9)	5 (6.2)	1 (1.2)
Seeing a machine (ventilator) breathe for my baby	15 (18.5)	10 (12.3)	4 (4.9)	10 (12.3)	30 (37.0)	12 (14.8)
Infant appearance and behaviour						
Tubes and equipment on or near my baby	21 (25.9)	11 (13.6)	15 (18.5)	10 (12.3)	24 (29.6)	–
Bruises, cuts, or lesions on my baby	10 (12.3)	5 (6.2)	11 (13.6)	12 (14.8)	30 (37.0)	13 (16.0)
My baby's abnormal colour (e.g. pale or yellow)	18 (22.2)	10 (12.3)	12 (14.8)	12 (14.8)	22 (27.2)	7 (8.6)
My baby's unusual or abnormal breathing	7 (8.6)	11 (13.6)	9 (11.1)	13 (16.0)	29 (35.9)	12 (14.8)
My baby's small size	25 (30.9)	11 (13.6)	15 (18.5)	9 (11.1)	10 (12.3)	11 (13.6)
My baby's wrinkled appearance	28 (34.6)	15 (18.5)	10 (12.3)	8 (9.9)	7 (8.6)	13 (16.0)
Seeing needles and tubes in my baby	9 (11.1)	10 (12.3)	10 (12.3)	9 (11.1)	42 (51.9)	1 (1.2)
My baby being fed through a vein or tube	14 (17.3)	9 (11.1)	11 (13.6)	16 (19.8)	30 (37.0)	1 (1.2)
When my baby appeared to be in pain	8 (9.9)	8 (9.9)	9 (11.1)	13 (16.0)	40 (49.4)	3 (3.7)
When my baby looked sad	4 (4.9)	10 (12.3)	10 (12.3)	12 (14.8)	40 (49.4)	5 (6.2)
My baby's limp and fragile appearance	14 (17.3)	12 (14.8)	5 (6.2)	13 (16.0)	35 (43.2)	2 (2.5)
My baby's restless and agitated movements	14 (17.3)	7 (8.6)	13 (16.0)	15 (18.5)	29 (35.8)	3 (3.7)
My baby not being able to cry like other babies	13 (16.0)	3 (3.7)	8 (9.9)	12 (14.8)	30 (37.0)	15 (18.5)
Parental role alteration						
Being separated from my baby	2 (2.5)	2 (2.5)	4 (4.9)	11 (13.6)	62 (76.5)	–
Not feeding my baby myself	1 (1.2)	4 (4.9)	9 (11.1)	18 (22.2)	49 (60.5)	–
Not being able to care for my baby myself (e.g. changing nappies, bathing)	3 (3.7)	6 (7.4)	9 (11.1)	17 (21.0)	46 (56.8)	–
Not being able to hold my baby when I want	4 (4.9)	2 (2.5)	8 (9.9)	16 (19.8)	49 (60.5)	2 (2.5)
Feeling helpless and unable to protect my baby from pain and painful procedures	1 (1.2)	3 (3.7)	6 (7.4)	12 (14.8)	59 (72.8)	–
Feeling unable to help my baby during this time	2 (2.5)	2 (2.5)	5 (6.2)	16 (19.8)	56 (69.1)	–
Not having time to be alone with my baby	13 (16.0)	5 (6.2)	13 (16.0)	11 (13.6)	39 (48.1)	–

*Not stressful; †Slightly stressful; ‡Moderately stressful; §Very stressful; ‖Extremely stressful; ¶Not applicable (items not experienced by the mothers)

In the "Infant Appearance and Behaviour" subscale, the response "extremely stressful" predominated in most items. However, the small size and wrinkled appearance of the newborn were predominantly rated as not stressful.

In the "Parental Role Alteration" subscale, extremely stressful responses predominated across all items. The highest scores were observed for the items "Being separated from my baby," "Feeling helpless and unable to protect my baby from pain and painful procedures," and "Feeling unable to help my baby during this time."

Table 2 shows the distribution of parental stress according to metrics 1 and 2. The "Sights and Sounds" subscale was classified as mildly stressful. The most stressful situations were "Seeing a machine (ventilator) breathe for my baby," "The sudden noise of monitor alarms," and "The constant noise of monitors and equipment," all classified as moderately stressful.

Table 2 – Mean levels of experienced and overall stress according to mothers' responses to the Parental Stress Scale: Neonatal Intensive Care Unit (n = 81). Teresina, PI, Brazil, 2023

Items	Experienced stress level	Overall stress level	95% CI*	p-value†
	Mean (SD)	Mean (SD)		
Sights and sounds	2.46 (0.68)	2.40 (0.59)	0.01-0.07	0.010
The presence of monitors and equipment	2.42 (1.56)	2.42 (1.56)		
The constant noise of monitors and equipment	2.64 (1.53)	2.62 (1.53)		
The sudden noise of monitor alarms	2.86 (1.60)	2.86 (1.60)		
Other sick babies in the room	1.81 (1.34)	1.80 (1.34)		
The large number of people working in the unit	1.60 (1.19)	1.59 (1.18)		
Seeing a machine (ventilator) breathe for my baby	3.43 (1.66)	3.07 (1.76)		
Infant appearance and behaviour	3.40 (0.51)	3.21 (0.52)	0.11-0.23	<0.001
Tubes and equipment on or near my baby	3.06 (1.58)	3.06 (1.58)		
Bruises, cuts, or lesions on my baby	3.69 (1.47)	3.26 (1.67)		
My baby's abnormal colour (e.g. pale or yellow)	3.14 (1.57)	2.95 (1.62)		
My baby's unusual or abnormal breathing	3.67 (1.42)	3.27 (1.62)		
My baby's small size	2.54 (1.45)	2.33 (1.45)		
My baby's wrinkled appearance	2.28 (1.38)	2.07 (1.35)		
Seeing needles and tubes in my baby	3.81 (1.47)	3.78 (1.49)		
My baby being fed through a vein or tube	3.49 (1.52)	3.46 (1.53)		
When my baby appeared to be in pain	3.88 (1.41)	3.78 (1.48)		
When my baby looked sad	3.97 (1.30)	3.79 (1.45)		
My baby's limp and fragile appearance	3.54 (1.59)	3.48 (1.62)		
My baby's restless and agitated movements	3.49 (1.51)	3.40 (1.56)		
My baby not being able to cry like other babies	3.65 (1.56)	3.16 (1.75)		
Parental role alteration	4.32 (0.30)	4.31 (0.30)	-0.01-0.03	0.161
Being separated from my baby	4.49 (0.89)	4.59 (0.89)		
Not feeding my baby myself	4.36 (0.95)	4.36 (0.95)		
Not being able to care for my baby myself (e.g. changing nappies, bathing)	4.20 (1.13)	4.20 (1.13)		
Not being able to hold my baby when I want	4.32 (1.09)	4.23 (1.20)		
Feeling helpless and unable to protect my baby from pain and painful procedures	4.54 (0.88)	4.54 (0.88)		
Feeling unable to help my baby during this time	4.51 (0.91)	4.51 (0.91)		
Not having time to be alone with my baby	3.72 (1.51)	3.72 (1.51)		
Total stress level	3.43 (0.83)	3.32 (0.84)	0.08-0.16	<0.001

*95% confidence interval of the mean differences between metrics; †Repeated-measures ANOVA

The "Infant Appearance and Behaviour" subscale indicated a moderate level of stress. The most stressful items were "When my baby looked sad," "When my baby appeared to be in pain," and "Seeing needles and tubes in my baby," all rated as very stressful (Table 2).

The "Parental Role Alteration" subscale showed the highest stress levels and was classified as very stressful. The most prominent items were "Feeling helpless and unable to protect my baby from pain and painful procedures," "Feeling unable to help my baby during this time," and "Being separated from my baby," all considered extremely stressful (Table 2).

When comparing the subscales of metric 1 with those of metric 2, statistically significant differences were observed between the "Sights and Sounds" and "Infant Appearance and Behaviour" subscales ($p < 0.05$). A significant difference was also identified in the comparison of total stress levels between the two metrics ($p < 0.001$), which indicates a moderate level of stress among participants across both metrics.

When comparing the mean scores of the subscales within each metric, a significant effect of the assessed dimension was observed in both analyses (Metric 1: $F(2,79) = 106.85$; $p < 0.001$; $\eta^2 = 0.730$; Metric 2: $F(2,79) = 115.68$; $p < 0.001$; $\eta^2 = 0.745$). Pairwise

comparisons with Bonferroni adjustment confirmed differences between all dimensions ($p < 0.001$), demonstrating a progression of scores from "Sights and Sounds" to "Infant Appearance and Behaviour," and subsequently to "Parental Role Alteration."

The 95% confidence intervals of the mean differences remained entirely distant from the null value and were narrow in width, supporting the precision of the estimates and the statistical robustness of the observed contrasts. These findings suggest that parental stress in NICUs follows a hierarchical dimensional structure, in which relational factors outweigh environmental stimuli.

Confidence intervals were not estimated for item-level comparisons within each metric due to insufficient variability in the differences, which precluded inferential calculation at this level. Therefore, analyses were conducted at the subscale level.

Discussion

For the mothers in this study, the "Parental Role Alteration" subscale showed the highest level of stress, as all its items recorded high proportions of "extremely stressful" responses, resulting in the highest mean scores (4.32 in metric 1 and 4.31 in metric 2). These findings are consistent with studies conducted in NICUs in small Brazilian cities (3.7)[12], in the state of Pernambuco (3.29)[13], in India (4.43)[14], and in Greece (3.63)[15], all of which identified this subscale as the most stressful. In contrast, in Poland, the highest mean score was observed in the "Infant Appearance and Behaviour" subscale (3.70)[16].

The high stress level observed in the "Parental Role Alteration" subscale may be related to the fact that this study included only mothers. Evidence indicates that mothers experience higher levels of stress than fathers across all three subscales of the PSS:NICU. This finding may be associated with cultural factors, social expectations linked to motherhood, and the mother's greater involvement in direct newborn care, partly facilitated by maternity leave[6].

At both national and international levels, parental role alteration is recognised as one of the main sources of maternal stress during neonatal hospitalisation. Mothers' emotional well-being is affected by the need to reorganise their role during hospitalisation, disruption of family routines, and the challenge of acquiring new knowledge and skills to care for a critically ill newborn. In addition, many mothers report assuming a secondary role in care since they often do not understand the technical language used in the NICU and perceive themselves as unable to perform complex care activities[2].

This situation is further exacerbated by the unpredictability of the newborn's clinical condition and by environmental limitations that may restrict essential practices such as holding, touching, or breastfeeding the baby, thereby intensifying feelings of helplessness and distress[17].

In this context, support from the healthcare team, combined with the implementation of family-centred care practices, plays a fundamental role in reducing parental stress by promoting greater parental involvement in care. Key actions that strengthen this approach include unrestricted parental access to the unit, respect for beliefs and values, active listening, clear and objective communication regarding the newborn's clinical progress, and encouragement of participation in decision-making and direct care. The adoption of these strategies contributes to reduced length of hospital stay, increased family autonomy, improved parental perception of the NICU experience, and reduced stress during hospitalisation[12].

Analysis of the items within the "Parental Role Alteration" subscale showed that the main sources of stress for mothers were "Being separated from my baby" and "Feeling unable to help my baby during this time." Research supports such findings, indicating that feelings of helplessness in the face of the newborn's pain and limitations in contributing to care are among the most stressful aspects for parents during hospitalisation[18]. Similarly, mother-infant separation is consistently identified as one of the most emotionally

impactful factors and is frequently classified as "very stressful"[12].

Separation between parents and newborns, often imposed by the NICU environment, is widely recognised as a major source of parental stress. During hospitalisation, mothers are frequently required to relinquish roles traditionally associated with motherhood, sharing caregiving responsibilities with health professionals. This dynamic may generate internal conflict and a sense of loss of the maternal role, particularly in the context of neonatal vulnerability. In addition, the newborn may initially show limited recognition of and response to the mother's presence, further intensifying emotional distress[18].

This experience can be understood considering the concept of family vulnerability[19], defined as a condition in which family members perceive a threat to their autonomy and role performance in response to a child's illness and hospitalisation. From this perspective, the maternal stress observed is not merely an isolated emotional response but reflects a broader relational and situational process influenced by the demands of the intensive care environment, clinical uncertainty, and changes in family dynamics.

This interpretation is consistent with the higher scores observed in the "Parental Role Alteration" subscale, indicating that limited participation in care and a perceived loss of control are central elements of the maternal experience in this context.

The "Sights and Sounds" subscale showed the lowest stress levels in both metrics and was classified as mildly stressful. Similar findings have been reported in studies conducted in Ukraine[20], Poland[16], Greece[15], and Brazil[12]. This pattern may reflect a process of perceptual desensitisation to the technological hospital environment, described in the literature as contextual cognitive adaptation, in which stimuli initially perceived as aversive come to be interpreted as necessary components of newborn care[20].

Within this subscale, "seeing a machine breathe for my baby" and "the sudden noise of monitor alarms" were identified as the most stressful items, a result also observed in another Brazilian study[12]. Situations in which technology highlights the newborn's dependence on intensive support may increase parental perception of vulnerability and clinical severity, thereby contributing to higher stress levels during hospitalisation[21].

The "Infant Appearance and Behaviour" subscale showed moderate levels of stress, consistent with findings reported in other studies conducted in NICUs[12,15,18]. However, the literature presents variability, with some studies classifying this subscale as mildly stressful[13], while others describe it as very stressful[16]. These differences may be related to clinical characteristics of the newborns and the severity of neonatal conditions, as factors such as lower gestational age, low birth weight, and the need for intensive support have been associated with higher levels of parental stress in this setting[20].

Within this dimension, the items "when my baby looked sad" and "when my baby appeared to be in pain" were identified as the most stressful, consistent with findings from another Brazilian study[12]. Signs perceived by mothers as indicating neonatal suffering are important triggers of parental stress during hospitalisation, as they reinforce feelings of helplessness and concern regarding the newborn's condition[22].

Conversely, "my baby's wrinkled appearance" showed the lowest stress level. A similar result was observed in another study, in which this item also had the lowest score in the subscale and was classified as not stressful[18]. This finding may indicate that some physical characteristics of the newborn are perceived as less stressful when compared with situations suggesting discomfort or suffering, such as behavioural changes or clinical signs associated with health status[20].

Analysis of the subscales revealed statistically significant differences among the three dimensions of the PSS:NICU across both metrics, consistent with findings from national research that also identified significant variation between subscales[23]. This result aligns with studies describing parental stress in NICUs as a multidimensional phenomenon influenced

by various factors, including the unit environment, the newborn's clinical condition, and limitations imposed on the parental role during hospitalisation[24].

Overall, parental stress was classified as moderate, in agreement with findings reported in other studies[12,18]. This level of stress may reflect the emotional impact of neonatal hospitalisation and the uncertainty surrounding the newborn's clinical course, particularly in the NICU context, where mothers must simultaneously cope with the infant's fragility, the technological environment, and restrictions on their parental role[25].

Study limitations

This study has some limitations. As a cross-sectional design, it does not allow causal relationships between variables to be established. In addition, data collection at a single time point may have influenced the observed stress levels, representing a potential prevalence bias, as participants may have been experiencing periods of greater emotional vulnerability and exposure to varying stress levels within the NICU environment. These factors may have influenced maternal perceptions of potentially stressful situations. Furthermore, it was not possible to quantify how many times mothers had visited their child in the unit prior to data collection, as only the criterion of at least one prior visit was considered. Finally, the study was conducted in a single maternity hospital and used convenience sampling, which limits the generalisability of the findings to other care settings.

Contributions to practice

The findings of this study have important implications for public health practice, neonatal nursing, and the management of intensive care units. They highlight the need for structured strategies to identify and manage maternal stress in NICUs, particularly stress related to parental role alteration and feelings of helplessness in response to the newborn's clinical condition. These results reinforce the importance of strengthening institutional policies focused on family-centred care, promoting greater parental involvement, ensuring clear communication, and providing supportive and empathetic care. The incorporation of these practices may enhance mother–infant bonding, reduce maternal distress, and improve the quality and humanisation of neonatal care.

Conclusion

This study demonstrated that mothers of newborns admitted to NICUs experience high levels of stress, with a distinct distribution across dimensions. The "Parental Role Alteration" subscale showed the highest scores, followed by "Infant Appearance and Behaviour" and "Sights and Sounds." The study advances the literature by empirically demonstrating the predominance of relational determinants over sensory stimuli in maternal-neonatal stress. Identifying this pattern reinforces the importance of systematically recognising and monitoring this construct in neonatal care in order to inform the planning of interventions aligned with identified needs.

Author contributions

Study conception and design or data analysis and interpretation: **Oliveira ETA, Gouveia MTO**. Manuscript drafting or critical revision of important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work related to accuracy or integrity: **Oliveira ETA, Costa MCS, Santos GPG, Dantas ALB, Costa GR, Gouveia MTO**.

Data availability

The authors declare that data supporting the findings of this study are fully presented within the article.

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