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Paediatrics Section

# Factors Influencing Maternal Stress during Infant's NICU Stay in a Tertiary Care Center, South Kerala, India: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Recent advances in neonatal medicine have helped sick babies survive. However, the birth of a baby needing Neonatal Intensive Care Unit (NICU) stay may be a significant source of stress for mothers.

**Aim:** To assess the maternal stress level perceived due to an infant's NICU stay and the factors influencing this stress.

**Materials and Methods:** The present cross-sectional study was conducted in the NICU of Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Kerala, India, between March 2021 and September 2021. The study included 74 mothers of infants requiring at least five days of NICU stay. The stress levels were recorded using the Parental Stressor Scale: NICU (PSS:NICU) questionnaire, which included 27 items under three stressor domains: Sights and Sounds (SS), Parental Role Alteration (PRA), and looks and behaviour of the baby. Data were statistically analysed using the Mann-Whitney U test and Kruskal-Wallis tests.

**Results:** In the study group, 33 (45%) mothers experienced moderate stress, 18 (24%) experienced a high level, and the remaining 23 (31%) experienced only low-level stress. The overall maternal stress perceived in the study group was found to be at a moderate level with a mean of 3.36±0.67. Factors causing stress in mothers included prematurity, low birth weight, low 1st-minute Appearance, Pulse, Grimace, Activity and Respiration (Apgar) score, expressed breastfeeding, and previous experience with abortion.

**Conclusion:** The present study found that mothers experienced moderate stress when their babies were admitted to the NICU. Significant stress was experienced by mothers when they were unable to perform their maternal duties.

**Keywords:** Breast feeding, Neonatal care, Neonatal intensive care unit, Stressors

## INTRODUCTION

The NICU, as a specialised care unit, ensures care for sick and preterm babies. For mothers, the birth of a baby who needs NICU stay may be a significant source of stress [1]. It is often an overwhelming experience for mothers walking into the NICU environment for the first time, as they are exposed to multiple stressors, including the baby's medical condition, preterm birth, the complexity of the NICU setting (machines, equipment, complex procedures), and the perceived vulnerability of the baby. The normal stress associated with new parenthood is compounded when the baby is admitted to the NICU [2].

The process of Maternal-infant Bonding (MIB), defined as the emotional tie of a mother to her baby, is gradually unfolding in the first year of a child's life [3,4]. This attachment begins during pregnancy, continues it develops completely after the child is born [5]. And is one of the most significant psychological processes for a mother in the postpartum period and the first year of a child's life, as it affects a child's healthy future development [6,7]. This concept of bonding is explained in literature, which examines the importance of early bonding with a newborn child [8]. Positive bonding corresponds with a child's healthy relationships and interactions with other people and determines the parenting of their children in the future [9,10].

Mothers may find it difficult to deal with the stress and worries they have in many ways [11]. This stress may interfere with making the best choices and contributing to the care of their infants. Additionally, they may seek help from others around them to cope with stress [12]. Unfortunately, caregivers, including nurses and doctors, are often unaware of this, which can leads to negative effects on the newborns, as well as, the mothers.

There is a dearth of literature on maternal stress when a newborn is admitted to a NICU in South India, especially in Kerala. It is essential to improve general awareness and sensitivity among medical caregivers and the general population regarding this issue, for which continuing research in this field is warranted. Hence, the present study was conducted to quantify the stress level perceived by mothers due to the NICU stay of their child and to identify the factors that can influence this stress level.

## MATERIALS AND METHODS

The present cross-sectional research was conducted at a Level III NICU in Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, South Kerala, India, between March 2021 and September 2021. The study commenced after obtaining written informed consent from the mothers and Institutional Ethics Committee clearance (Approval No: PIMSRC/E1/388A/38/2021).

**Inclusion criteria:** All mothers of infants requiring atleast five days of NICU stay were included in the study.

**Exclusion criteria:** Mothers of infants who required surgical interventions and had a past or present history of psychiatric disease were excluded from the study.

**Sample size calculation:** The sample size was calculated as 72 using the mean (x) and standard deviation (S) of maternal stress level due to NICU stressors from another Indian study conducted by Chourasia N et al., using the formula, $n=\{(Z(1-\alpha/2)\ S)/d\}^2$ [2].

$Z(1-\alpha/2)$=Confidence interval=1.96 (95%)

S=Standard deviation of reference study

D=Desired precision=5% of mean of reference study

Mean of reference study=4.12

Standard deviation of reference study=0.626

The study was planned for a period of around six months expecting to enroll around 72 participants. The current research included a total of 74 postnatal mothers who fulfilled the inclusion criteria.

### Study Procedure

Demographic characteristics, including possible factors that can influence maternal stress, were recorded on a proforma based on previous studies [1,2]. The PSS:NICU scale, formulated by Miles MS et al., was used to assess stress levels, which was first translated into the native language and then back-translated to English [13]. An updated version of this scale was obtained from correspondence with Miles MS et al., [13]. The updated scale was peer-reviewed and validated by subject experts and contained 27 items instead of the original 46 items across three major domains. A questionnaire was then formulated to analyse the influence of these 27 items under three principal components of PSS:NICU scale, which includes SS-06 items, Infant Look and Behaviour (ILB)- 11 items and -10 items. This questionnaire was given to mothers on day 05 of the infant's NICU stay. Mothers were asked to mark against each item according to the degree of stress felt in the situation described: 1- no stress, 2- little stress, 3- moderate stress, 4- very much stress and 5- extreme stress, and then quantification of stress was done based on the Likert scale as mild stress (1 to 2.9), moderate stress (3 to 3.9), and severe stress (4 to 5).

## STATISTICAL ANALYSIS

After data analysis, categorical data were displayed as frequency and percentage, while continuous data were presented descriptively (mean, standard deviation, median and range). The stress level was calculated for each factor and presented as mean±Standard Deviation (SD), and 95% confidence interval. The effect of infant and maternal characteristics on stress levels has been determined using the Mann-Whitney U or Kruskal-Wallis test. A p-value ≤0.05 was considered statistically significant.

## RESULTS

Out of total 74 study particpants, mothers experienced the highest level of stress in the PRA subscale (3.75±0.64), followed by looks and behaviour (3.51±0.72) and SS (2.84±0.66) subscales. Components of the subscales that caused the maximum stress in mothers were 'being separated from my baby' and 'not feeding my baby myself' [Table/Fig-1].

With increasing maternal age, mothers experienced significant stress in the SS subscale. Mothers aged above 36 years experienced higher stress than the younger age group. Infant's extreme low birth weight also caused a significant difference in the amount of stress perceived by mothers in the SS subscale. In the looks and behaviour subscale, mothers experienced more stress with respect to having a previous experience of abortion. Mothers also experienced higher stress in this subscale when their babies were premature and not directly fed. Factors like extreme prematurity, severely depressed babies, babies not being fed, and complications such as respiratory problems and seizures contributed to a higher stress level in the PRA subscale [Table/Fig-2].

| Domains | Mean±SD |
|---|---|
| **Domain 1: Sights and Sounds (SS)** | |
| **Components of domain** | |
| Monitors and equipment presence | 2.42±1.03 |
| Monitors and equipment constant noises | 2.65±1.07 |
| Sudden noises of alarms of monitor | 3.05±1.03 |
| Other sick infants in the room | 3.09±1.05 |
| Numerous nurses and doctors in the NICU | 2.45±1.12 |
| Having a ventilator for the baby to breathe | 3.39±1.33 |
| Mean score | 2.84±0.66 |
| **Domain 2: Looks and behaviour** | |
| **Components of domain** | |
| Tubes and equipment presence on/near the baby | 3.69±0.91 |
| Seeing needles and tubes being put on the baby | 3.95±1.02 |
| Babies' unusual colour (yellow/pale) | 3.41±0.94 |
| Babies' small size | 3.46±1.02 |
| Babies' wrinkled appearance | 3.30±1.10 |
| Baby nourished through a tube or intravenous line | 3.36±1.14 |
| The limp or weak appearance of the baby | 3.42±1.03 |
| Baby not crying like other babies | 3.31±1.16 |
| Jerky movements of the baby | 3.30±1.31 |
| Seeing baby in pain | 3.70±1.16 |
| Mean score | 3.51±0.72 |
| **Domain 3: Parental Role Alteration (PRA)** | |
| **Components of domain** | |
| Seeing my baby looking sick | 3.7±1.27 |
| Not feeding baby myself | 4.22±0.85 |
| Being separated from the baby | 4.23±0.93 |
| Inability to care for my baby myself | 3.91±0.92 |
| Inability to take my baby when I like | 4.15±0.81 |
| Feeling helpless about how to help my baby at this time | 4.05±0.91 |
| Feeling helpless and unable to protect my baby from painful treatments | 4.09±1.05 |
| Not having alone time to be with my baby | 3.64±1.05 |
| Sometimes forgetting how my baby looks like | 3.49±1.13 |
| Unable to share my baby with other family members | 3.36±1.14 |
| Feeling that workers are closer to my baby than I am | 2.41±1.24 |
| Mean score | 3.75±0.64 |
| Overall mean score | 3.36±0.67 |

**[Table/Fig-1]:** The perceived overall maternal stress level according to each component of all the domains of PSS:NICU scale.

In the present study, 30 (40.5%) mothers experienced a high level of stress in the PRA subscale, followed by 21 (28.4%) mothers perceiving a high level of stress in the looks and behaviour subscale, and only 3 (4.1%) were in the SS subscale [Table/Fig-3].

## DISCUSSION

Maternal stress in the event of an infant's admission to the NICU is often an unnoticed entity among health professionals, and there is a dearth of literature regarding the stress experienced by

| Parameters | | n (%) | Sight and sound | | Looks and behaviour | | Parental Role Alteration (PRA) | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean score | p-value | Mean score | p-value | Mean score | p-value |
| Age (in years) | ≤25 | 21 (29) | 2.68 | **0.002** | 3.55 | 0.924 | 3.90 | 0.192 |
| | 26-35 | 45 (61) | 2.78 | | 3.48 | | 3.64 | |
| | >35 | 8 (10) | 3.58 | | 3.52 | | 3.96 | |
| Education | High school | 25 (34) | 2.81 | 0.242 | 3.58 | 0.567 | 3.75 | 0.81 |
| | Graduate | 23 (31) | 2.86 | | 3.59 | | 3.76 | |
| | Medical professional | 16 (21) | 2.89 | | 3.48 | | 3.88 | |
| | Non medical professional | 10 (14) | 3.06 | | 3.43 | | 3.64 | |
| Profession | Private job | 30 (38) | 2.93 | 0.248 | 3.45 | 0.682 | 3.75 | 0.902 |
| | House wife | 44 (62) | 2.75 | | 3.52 | | 3.73 | |
| Gravida | Primigravida | 49 (66) | 2.78 | 0.338 | 3.49 | 0.754 | 3.75 | 0.955 |
| | Multigravida | 25 (34) | 2.94 | | 3.54 | | 3.76 | |
| Previous loss of baby | Yes | 4 (5) | 2.75 | 0.777 | 3.91 | 0.253 | 4.00 | 0.431 |
| | No | 70 (95) | 2.85 | | 3.49 | | 3.74 | |
| Previous experience with abortion[#] | Yes | 8 (32) | 3.04 | 0.372 | 4.03 | **0.027** | 4.01 | 0.226 |
| | No | 17 (68) | 2.81 | | 3.44 | | 3.72 | |
| Previous experience of NICU | Yes | 9 (36) | 2.87 | 0.894 | 3.58 | 0.733 | 3.88 | 0.5.2 |
| | No | 16 (64) | 2.83 | | 3.49 | | 3.73 | |
| Type of pregnancy | Singleton | 68 (92) | 2.87 | 0.229 | 3.48 | 0.439 | 3.74 | 0.518 |
| | Twins | 6 (8) | 2.52 | | 3.72 | | 3.91 | |
| Mode/type of feeding | Direct breastfeed | 32 (43) | 2.71 | 0.347 | 3.22 | **0.003** | 3.55 | **0.028** |
| | EBM by pallada/tube | 39 (53) | 2.93 | | 3.68 | | 3.88 | |
| | NPO | 3 (4) | 3.00 | | 4.30 | | 4.30 | |
| **Parameters** | | **n (%)** | **Sight and sound** | | **Looks and behaviour** | | **Parental Role Alteration (PRA)** | |
| | | | **Mean score** | **p-value** | **Mean score** | **p-value** | **Mean score** | **p-value** |
| Birth weight | Large for gestational age | 1 (1) | 3.33 | **0.027** | 3.63 | 0.472 | 4.40 | 0.363 |
| | Appropriate for gestational age | 27 (36.5) | 2.84 | | 3.31 | | 3.60 | |
| | Low birth weight (<2500 gm) | 28 (37.8) | 2.80 | | 3.58 | | 3.83 | |
| | Very low birth weight (<1500 gm) | 14 (19) | 2.60 | | 3.62 | | 3.71 | |
| | Extremely low birth weight (>100 gm) | 4 (5.4) | 3.79 | | 3.86 | | 4.12 | |
| Gestational age | Term | 27 (37) | 2.78 | 0.309 | 3.22 | 0.068 | 3.50 | **0.029** |
| | Late preterm (33w-37w) | 30 (40) | 2.80 | | 3.63 | | 3.94 | |
| | Very preterm (29w-32w) | 15 (20) | 2.92 | | 3.70 | | 3.74 | |
| | Extremely preterm (<28w) | 2 (3) | 3.66 | | 4.00 | | 4.35 | |
| Apgar score | (0-3) | 7 (10) | 3.16 | 0.131 | 3.83 | 0.094 | 4.21 | **0.039** |
| | (4-6) | 15 (20) | 3.03 | | 3.76 | | 3.92 | |
| | (7-10) | 52 (70) | 2.74 | | 3.39 | | 3.64 | |
| Reason for admission | Respiratory problems | 53 (72) | 2.90 | 0.218 | 3.59 | 0.121 | 3.86 | 0.015 |
| | Prematurity | 46 (62) | 2.88 | 0.456 | 3.68 | **0.006** | 3.91 | **0.006** |
| Associated commodities | Seizures | 8 (11) | 3.22 | 0.081 | 3.83 | 0.182 | 4.22 | **0.026** |

**[Table/Fig-2]:** Maternal stress level in relation to various demographic parameters.
[#]Data was considered for multigravida only; The p-value in bold font indicates statistically significant value

| Stress levels | DOMAINS | | | p-value |
|---|---|---|---|---|
| | Sights and sounds | Looks and behaviour | Parental Role Alteration (PRA) | |
| | n (%) | n (%) | n (%) | |
| Low (1.0-2.9) | 39 (52.7) | 21 (28.4) | 8 (10.8) | **0.001** |
| Medium (3.0-3.9) | 32 (43.2) | 32 (43.2) | 36 (48.6) | |
| High (4.0-5.0) | 3 (4.1) | 21 (28.4) | 30 (40.5) | |

**[Table/Fig-3]:** The frequency of perceived stress in every domain of PSS: NICU scale.

NICU mothers in South India. Kerala has a significant population of educated, working and professionally trained mothers, with a significant proportion of them working in the healthcare sector. This may be the first research on this significant subject to be conducted in Kerala, India.

In the present study, the mean overall stress of mothers is 3.36±0.67, which indicates a moderate level of stress. This was comparable with another Indian study by Agrawal R and Gaur A, who found that the NICU environment for mothers is moderately stressful, with

an overall mean stress of 2.73±0.334 [14]. Total 45% of mothers experienced moderate stress, 24% experienced high stress, and the remaining 31 percent experienced low-level stress. The highest mean score of maternal stress was in the parental role modification subscale (3.75±0.64), where 30 (40%) mothers experienced a high stress level. This was followed by the looks & behaviour subscale (3.51±0.72), where 21 (30%) mothers perceived higher levels of stress. The mean score of stress perceived for the sights and sounds subscale was low (2.84±0.66). However, in a study done in Sri Lanka by Umasankar N and Sathiadas MG, the maximum stress faced was in the 'sight and sound subscale' followed by PRA. Apart from this, most studies have found significant stress lying in the PRA subscale [15,16].

This understanding can aid the present study NICU staff and doctors in formulating specific interventions like counseling by emphasising more on the components of the subscales where mothers experience more stress. In the present study Institute NICU, the alarm volume low for the equipment and monitors have been to the lowest possible level, which may be the reason why the NICU mothers did not experience significant stress in the SS of the NICU subscale.

The components of the PRA with maximum stress experienced were 'being separated from my baby' and 'not feeding my baby myself'. This reiterates the fact that mothers experience separation anxiety when their babies are taken away from them while being admitted to the NICU. Mothers also experience severe stress being unable to breastfeed their babies when compared to mothers of healthy infants admitted to wards. Mothers may remain stress-free, if they are allowed to spend more time with their babies and start direct breastfeeding earlier.

In the present study, any previous experience of abortion had caused a significant stress level in the area of behaviour and appearance of the baby (p-value=0.027). This shows that mothers who had the previous traumatic experience of pregnancy loss have experienced stress on seeing their infant's condition. A Turkish study by Çekin B and Turan T, also found that parents who had faced a stressful event in the previous year were linked with high stress in the NICU environment [11]. Mothers who expressed breast milk instead of directly feeding their babies showed an association with stress in the PRA subscale (p-value=0.028).

The stress produced by modification in the parental role is more in mothers of infants who were born prematurely (p-value=0.029), with a low Apgar score (p-value=0.039). Premature babies inevitably require NICU stay due to their inability to thrive independently. This was comparable to a study where mothers have been shown to perceive their premature infant as more difficult compared to fathers, at admission and discharge [17]. Premature infants with conditions like Hyaline membrane disease might be ventilated and on parenteral nutrition for a long period, thereby disrupting the performance of parental duties.

Reasons for admission to NICU that caused stress in mothers due to PRA are prematurity (p-value=0.006), respiratory problems (p-value=0.015), and seizures (p-value=0.026). It is evident that in all these conditions, the role of a mother in performing her duties to her infant is altered, for example, she will be unable to nurse and feed the baby, unable to hold the baby whenever they want, do the baby's daily requirements by her own, and unable to share the baby with others/relatives.

Interestingly, maternal characteristics like primigravida/multigravida, mode of delivery, mode of conception, educational qualification, employment status, previous experience of the NICU environment and twin pregnancy did not significantly affect maternal stress levels. These findings are consistent with those of previous studies.

### Limitation(s)

Being a single-centre study, the numbers were limited to satisfy the minimum sample size. Additionally, the study did not measure the father's stress or experience in the same situation. These may be some of the limitations of the present study.

## CONCLUSION(S)

The present study found that mothers experienced moderate stress due to many factors when their babies were admitted to the NICU. Significant stress was experienced by mothers when they were unable to perform their maternal duties. This points out the necessity for a proper support system for mothers in a NICU setting, encouraging counseling, making them competent, and thereby enabling them to perform maternal duties with ease. Confounding factors like postpartum blues or depression in mothers may often go unrecognised and can be avoided by using other scales or tools in future studies which can assess postpartum blues or depression along with the PSS:NICU scale.

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