

# BMJ Open Stress and its associated factors in mothers with preterm infants in a private tertiary care hospital of Karachi, Pakistan: an analytical cross-sectional study

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## ABSTRACT

**Objectives** This goal of this research is to present a comprehensive method for evaluating stress and the factors that contribute to it in mothers of premature babies.

**Design** Analytical cross-sectional study.

**Setting** Data were collected from inpatient service for preterm infants including neonatal intensive care unit, and neonatal step-down units of the Aga Khan University Hospital—a private tertiary care hospital in Karachi, Pakistan.

**Participants** Mothers aged 18 years and above who delivered preterm infants (gestational age of preterm below 37 weeks) in a private tertiary care hospital in Karachi, Pakistan.

**Primary outcome** Stress in mothers of preterm infants.

**Results** 200 participants with a mean age of 30.12 years (SD ±5.21) were assessed. The level of stress identified using the perceived stress scale (PSS) among mothers who had delivered preterm infants was significantly higher as compared with other countries around the world. Based on the criteria of PSS scoring, the majority of the participants (92%, n=184) were categorised as having high perceived stress and 8% (n=16) of the mothers fell into the category of moderate stress.

**Conclusions** The study findings suggest high levels of perceived stress among mothers of preterm infants. The factors associated with the stress among mothers of preterm infants included immunisation of newborn, education and occupation status of mothers, substance abuse by mother, gender preference from family, planning for further children, consumption of balance diet, education status of husband, mode of socialisation, years of marriage and hours of sleep.

## INTRODUCTION

In the context of obstetrics, ‘preterm’ refers to delivery of an infant prior to the completion of 37 weeks of pregnancy.<sup>1</sup> Compared with term newborns, preterm infants have different needs. Preterm babies are more likely to experience infections, hypothermia,

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This is the first study that assessed level of stress among mothers of preterm infants in Karachi, Pakistan.
- ⇒ The self-developed questionnaire used in the study was approved by the experts after achieving satisfactory rating in content validity index.
- ⇒ The perceived stress scale (PSS) tool used in the study has been validated nationally and internationally in various languages.
- ⇒ The PSS tool has been administered to similar groups of participants as in the current study.
- ⇒ This study was conducted in a private hospital; therefore, the sample size cannot be generalised for government settings.

poor suck reflex, difficulty feeding, effort to gain weight, and impaired lung maturation.<sup>2</sup>

Preterm births are escalating, globally. Each year, approximately 15 million newborns are delivered preterm globally.<sup>3</sup> One of the reasons for the substantial prevalence of neonatal deaths is preterm births, which accounts for 28% of all neonatal deaths worldwide.<sup>4</sup> Almost 45% of the children who die below the age of 5 years are newborns; among these 60%–80% are those born prematurely.<sup>2</sup>

Pakistan is determined to work on this challenging issue, as Pakistan is ranked third in the world for neonatal mortality and accounts for about 7% of the universal neonatal death.<sup>5</sup> Moreover, the high burden of neonatal morbidity and mortality rates in the nation can be attributed to preterm births. The prevalence of neonatal mortality in Pakistan is such that for every 1000 live births, there are 42 neonatal deaths.<sup>6</sup> Furthermore, to achieve Sustainable Development Goal 3.2, which states to reduce neonatal and below 5 mortalities, the matter of preterm births needs to be addressed. Among the four provinces

of Pakistan, Balochistan has the highest prevalence of neonatal mortality at 63 deaths per 1000 live births.<sup>6</sup>

Stress can be described as an innate response of an individual to undesirable circumstances that disturbs the body's equilibrium and stability.<sup>7</sup> Stress on the birth of preterm infants produces physical and psychological stressors for both the newborn and the mothers. The need for intensive care treatments, feeding difficulties and low birth weight are among the physical challenges for preterm infants. These physical problems for the newborn often lead to psychological impacts on the health of the mothers as well. Preterm infants may have enduring effects of prematurity, preoccupation with the survival of the newborn leading to the development of stress, depression and post-traumatic stress disorders in mothers.<sup>8</sup> The mother-child bond is at risk when a preterm infant is born because of the early detachment of the infant from the mother, due to the aggressive treatment requisites for the newborn. A mother's stress stemming from a particular course of treatment for her preterm infant hinders the development of a stable parent-child bond.<sup>9</sup>

The incidence of postpartum depression in Pakistan is 63.3%.<sup>10</sup> Preterm births potentially create disturbing effects on the newborn, while simultaneously initiating distressing challenges for the mothers. These difficult challenges account for the advancement of stress resulting in high levels of depression in some mothers.<sup>11</sup> Furthermore, this challenging issue makes the mother of a preterm more prone to mental instabilities, in contrast to mothers of term babies. The incidence of stress in mothers of preterm infants is as elevated as 30%–40% in contrast to 6%–12% in mothers with infants born at the completion of the gestational period.<sup>12</sup> In the initial post-natal period, mothers of preterm infants have been found to have more stress and depression than mothers of term babies.<sup>10</sup>

A multitude of factors contribute to the upsurge in stress experienced by mothers of preterm newborns. According to a research conducted in India, hospitalisation of the child in the critical care setting, socio-economic status and environmental support in the hospital setting for the mothers and the newborn are frequently associated with stress in mothers of preterm infants.<sup>13</sup>

This study is important because the identification of stressors can lead to careful planning for the interventions and prevention programmes for mothers of premature babies, in the future. This research potentially facilitates the accomplishment of the Sustainable Development Goal 3, by reducing maternal and infant mortalities and morbidities.

## METHODOLOGY

### Study design

The analytical cross-sectional study design was employed to identify stress and its associated factors among mothers of preterm infants. The analytical cross-sectional study design is beneficial when the plan of the study is to

identify the prevalence of a problem, its associated factors and the association between exposure and outcome.<sup>14</sup> To ascertain an association between the level of stress, and its associated factors, an analytical cross-sectional study design was considered relevant for this study.

### Sampling method

A consecutive sampling method was used for selecting participants. Consecutive sampling involves enlisting a group of people from the available population that meets the eligibility criteria over a particular period. Consecutive sampling is an enhanced approach as it minimises bias in the study, as compared with the convenience sampling method.<sup>14</sup>

### Sample size

The sample size of the study must be preplanned, systematically considered and adequately large to depict the population.<sup>15</sup> The sample size was calculated using the OpenEpi software.

#### Sample size for the prevalence of stress among mothers of preterm infants

The prevalence of stress among mothers of preterm infants was reported to be 75%.<sup>16</sup> The reported prevalence of stress was used to calculate the sample size, with a 95% CI, 10% room for error and a non-response rate of 10% was also adjusted. To achieve the study objective, the final sample size was determined as 73+7, that is, 80.

#### Sample size for determining the associated factors of stress among mothers of preterm infants

The sample size was also calculated for associated factors by considering the prevalence of comorbidities in mothers of preterm infants. The prevalence of comorbidities among mothers of preterm infants was 38.41% and for mothers of term infants was 20.76%.<sup>17</sup> Considering the proportions, with a study power of 80%, a 95% CI, two-sided hypotheses, a 1:1 ratio for unexposed and exposed groups and an estimated prevalence ratio of 1.8, the approximate sample size was calculated to be 213. Adding a 10% non-response rate, that is, 21, the final sample size was 234.

Since the required sample size for studying the associated factors of stress among mothers of preterm infants was 234, this sample size was planned for the study. However, during data collection, due to the non-availability of mothers in the neonatal intensive care unit (NICU), a sample size of 200 was ultimately achieved.

### Recruitment process of participants

The selection of relevant participants is fundamental for the correct interpretation of the population in a study.<sup>18</sup> First, permission for the research was taken from the Chief Medical Officer of the Aga Khan University Hospital.

After getting the required permissions, the recruitment process of participants was started. The researcher approached the participants in the NICU and neonatal step-down units. In addition, the researcher evaluated

the participants based on eligibility criteria with the help of the patient's medical record numbers. After screening the relevant participants, the researcher shared the aim of the study with the participants. Moreover, the benefits of the study were also explained.

### Study period

This quantitative analytical cross-sectional research study was completed over a 5-month period, from December 2022 to April 2023.

### Study variables

Stress levels among mothers of preterm infants were the dependent variable of the study. The stress levels among mothers were assessed using the perceived stress scale (PSS). This scale measures the overall level of stress by assessing control over oneself and life circumstances, personal confidence and the ability to manage important aspects of life. The scores from the scale were examined in the research study.

The factors associated with the stress among mothers of preterm infants were considered the independent variables in the study. The following were the independent variables of the study:

- ▶ Newborn's information
- ▶ Mother's demographic data
- ▶ Pregnancy-related variables
- ▶ Family information
- ▶ Coping mechanisms

### Data sources

Demographic data were obtained from the medical records, which were accessed through confidential files and the hospital's electronic system, considering both the mother and the newborn. Additionally, a study-specific self-developed questionnaire, which included components of demographic data for both mothers and newborns, was used. Moreover, pregnancy, family and coping-related variables were also included. Furthermore, the PSS was used to collect data from the mothers.

### Eligibility criteria

Defining the inclusion and exclusion criteria for the study participants enhances the reliability of the results and reduces the likelihood of recruiting inappropriate participants.<sup>19</sup> The participants for the study were selected based on the below mentioned inclusion and exclusion criteria.

#### Inclusion criteria

The inclusion criteria of a study define the key characteristics that potential participants must possess; these criteria include demographic factors and other relevant characteristics related to the study.<sup>20</sup> The inclusion criteria for this study included:

- ▶ Mothers aged 18 years and above.
- ▶ Gestational age of preterm below 37 weeks.
- ▶ Mothers who were willing to participate and give consent.

#### Exclusion criteria

The exclusion criteria of the study specify the subjects who meet the inclusion criteria but possess other characteristics that are not favourable for the study and need to be excluded.<sup>20</sup> The exclusion criterion for this study included:

- ▶ Mothers who could not communicate in Urdu or English.

#### Data collection tool

Data collection tools must be validated by the researcher prior to use to ensure their appropriateness in a particular context to minimise any bias.<sup>15</sup> An internally developed questionnaire was used for the data collection. This tool included components regarding demographic data for mothers and newborns. Moreover, pregnancy, family and coping-related variables were also included. Furthermore, the PSS was also integrated into the questionnaire.

The study-specific tool was reviewed using a CVI, where four experts in the concerned field were approached. Each expert rated the questions in the questionnaire for relevance and clarity, giving marks out of 4. The rating scale ranged from 1 (not relevant or not clear) to 4 (very relevant and very clear). After the experts' evaluations, the results were combined; the relevance score was 0.86 and clarity score was 0.92, both of which are considered satisfactory.

The PSS is a widely used functional tool for assessing stress among individuals experiencing difficult circumstances. This tool has been validated in the Pakistani context for evaluating stress levels among individuals.<sup>21</sup> This tool consists of 10 items, where participants rate their emotions and mindset in relation to the events and circumstances they experienced in the past month. Each item is rated on a 5-point Likert scale, ranging from 0 (never) to 4 (very often). Six items are negative (1, 2, 3, 6, 9, 10), and the remaining four are positive (4, 5, 7, 8). To calculate the score, the four positive items are reverse-scored, and then all the items are summed, with a total score ranging from 0 to 40. This scoring system includes three levels: 0–13 (low stress), 14–26 (moderate stress) and 27–40 (high perceived stress).<sup>22</sup> A higher score indicates an elevated level of stress.

#### Internal consistency

The internal consistency of the measuring tool is determined by the inter-relationship of all items developed for measurement within the tool.<sup>23</sup> The internal consistency is assessed using Cronbach's alpha. The Cronbach's alpha value for the total perceived stress score is 0.87, indicating acceptable internal consistency.<sup>24</sup> In the current study, the calculated Cronbach's alpha for the PSS tool is 0.70, which is considered satisfactory.

#### Construct validity

Validity reflects whether the assessment tool measures the attributes it is intended to measure.<sup>22</sup> The construct validity of the tool was evaluated, and the factor structure was

assessed to determine whether the associations between the different variables in the tool accurately measure the intended construct. The test-retest reliability score ( $r$ ) for the total perceived stress score is 0.86.<sup>24</sup> This value indicates satisfactory construct validity of the tool.

### Data analysis plan

Data analysis was conducted using the SPSS version 22. Both descriptive and inferential analyses were performed in the study.

### Descriptive analysis

Descriptive analysis is a method used to portray the data in a comprehensive manner, examining the patterns and relationships within the data in the research study.<sup>25</sup> Demographic variables of the study, including categorical data, frequencies and proportions, were analysed using descriptive analysis. Continuous data were analysed by calculating the mean and SD. The level of stress among mothers of preterm infants, as assessed through the questionnaire, was categorical in nature, and reported using frequencies and percentages.

### Inferential analysis

The inferential analysis is used to determine the consistency of outcomes regarding a population, based on the data collected from the sample in the research study.<sup>25</sup> Inferential analysis of the study findings was initially carried out by differentiating between categorical and continuous variables. Analysis was further conducted using the  $\chi^2$  test for the categorical variables and the t-test for two independent samples for continuous variables. During the analysis, a 95% CI and a p value of <0.05 was considered statistically significant.

### Ethical considerations

Ethical considerations are important throughout the research process. Participants were informed of their right to withdraw from the study at any time before the data coding was complete. They were assured that withdrawal from the study would not affect their treatment process. Additionally, the informed consent form was provided in both English and Urdu to ensure that participants fully understood the process. Furthermore, it was explained to the participants that participation in the study was voluntary and that no incentives would be provided for participating in the study.

The privacy and confidentiality of the study participants were considered important, and the survey was conducted in separate rooms. The data were accessible only to the primary investigator, supervisor and committee members of the research study. It was stored in both soft and hard formats. The hard copies were kept by the primary investigator and stored under lock and key. The soft copies were saved using password protection. For publication of the research study, the data will be presented in a deidentified manner. In addition, participants were assigned codes in the data entry system to protect their identities.

**Table 1** Sociodemographic characteristics of mothers of preterm infants (n=200)

Variables	Frequency (n)	Percentage (%)
Age (in years)	30.12	5.21
Monthly income in PKR	109 250.00	21 027.32
Language spoken		
Urdu	165	82.5%
Sindhi	19	9.5%
Other languages	16	8%
Educational status		
Below matriculation	5	2%
Matriculation	48	24%
Intermediate	47	23.5%
Graduate	80	40%
Postgraduate and above	20	10%
Substance abuse		
Yes	18	9%
No	182	91%
Occupation status		
Housewife	167	83.5%
Working	33	16.5%
Satisfaction with financial status		
Yes	179	89.5%
No	21	10.5%

PKR, Pakistani rupee.

### Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research. Research question and outcome measures were not informed by patients' priorities, experiences and preferences. Patients were not involved in the design and recruitment of this study. Moreover, results will be disseminated through publication in a reputable journal. Randomised controlled trials were not used in this study.

## RESULTS

### Descriptive analysis

A total of 200 mothers who delivered preterm infants were recruited for the study. For descriptive analysis, continuous variables were summarised using mean and SD. The categorical variables were reported as frequencies and percentages.

### Sociodemographic characteristics of the mothers of preterm infants

The sociodemographic characteristics of the mothers who delivered preterm infants are illustrated in [table 1](#). The mean age of these mothers was 30.12 years (SD  $\pm 5.21$ ), with ages ranging from 18 to 44 years. The majority of the



participants were Urdu-speaking, accounting for 82.5% (n=165).

Most of the mothers, approximately 97% (n=195), had completed their education, ranging from matriculation to postgraduate level and beyond. The use of substances such as betel nuts and other forms of substance was reported by 9% (n=18) of the mothers. Around 16.5% (n=33) of the mothers were employed, while nearly 83.5% (n=167) were housewives. The household income was treated as continuous data, with a mean of 109 250.00 PKR (SD  $\pm$ 21 027.32), ranging from 50 000 to 160 000 PKR. Most of the mothers, approximately 89.5% (n=179), were satisfied with their financial status.

#### Obstetric and gynaecological characteristics of mothers of preterm infants

Among the mothers who delivered preterm infants, the average gestational age was 33.26 weeks (SD  $\pm$ 2.86). Nearly 70.5% (n=141) of the mothers had experienced multiple pregnancies, and 38.5% (n=77) had one child. More than half of the study participants (59.5%, n=119) reported that during their pregnancy, their other children were taken care of by their family members. Almost 73% (n=146) of the mothers reported that their current pregnancy was planned. More than half of the participants (53%, n=106) reported that they planned to have more children. Gender preference within the family was reported by nearly 45.5% (n=91) of the participants, with 42.5% (n=85) expressing a preference for male child, and only 3% (n=6) expressing a preference for a female child.

About 12% (n=24) of the mothers had fertility and gynaecological issues, including polycystic ovary syndrome, uterine fibroids, bicornuate uterus and anovulatory infertility. All of the study participants had experienced a complication during their current pregnancy. The most common complication was preterm labour, reported by 30.5% (n=61) of the mothers. The mode of delivery was predominantly caesarean section, with 81% (n=162) of the mothers undergoing a cesarean delivery. A history of previous complications was also noteworthy, with 33% (n=66) of participants having experienced a miscarriage, 13.5% (n=27) having had preterm deliveries, 6.5% (n=13) reporting intrauterine deaths (IUD) and 2.5% (n=5) having experienced an abortion. More than half of the study participants (62.5%, n=125) started their antenatal visits during the initial weeks of pregnancy.

Nearly 64% (n=128) of the participants reported that they had completed their immunisation. Nearly all the study participants (96%, n=192) had conceived naturally. More than half of the study population (76%, n=152) used artificial methods for family planning. Consuming a well-balanced diet during their pregnancy was reported by 92% (n=184) of the mothers. Most of the study participants (79.5%, n=159) reported that they slept for 5–6 hours per day. The obstetric and gynaecological characteristics of the mothers of preterm infants are illustrated in [table 2](#).

**Table 2** Obstetrics and gynaecological characteristics of the mothers of preterm infants (n=200)

Variables	Frequency (n)	Percentage (%)
<b>Gravida</b>		
Primigravida	59	29.5%
Two pregnancies	51	25.5%
Three pregnancies	24	12%
Four pregnancies	26	13%
More than four pregnancies	40	20%
<b>Children alive</b>		
1	77	38.5%
2	52	26%
3	44	22%
>3	27	13.5%
<b>Children deceased</b>		
None	185	92.5%
Yes	15	7.5%
<b>Comorbidities in children</b>		
Yes	16	8%
No comorbidities	184	92%
<b>Care of children during pregnancy</b>		
Family member	119	59.5%
NA for primigravida	81	40.5%
<b>Planned pregnancy</b>		
Yes	146	73%
No	54	27%
<b>Plan to have more children</b>		
Yes	106	53%
No	33	16.5%
Will decide later	61	30.5%
<b>Gender preference</b>		
Boy	85	42.5%
Girl	6	3%
No	109	54.5%
<b>Gynaecological or fertility issues</b>		
Yes	24	12%
No	176	88%
<b>Mode of delivery</b>		
Spontaneous vaginal delivery without episiotomy	16	8%
Spontaneous vaginal delivery with episiotomy	22	11%
Caesarean section	162	81%
<b>History of miscarriage</b>		
Yes	66	33%
No	134	67%
<b>History of abortion</b>		

Continued

**Table 2** Continued

Variables	Frequency (n)	Percentage (%)
Yes	5	2.5%
No	195	97.5%
History of preterm deliveries		
Yes	27	13.5%
No	173	86.5%
History of IUD		
Yes	13	6.5%
No	187	93.5%
Antenatal visits during pregnancy		
Initial weeks	125	62.5%
First trimester	67	33.5%
Second trimester and third trimester	8	4%
Immunisation status		
Complete	128	64%
Incomplete	72	36%
Mode of conception		
Natural	192	96%
Artificial	8	4%
Family planning method		
Natural	48	24%
Artificial	152	76%
Balanced diet		
Yes	184	92%
No	16	8%
Hours of sleep		
>3	2	1%
3–4	20	10%
5–6	159	79.5%
7–8	19	9.5%
Gestational age in weeks	33.26	2.86

IUD, intrauterine death; NA, not available .

#### Marital and familial characteristics and coping-related factors

Among the study participants, 75% (n=150) lived in extended families. Nearly all the study participants (96.5%, n=193) had comorbidities in their families. Among them, 83.5% (n=167) had endocrine disorders. Almost all the families had earning members, out of which, 53.5% (n=107) had two earning members in the family. The average age of the husbands was 35.08 years (SD  $\pm 5.43$ ). The educational status of the husbands was high; most of the husbands (65%, n=130) had studied up to graduation. All the husbands were employed; 53% (n=106) of them were doing business. There was a wide range of substance abuse among the husbands, which

included 32% (n=64) smoking a cigarette, and 29.5% (n=59) using betel nut, pan, gutka and naswar.

Among the study participants, 65.5% (n=131) had non-consanguineous marriages. Almost half of the study participants (40.5%, n=81) had been married for <5 years. Nearly all the participants (97%, n=194) were satisfied to a greater extent in the relationship with their husbands. On the other hand, more than half of the mothers (84%, n=168) reported being satisfied, to some extent or to a lesser extent, with their relationship with their in-laws.

Practising coping in stressful situations was reported by almost every participant. Among these, 38.5% (n=77) talked to their husbands in stressful situations. Almost all the study participants (99%, n=198) worked on finding a solution for the stressful situation. All the participants in the study had some reliable person with whom they could talk and share their feelings in stressful situations. Socialisation was reported by every participant with 39% (n=78) linking family as a mode of socialisation. Marital and familial characteristics and coping-related factors of the mothers of preterm infants are illustrated in [table 3](#).

#### Newborn characteristics

The average age of preterm neonates was 10.11 days (SD  $\pm 13.98$ ). The average weight and height of neonates was 1.97 kg (SD  $\pm 0.65$ ) and 43.75 cm (SD  $\pm 5.46$ ), respectively. More than half of the newborns (62%, n=124) were males. The APGAR score of the neonates at the first minute of life was 7.66 (SD  $\pm 1.04$ ). Moreover, preterm neonates were admitted with a range of complaints; among them 31.5% (n=63) were suffering from the Respiratory Distress Syndrome (RDS). More than half of the newborns (51%, n=102) did not receive their immunisation. Most of the newborns (43.5%, n=87) were transferred from the NICU to the step-down unit. More than half of the preterm infants (65%, n=130) were on orogastric (OG) tube feeding, and 59.5% (n=119) were receiving breast milk. Newborn characteristics are illustrated in [table 4](#).

#### Outcome variables

The PSS tool was used in the study to identify the level of stress among mothers of preterm infants. The level of stress reported by mothers using the PSS tool was significantly higher, as indicated by the PSS scale scores. This scoring included three levels, 0–13 low stress, 14–26 moderate stress and 27–40 is considered high perceived stress.<sup>22</sup> Based on the PSS scoring criteria, the majority of the participants (92%, n=184) were classified as having high perceived stress, while the remainder were categorised as experiencing moderate stress. [Table 5](#) depicts the level of stress among mothers of preterm infants.

#### Inferential analysis

Inferential analysis of the study findings was carried out first by differentiating categorical variables and continuous variables. Analysis was further continued by using the  $\chi^2$  test for the categorical variables and t-test for two

**Table 3** Marital and familial characteristics and coping-related factors of the mothers of preterm infants (n=200)

Variables	Frequency (n)	Percentage (%)
Type of family		
Nuclear	50	25%
Extended	150	75%
Comorbidities in family		
Endocrine disorder	167	83.5%
Heart diseases	17	8.5%
Cancers, neurological and respiratory problems	9	4.5%
No comorbidities	7	3.5%
Educational status of husband		
Matriculation	6	3%
Intermediate	42	21%
Graduate	134	67%
Postgraduate and above	18	9%
Occupation of husband		
Job	94	47%
Business	106	53%
Substance abuse by husband		
No substance abuse	77	38.5%
Pan, betel nut, gutka and naswar	59	29.5%
Cigarette	64	32%
Earning members in family		
1	55	27.5%
2	107	53.5%
3	30	15%
>3	8	4%
Type of marriage		
Consanguinity	69	34.5%
Non-consanguinity	131	65.5
Years of marriage		
<5	81	40.5%
5–10	75	37.5%
11–15	40	20%
>15	4	2%
Satisfaction in relationship with husband		
To greater extent	194	97%
To some extent and to lesser extent	6	3%
Satisfaction in relationship with in-laws		
To greater extent	32	16%
To some extent and to lesser extent	168	84%
How do mothers cope in stressful situations		
Share with someone	70	35%
Talk to husband	77	38.5%

Continued

**Table 3** Continued

Variables	Frequency (n)	Percentage (%)
Analyse it	22	11%
Other	31	15.5%
Finding solutions in stressful situations		
Yes	198	99%
No	2	1%
Reliable person		
Husband	169	84.5%
Mother	27	13.5%
Other	4	2%
Mode of socialisation		
Outing with family	78	39%
Outing with friends	45	22.5%
Social media	34	17%
Other	43	21.5%

independent samples for continuous variables in the study.

#### Categorical variables

Most of the mothers in the high perceived stress category had male child (62.5%, n=115), and 31% (n=57) reported RDS as the presenting complaint of their newborns. More than half of the mothers (53.3%, n=98) reported high perceived stress due to their newborn's incomplete immunisation status, and 42.9% (n=79) had babies transferred from the NICU. On the other hand, mothers in moderate levels of stress had similar findings, except three-quarters (75% n=12) of mothers in this category reported complete immunisation status of their newborns.

Around half of the mothers in the high perceived stress category had completed their graduation. However, three-quarters (85.9%, n=158) were housewives, and the majority of mothers (89.7%, n=165) were satisfied with their financial status. Most mothers (65.2%, n=120) were in non-consanguineous marriages, and 7.6% (n=14) reported substance abuse. On the other hand, mothers in the moderate stress category had similar findings, except that 37.5% (n=6) had completed postgraduate education or higher.

A small number of mothers in the high stress category (8.7%, n=16) reported that their children had comorbidities, including congenital heart diseases, metabolic disorders, seizures disorders and genetic disorders. In addition, more than half of the mothers (59.2%, n=109) reported having family support to help care for other children during pregnancy. Mothers in the moderate stress category had similar findings, except none reported any comorbidities in their children.

Almost three-quarters (74.5%, n=137) of the study participants in high stress category had planned their

**Table 4** Newborn characteristics (n=200)

Variables	Frequency (n)	Percentage (%)
Age in days	10.11	13.98
Weight in kg	1.97	0.65
Height in cm	43.75	5.46
APGAR score at first minute of life	7.66	1.04
Gender		
Male	124	62%
Female	76	38%
Presenting complaints		
Neonatal Jaundice (NNJ)	50	25%
RDS	63	31.5%
Intrauterine Growth Restriction (IUGR) and LBW	23	11.5%
Transient Tachypnea of Newborn (TTN)	24	12%
Necrotizing Enterocolitis (NEC), Transient Neonatal Hyperinsulinemic Hypoglycemia (TNHI), sepsis, cardiac anomalies and others	40	20%
Immunisation status		
Complete	98	49%
Incomplete	102	51%
Transferred from		
NICU	87	43.5%
B2 nursery	35	17.5%
ER	37	18.5%
OR and other	41	20.5%
Mode of feeding		
Direct breastfeeding	50	25%
Bottle feeding	20	10%
OG tube feeding	130	65%
Type of feed		
Breastfeed	119	59.5%
Formula feed	81	40.5%

ER, emergency room; LBW, low birth weight; NICU, neonatal intensive care unit; OG, orogastric; OR, operating room.

pregnancy, and more than half (55.4%, n=102) planned to have more children in the future. However, 45.1% (n=83) had a family preference for a male child. The findings in the moderate stress category were similar, except

**Table 5** Perceived stress score of mothers of preterm infants (n=200)

Characteristics	Frequency	Percentage (%)
Moderate stress	16	8
High perceived stress	184	92

that more than half (56.3%, n=9) of the mothers were undecided about planning more children.

A small number of mothers in the high perceived stress category (12.5%, n=23) reported gynaecological issues. The complications during their pregnancies included preterm labour (31%, n=57), gestational diabetes mellitus (GDM) (23.4%, n=43) and pre-eclampsia (21.7%, n=40). Most mothers (81.5%, n=150) underwent a caesarean section as their mode of delivery. A history of miscarriage, abortion, preterm deliveries and IUD was reported by 32.6% (n=60), 2.2% (n=4), 13% (n=24) and 6.5% (n=12) of mothers, respectively. On the other hand, mothers in the moderate stress category had similar findings, except that 37.5% (n=6) had premature rupture of membranes instead of pre-eclampsia.

Majority of mothers in the high perceived stress category (93.5%, n=172) consumed a balanced diet during pregnancy. More than half of the mothers (64.7%, n=119) started the antenatal visits in the initial weeks of pregnancy, and 62.5% (n=115) had complete immunisation status. The findings for mothers in the moderate stress category were similar, except that the majority (56.3%, n=9) started antenatal visits in the first trimester.

Majority of mothers in the high perceived stress category (66.8%, n=123) used OG tube feeding as the mode of feeding for their babies. Additionally, 58.7% (n=108) of these mothers were breastfeeding their newborns. Three-quarters (75%, n=138) were using artificial methods for family planning. However, there were no significant differences in the moderate stress category regarding these findings.

Majority of mothers in the high perceived stress category (76.1%, n=140) were living in extended families, and 85.3% (n=157) had family members with endocrine disorders. Most mothers (67.4%, n=124) reported that their husbands had graduated, 52.7% (n=97) were running their own business, 32.6% (n=60) smoked cigarettes and 31% (n=57) chewed betel nut, pan, gutka and naswar. Almost all of the mothers in the high perceived stress category (96.7%, n=178) were satisfied with their relationships with their husbands. However, most mothers (84.8%, n=156) reported being satisfied to some extent, or to a lesser extent, with their relationship with their in-laws. The findings were similar in the moderate stress category, except that 43.8% (n=7) of mothers had husbands with postgraduate education or higher.

Approximately half of the mothers in the high perceived stress category (40.8%, n=75) reported talking to their husbands during stressful situations. Nearly all the mothers (99.5%, n=183) stated that they found solutions during stressful situations, and almost half (39.7%, n=73) used family outings as a mode of socialisation. The findings for mothers in moderate stress category were similar, except that 50% (n=8) shared their stress with someone other than their husbands and engaged in different modes of socialisation, rather than family outings. [Table 6](#) shows the inferential statistics for the categorical variables in the study.



**Table 6** Inferential statistics for categorical variables of stress among mothers of preterm infants (n=200)

Characteristics	Moderate stress 8% (n=16)	High perceived stress 92% (n=184)	P value
<b>Neonate gender</b>			
Male	56.3% (9)	62.5% (115)	0.6
Female	43.8% (7)	37.5% (69)	
<b>Presenting complaints</b>			
Neonatal Jaundice (NNJ)	37.5% (6)	23.9% (44)	0.501*
Respiratory Distress Syndrome (RDS)	37.5% (6)	31% (57)	
Intrauterine Growth Restriction (IUGR) and LBW	6.3% (1)	12% (22)	
Transient Tachypnea of Newborn (TTN)	12.5% (2)	12% (22)	
Necrotizing Enterocolitis (NEC), Transient Neonatal Hyperinsulinemic Hypoglycemia (TNHI), sepsis, cardiac anomalies and others	6.3% (1)	21.2% (39)	
<b>Immunisation of newborn</b>			
Complete	75% (12)	46.7% (86)	0.03
Incomplete	25% (4)	53.3% (98)	
<b>Transferred from</b>			
NICU	50% (8)	42.9% (79)	0.300*
B2 nursery	12.5% (2)	17.9% (33)	
ER	31.3% (5)	17.4% (32)	
OR and other	6.3% (1)	21.7% (40)	
<b>Education status of mother</b>			
Below matriculation	6.3% (1)	2.2% (4)	0.003*
Matriculation	18.8% (3)	24.5% (45)	
Intermediate	12.5% (2)	24.5% (45)	
Graduate	25% (4)	41.3% (76)	
Postgraduate and above	37.5% (6)	7.6% (14)	
<b>Language spoken</b>			
Urdu	68.8% (11)	83.7% (154)	0.057*
Sindhi	12.5% (2)	9.2% (17)	
Balochi	12.5% (2)	1.6% (3)	
Other	6.3% (1)	5.4% (10)	
<b>Mother's occupation</b>			
Housewife	56.3% (9)	85.9% (158)	0.007
Working	43.8% (7)	14.1% (26)	
<b>Satisfaction with financial status</b>			

Continued

**Table 6** Continued

Characteristics	Moderate stress 8% (n=16)	High perceived stress 92% (n=184)	P value
Yes	87.5% (14)	89.7% (165)	0.678
No	12.5% (2)	10.3% (19)	
<b>Substance abuse by mother</b>			
No	75% (12)	92.4% (170)	0.042
Yes	25% (4)	7.6% (14)	
<b>Marriage type</b>			
Consanguinity	31.3% (5)	34.8% (64)	1
Non-consanguinity	68.8% (11)	65.2% (120)	
<b>Comorbidities in children</b>			
Yes	0% (0)	8.7% (16)	0.373
No	100% (16)	91.3% (168)	
<b>Person taking care of other children during pregnancy</b>			
Family members	62.5% (10)	59.2% (109)	1
NA for primigavid mothers	37.5% (6)	40.8% (75)	
<b>Planned pregnancy</b>			
Yes	56.3% (9)	74.5% (137)	0.142
No	43.8% (7)	25.5% (47)	
<b>Plan for more children</b>			
Yes	25% (4)	55.4% (102)	0.041*
No	18.8% (3)	16.3% (30)	
Will decide later	56.3% (9)	28.3% (52)	
<b>Gender preference from family</b>			
Boy	12.5% (2)	45.1% (83)	0.037*
Girl	6.3% (1)	2.7% (5)	
No	81.3% (13)	52.2% (96)	
<b>Gynaecological issues</b>			
Yes	6.3% (1)	12.5% (23)	0.699
No	93.8% (15)	87.5% (161)	
<b>Complications in pregnancy</b>			
GDM	18.8% (3)	23.4% (43)	0.086*
Pre-eclampsia	6.3% (1)	21.7% (40)	
PROM	37.5% (6)	11.4% (21)	
IUGR	6.3% (1)	4.3% (8)	
Preterm labour pain	25% (4)	31% (57)	
Ante-partum Hemorrhage (APH)	6.3% (1)	8.2% (15)	
<b>Mode of delivery</b>			

Continued

Table 6 Continued

Characteristics	Moderate stress 8% (n=16)	High perceived stress 92% (n=184)	P value
Spontaneous Vaginal Delivery (SVD) without episiotomy	12.5% (2)	7.6% (14)	0.758*
Spontaneous Vaginal Delivery (SVD) with episiotomy	12.5% (2)	10.9% (20)	
Caesarean section	75% (12)	81.5% (150)	
History of miscarriage			
Yes	37.5% (6)	32.6% (60)	0.783
No	62.5% (10)	67.4% (124)	
History of abortion			
Yes	6.3% (1)	2.2% (4)	0.344
No	93.8% (15)	97.8% (180)	
History of preterm deliveries			
Yes	18.8% (3)	13% (24)	0.458
No	81.3% (13)	87% (160)	
History of IUD			
Yes	6.3% (1)	6.5% (12)	1
No	93.8% (15)	93.5% (172)	
Balance diet			
Yes	75% (12)	93.5% (172)	0.028
No	25% (4)	6.5% (12)	
Antenatal visits during pregnancy			
Initial weeks	37.5% (6)	64.7% (119)	0.098*
First trimester	56.3% (9)	31.5% (58)	
Second and third trimester	6.3% (1)	3.8% (7)	
Immunisation status of mother			
Complete	81.3% (13)	62.5% (115)	0.178
Incomplete	18.8% (3)	37.5% (69)	
Mode of feeding baby			
Direct Breast Feeding (DBF)	31.3% (5)	24.5% (45)	0.067*
Bottle feeding	25% (4)	8.7% (16)	
OG feeding	43.8% (7)	66.8% (123)	
Type of feed for baby			
Breastfeed	68.8% (11)	58.7% (108)	0.597
Formula feed	31.3% (5)	41.3% (76)	
Family planning method			
Natural	12.5% (2)	25% (46)	0.367
Artificial	87.5% (14)	75% (138)	
Type of family			
Nuclear	37.5% (8)	23.9% (44)	0.237
Extended	62.5% (10)	76.1% (140)	

Continued

Table 6 Continued

Characteristics	Moderate stress 8% (n=16)	High perceived stress 92% (n=184)	P value
Comorbidities in family			
Endocrine disorders	62.5% (10)	85.3% (157)	0.072*
Heart diseases	25% (4)	7.1% (13)	
Cancers, neurological and respiratory problems	6.3% (1)	4.3% (8)	
No comorbidities	6.3% (1)	3.3% (6)	
Education status of husband			
Matriculation	12.5% (2)	2.2% (4)	<0.000*
Intermediate	6.3% (1)	22.3% (41)	
Graduate	37.5% (6)	67.4% (124)	
Postgraduate and above	43.8% (7)	8.2% (15)	
Occupation of husband			
Job	43.8% (7)	47.3% (87)	1.000
Business	56.3% (9)	52.7% (97)	
Substance abuse by husband			
No	62.5% (10)	36.4% (67)	0.102*
Betel nut, pan, gutka and naswar	12.5% (2)	31% (57)	
Cigarette	25% (4)	32.6% (60)	
Satisfaction in relationship with husband			
To greater extent	100% (16)	96.7% (178)	1.000
To some extent and to lesser extent	0% (0)	3.3% (6)	
Satisfaction in relationship with in-laws			
To greater extent	25% (4)	15.2% (28)	0.294
To some extent and to lesser extent	75% (12)	84.8% (156)	
How do you cope with stressful situation			
Share with someone	50% (8)	33.7% (62)	0.156*
Talk to husband	12.5% (2)	40.8% (75)	
Analyse it	12.5% (2)	10.9% (20)	
Other	25% (4)	14.7% (27)	
Finding solution in stressful situation			
Yes	93.8% (15)	99.5% (183)	0.154
No	6.3% (1)	0.5% (1)	
Mode of socialisation			
Outing with family	31.3% (5)	39.7% (73)	0.032*
Outing with friends	12.5% (2)	23.4% (43)	
Social media	6.3% (1)	17.9% (33)	
Others	50% (8)	19% (35)	

Continued

**Table 6** Continued

Characteristics	Moderate stress 8% (n=16)	High perceived stress 92% (n=184)	P value
*Pearson's $\chi^2$ p value.			
ER, emergency room; GDM, gestational diabetes mellitus; IUD, intrauterine death; LBW, low birth weight; NA, not available; NICU, neonatal intensive care unit; OG, orogastric; OR, operating room; PROM, premature rupture of membranes.			

### Continuous variables

The mean age, weight and length of newborns in mothers with high levels of perceived stress was 9.88 (SD +13.47), 1.97 (SD +0.66) and 43.75 (SD +5.54), respectively. The mean APGAR score for neonates was 7.65 (SD +1.05), and the mean gestational age of mothers was 33.21 (SD +2.91). However, these scores were comparatively higher for mothers in the moderate stress category compared with those in the high perceived stress category.

The mean age and monthly income of mothers with high levels of perceived stress were 30.27 (SD +5.16) and 110 054.35 (SD +21 051.51), respectively, which was higher compared with mothers in moderate stress category. The mean of years of marriage and number of earning members in the family for mothers with high levels of stress were 1.80 (SD +0.80) and 1.93 (SD +0.75), respectively, which were comparatively lower than those for mothers in the moderate stress category. The mean gravida, hours of sleep and age of husbands of mothers with high levels of perceived stress were 2.78 (SD +1.65), 3.01 (SD +0.45) and 35.24 (SD +5.40), respectively, which

were higher than those for mothers in the moderate stress category. The mean number of children alive and deceased for mothers with high levels of perceived stress were 2.17 (SD +1.21) and 1.09 (SD +0.35), respectively, which were similar to those for mothers in the moderate stress category. [Table 7](#) shows the inferential statistics for the continuous variables in the study.

## DISCUSSION

### Level of stress among mothers of preterm infants

This study focused on the level of stress and its associated factors among mothers of preterm infants in Karachi, Pakistan. To assess the level of stress, the PSS tool was incorporated into a self-developed questionnaire. PSS has been used extensively around the globe to measure stress across various populations. Additionally, it is employed to gauge the level of stress experienced by mothers of preterm infants in countries such as Taiwan and Pakistan.

In our study, 92% of the study participants fell under the category of high perceived stress, which is considerably higher than what has been reported in other studies. For instance, a study conducted in Kenya on the prevalence of psychological distress among mothers of term and preterm infants found that 83.7% who delivered preterm infants experienced stress.<sup>26</sup> Additionally, a systematic review conducted in high-income countries (HIC) on post-traumatic stress symptoms in mothers of preterm infants reported that 77.8% of the mothers had stress and met the criteria for potential post-traumatic stress disorder following the birth of a preterm infant.<sup>25</sup> These findings support the results of the current study, as they are similar to a great extent.

**Table 7** Inferential statistics for continuous variables of stress among mothers of preterm infants (n=200)

Characteristics	Moderate stress		High perceived stress		P value
	Mean	SD	Mean	SD	
Neonate age	12.75	±19.19	9.88	±13.47	0.43
Neonate weight	2.06	± 0.57	1.97	±0.66	0.59
Neonate height	43.75	±4.53	43.75	±5.54	1.000
APGAR score	7.69	±0.87	7.65	±1.05	0.89
Gestational age	33.75	±2.23	33.21	±2.91	0.47
Mother's age	28.44	±5.60	30.27	±5.16	0.17
Monthly income	100 000	±18 973.66	110 054.35	±21 051.51	0.06
Years of marriage	2.25	±0.85	1.80	±0.80	0.03*
Gravida	2.69	±1.74	2.78	±1.65	0.83
Children alive	2.13	±1.25	2.17	±1.21	0.87
Children deceased	1.31	±0.87	1.09	±0.35	0.33
Hours of sleep	2.63	±0.71	3.01	±0.45	0.05
No of earning members	2.25	±0.85	1.93	±0.75	0.10
Age of husband	33.25	±5.58	35.24	±5.40	0.16

\*Significant p value.

On the contrary, a recent systematic review conducted in urban HIC on the prevalence of stress among mothers of preterm infants admitted to the NICU reported a stress prevalence of 39.9%.<sup>27</sup> Additionally, a study conducted in Malaysia found that 56.5% of mothers of preterm infants admitted to the NICU experienced high levels of stress.<sup>28</sup> However, these findings are relatively lower than those of the current study. The plausible difference may be attributed to the diverse socio-cultural stressors related to the income levels of the two countries, as Malaysia is classified as an upper-middle-income country, while Pakistan is categorized as a lower-middle-income country (LMIC).<sup>29</sup>

Another study conducted in the USA regarding the association between preterm birth and maternal mental health found that 11.26% of the mothers who delivered preterm infants reported experiencing stress.<sup>30</sup> A recent study conducted in the USA, focusing on maternal mental health after the discharge of preterm infants from the NICU, showed that 29% of mothers experienced stress and depressive disorders.<sup>31</sup> However, the level of stress reported in these studies is relatively lower compared with the findings of the current study conducted in Pakistan, where the stress levels among mothers are significantly higher. When comparing the results from studies conducted in the USA, which is considered a HIC, with those from Pakistan, a noticeable difference in stress levels emerges. This difference may be attributed to factors such as cultural differences in reporting stress, variations in income status or differences in care approaches between the two settings.

### Factors affecting stress levels among mothers of preterm infants

The literature suggests that the social, cultural and environmental factors in LMIC, such as Pakistan, contribute to increased exposures to stressors, which in turn elevate the risk of stress and depression among mothers during pregnancy and childbirth.<sup>32</sup> Additionally, several factors have been identified in the literature as being associated with higher levels of stress among mothers of preterm infants. Among the cultural determinants, unplanned pregnancy and the preference of male children over female children are key contributors to stress.<sup>32</sup> Another study conducted in Pakistan also highlighted that the limited autonomy of mothers in making decisions related to pregnancy and reproductive health is a significant factor associated with higher stress levels among mothers of preterm infants.<sup>33</sup> In addition, Pakistani women are more susceptible to stress and depression due to overlapping socio-economic factors, such as unemployment and lack of education. Obstetric factors, including multiple and unplanned pregnancies, as well as psycho-social factors, such as verbal and physical abuse by husbands and mothers-in-law, further contribute to this risk.<sup>33</sup>

The current study found that nearly half of the mothers in the moderate stress group and one-quarter of those in the high stress group had unplanned pregnancies. These findings are consistent with a study conducted in Kenya,

which also identified unwanted and unplanned pregnancies, poor social support, marital discord and low socio-economic status of as significant factors contributing to stress among mothers of preterm infants.<sup>26</sup> Kenya is also an LMIC with similar social, cultural and environmental factors like Pakistan. Therefore, this study validates the findings of the current research in a comparable context.

The study conducted in Kenya also identified domestic violence as a factor associated with stress among mothers of preterm infants.<sup>26</sup> However, this finding contrasts with the results of the current study, where the majority of mothers reported being highly satisfied with their relationship with their husbands.

When comparing the results of the current study with previous research, it was found that although 50% of mothers had a higher education level, the majority were housewives, which could be a contributing factor to the unemployment rate in Pakistan. Furthermore, two-thirds of the mothers had planned their pregnancies, while most of them were carrying multiple pregnancies, which could contribute to the preference for male children. This implies that these elements are in line with the literature.

This study has highlighted multiple factors associated with increased stress levels among mothers of preterm infants. However, only those factors with a *p* value of <0.05 were considered statistically significant and were identified as key contributors to stress. The findings of the current study are consistent with factors identified in the literature, including hours of sleep, consumption of a balanced diet, immunisation status of the newborn, modes of socialisation, education and occupational status of mothers, substance abuse by the mother, education level of the husband, family gender preference, plans for additional children and years of marriage.

Immunisation status of the newborn is another factor associated with increased stress levels among mothers of preterm infants. High perceived stress was reported in a significant number of mothers whose preterm infants had incomplete immunisation. This finding is consistent with a systematic review on vaccination in preterm infants, which suggests that parents experience higher stress when vaccinating preterm infants compared with term infants.<sup>19</sup> The plausible reasons included decreased weight of preterm infants compared with term infants, as well as delays in the vaccination to ensure the infant reaches the correct gestational age before receiving vaccines.<sup>19</sup>

The educational status of mothers was also a key factor associated with stress levels among mothers of preterm infants. In the current study, moderate and high levels of stress were reported in mothers who had graduated from high school. In contrast, a study conducted in Maichew, North Ethiopia, found that mothers with advanced levels of education reported no stress, while stress levels were higher among mothers with low education or no formal education.<sup>34</sup> The contradiction may be explained by the fact that, in the current study, mothers with higher



education may have wanted to work but felt the need to prioritise the care of their preterm infant.

The current study found that mothers who were not employed experienced higher levels of stress compared with working mothers. This finding is consistent with a study conducted in southeastern Ethiopia, which also reported higher stress levels in mothers who were housewives.<sup>34</sup> A potential reason for the low levels of stress in working mothers could be the regular social interaction with friends and co-workers, which may provide a change of environment and enhance mental well-being. Thus, the current study highlights the importance of employment in reducing the stress among mothers of preterm infants.

Substance abuse by mothers is another risk factor associated with increased stress among mothers of preterm infants. In the current study, while the number of mothers reporting substance abuse was not statistically significant, those who did report substance use showed higher levels of stress. This finding is consistent with the findings of the study conducted in Maichew, North Ethiopia, where tobacco chewing was linked to higher stress levels among mothers.<sup>35</sup> Substance abuse is associated with many health problems, including anaemia during pregnancy and lactation, as seen in the current study, particularly the impact of chewing betel nut. Therefore, the study highlights the need for counselling mothers to reduce substance abuse in order to improve the high levels of stress among mothers of preterm infants.

Planning for further children was also associated with higher levels of stress among mothers of preterm infants. In the current study, more than half of the mothers in the high perceived stress category reported plans to have more children. In contrast, mothers with moderate stress levels reported that they would decide later about having more children. A study conducted in China, which assessed parenting stress differences between mothers with one child and those with two, found that mothers with two children had significantly higher stress scores compared with those with one child.<sup>36</sup> The finding is consistent to some extent, as planning for further children and parenting two children—while also caring for a preterm infant—can be a challenging situation that increases stress in mothers. One of the plausible reasons could be the minimal age gap between the two children, which may contribute to additional parenting stress for mothers who have delivered a preterm infant.

Gender preference was also a major factor associated with increased stress levels in mothers of preterm infants. In the current study, although the majority of mothers reported no gender preference, a significant number indicated a preference for male children. This finding is similar to another study conducted in Pakistan, which found that gender preference, particularly the preference for male children, was a contributing factor to unplanned pregnancies, and in turn, increased stress levels among mothers.<sup>32</sup>

In the current study, it was found that mothers with both moderate and high levels of stress were consuming a balanced diet, yet they still experienced increased stress levels. This finding is in contradiction with the findings of a study conducted in Taiwan, where a balanced diet was associated with lower levels of stress.<sup>10</sup>

The educational status of the husband was also an important factor associated with stress levels among mothers of preterm infants. In the current study, increased stress levels were reported among mothers whose husbands had a graduate-level education. This finding contrasts with a study conducted in India, which showed lower stress levels among mothers whose husbands had higher educational status.<sup>37</sup> One possible reason for this contradiction could be the high unemployment rate in Pakistan. In this context, having a graduate degree but lacking employment opportunities may contribute to increased stress.

Socialisation is another important factor associated with stress among mothers of preterm infants. In the current study, all the mothers engaged in various modes of socialisation, such as outings with family, interactions with friends, social media and other activities, which helped reduce their stress by providing social support. This finding is also consistent with the study conducted in Taiwan, which suggested that social support from family, friends and social groups act as a mediator for mothers, boosting their self-esteem and providing emotional stability, especially in dealing with increased stress following the birth of a preterm infant.<sup>10</sup> The current study has identified support groups and socialisation as the key factors in reducing stress levels among mothers of preterm infants.

Years of marriage was another factor associated with the level of stress among mothers of preterm infants. The current study found that fewer years of marriage were associated with higher levels of stress among mothers. This finding is similar to another study conducted in Pakistan, which showed that longer years of marriage contributed to a sense of satisfaction for mothers. With more experience in shared decision-making about family planning, including decisions on further pregnancies and gender preference, stress levels, unplanned pregnancies and gender preference were reduced.<sup>32</sup>

In the current study, reduced hours of sleep were found to increase stress levels among the participants. Mothers in the high perceived stress category had an average sleep duration of 3.01 hours (SD  $\pm 0.45$ ). This finding is consistent with a study conducted in Taiwan, which found that 65% of the mothers of preterm infants experienced insufficient and poor sleep, factors associated with higher stress levels.<sup>10</sup> The possible reasons for disturbed sleep quality could include frequent awakenings for feeding and caring for the preterm infant.

The factors associated with stress among mothers of preterm infants are well supported by national and international literature. The overall results of this study, within the context of Pakistan and focusing specifically on

mothers of preterm infants, show many similarities with the existing literature.

### Limitations of the study

The limitations of the research study are as follows:

- ▶ An analytical cross-sectional study design was used in this study. However, to better explore the association between the study outcomes and the factors associated, longitudinal or prospective cohort studies could provide better results.
- ▶ The study has limited generalisability, as the sample of the study included only mothers who delivered preterm infants.
- ▶ This study was conducted in a private hospital; therefore, the sample size cannot be generalised to public or government settings.

### CONCLUSION AND RECOMMENDATIONS

Education and counselling of the mothers regarding status of their neonate and ways to involve mothers in the care of their newborn are crucial. Kangaroo mother care is significant in reducing the separation time and improving the bond between the mother and the newborn. Additionally, teaching nurses therapeutic communication techniques is essential to provide emotional support to the mothers.

### Nursing practice

Thorough training of the healthcare professionals is necessary for the assessment of mental health in mothers of preterm infants, and for conducting appropriate interventions. In addition, a specialised clinical pathway for the infants born preterm could be initiated. This pathway can include the details about the child and the mother, the associated risk factors and the scale used to assess the level of stress in mothers. It will also include the pertaining stress during pregnancy and the ongoing stress assessment for the mothers. Additionally, teaching coping strategies for stress management and newborn care should be incorporated into the clinical pathway. A role of the nurse practitioner that incorporates the care of both newborns and mothers at the same time must be initiated. This role will help nurses identify and address stress in mothers undergoing delivery, neonatal care and handling, ensuring holistic support for both the mother and infant during this critical period. The study findings identified high levels of perceived stress among mothers of preterm infants, highlighting the urgent need to emphasise psychological health screening in both antenatal and postnatal care. A support group should also be established, consisting of mothers who have delivered preterm infants. This support group would help reduce stress levels and enhance coping by providing mothers an opportunity to express their feelings and concerns related to preterm handling and care. Hospital administration should provide a separate area where the mothers of preterm infants can be individually assessed for stress levels, with tailored support and guidance provided. At the policy level, it should be mandatory to incorporate a

multidisciplinary team approach, ensuring that a psychologist is part of the team to offer consultations to mothers of preterm infants during the postnatal period.

### Nursing education

Nursing education should include a dedicated course on neonatal care, including the handling, feeding and support of mothers with preterm infants. The course should also cover basic assessment tools for evaluating maternal stress in mothers of preterm infants. Additionally, nursing students should be introduced to the role and concept of nurse practitioners in this field. These nurse practitioners would serve as a liaison between mothers and their preterm infants, helping students identify their areas of interest and potentially guiding their career choices in this specialty.

### Nursing research

Given the findings of increased stress levels among mothers of preterm infants, there is a need for intervention studies aimed at improving their mental health. A cross-sectional study could also be conducted to assess the level of stress among mothers of term infants for comparison. Additionally, since this study focused on the stress levels and associated factors among mothers of preterm infants, a similar study could be carried out to explore the stress levels and related factors among fathers of preterm infants. Future studies with a multicentred approach, involving large sample sizes, are needed to validate the findings of this study. Additionally, research including public hospitals should be conducted to incorporate a broader range of healthcare settings, thereby improving the generalisability of the findings. A longitudinal follow-up study would also be valuable to provide deeper insights into the long-term effects of stress on mothers over time.

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## REFERENCES

- Machado JS, Ferreira TS, Lima RCG, *et al.* Premature birth: topics in physiology and pharmacological characteristics. *Rev Assoc Med Bras* 2021;67:150–5.
- World Health Organization. WHO recommendations for care of the preterm or low birth weight infant. *WHO* 2022.
- Hanif A, Ashraf T, Waheed K, *et al.* Prevalence of Preterm Birth in Pakistan: A Systematic Review and Meta-Analysis. *Annals KEMU* 2017;23.
- Khan HS, Khalil S, Akhtar P. Morbidity and mortality pattern of preterms. *J Islamabad Med Dent Coll* 2016;5:77–80.
- Dawood Z, Majeed N. Assessing neo-natal mortality trends in Pakistan: an insight using equity lens. *Arch Public Health* 2022;80:7.
- Kumar V, Ali BS, Choudry E, *et al.* Quality of Neonatal Care: A Health Facility Assessment in Balochistan Province, Pakistan. *Cureus* 2022;14:e22744.
- Alves AC, Cecatti JG, Souza RT. Resilience and Stress during Pregnancy: A Comprehensive Multidimensional Approach in Maternal and Perinatal Health. *Sci World J* 2021;2021:9512854.
- Malliarou M, Karadonta A, Mitroulas S, *et al.* Preterm Parents' Stress and Coping Strategies in a Neonatal Intensive Care Unit in a University Hospital of Central Greece. *Mat Soc Med* 2021;33:244:244–9.
- Lau C, Turcich MR, Smith EO. Early detection of parenting stress in mothers of preterm infants during their first-year home. *BMC Psychol* 2020;8:66.
- Chang Y-S, Cheng Y-C, Li T-C, *et al.* Exploring Perceived Stress in Mothers with Singleton and Multiple Preterm Infants: A Cross-Sectional Study in Taiwan. *Healthcare (Basel) -> Healthc (Basel)* 2022;10:1593.
- Karbandi S, Momenizadeh A, Heidarzadeh M, *et al.* Effects of Empowering Mothers of Premature Infants on Their Stress Coping Strategies. *Iran J Psychiatry Behav Sci* 2018;12.
- Pisoni C, Spairani S, Manzoni F, *et al.* Depressive symptoms and maternal psychological distress during early infancy: A pilot study in preterm as compared with term mother-infant dyads. *J Affect Disord* 2019;257:S0165-0327(19)30878-X:470–6.
- Ansari TF, Wade P, Singh V, *et al.* Maternal stress experiences with neonatal intensive care unit admissions. *Egypt Pediatr Assoc Gaz* 2022;70:47.
- Polit D, Beck C. *Essentials of Nursing Research: Appraising Evidence for Nursing Practice.* Lippincott Williams & Wilkins, 2017.
- Garg R. Methodology for research I. *Indian J Anaesth* 2016;60:640–5.
- Fróes GF, Mendes ENW, Pedroza G de A, *et al.* Stress experienced by mothers of preterm newborns in a neonatal intensive care unit. *Rev Gaucha Enferm* 2020;41:S1983-14472020000200409.
- Al-Hindi MY, Alshamrani ZM, Alkhotani WA, *et al.* Utilization of Health-Care Resources of Preterm Infants during their First 2 Years of Life after Discharge from Neonatal Intensive Care Unit. *J Clin Neonatol* 2021;10:37–44.
- Manohar N, MacMillan F, Steiner GZ, *et al.* Recruitment of research participants. In: *Handbook of research methods in health social sciences.* 2018: 71–98.
- Chiappini E, Petrolini C, Sandini E, *et al.* Update on vaccination of preterm infants: a systematic review about safety and efficacy/effectiveness. Proposal for a position statement by Italian Society of Pediatric Allergology and Immunology jointly with the Italian Society of Neonatology. *Expert Rev Vaccines* 2019;18:523–45.
- Hornberger B, Rangu S. n.d. Designing inclusion and exclusion criteria. *Univ of Penn ScholarlyCommons*2020:3–13.
- Schwaiger E, Zehra SS, Suneel I. Attachment, Religiosity, and Perceived Stress Among Religious Minorities During the COVID-19 Pandemic: The Impact of Cultural Context. *J Psychol Theol* 2022;50:369–83.
- Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;24:385–96.
- Siqueira Reis R, Ferreira Hino AA, Romélio Rodriguez Añez C. Perceived stress scale: Reliability and validity study in Brazil. *J Health Psychol* 2016;15:107–14.
- Sürücü L, Maslakçı A. VALIDITY AND RELIABILITY IN QUANTITATIVE RESEARCH. *bmj* 2020;8:2694–726.
- Gondwe KW, Holditch-Davis D. Posttraumatic stress symptoms in mothers of preterm infants. *Int J Afr Nurs Sci* 2015;3:8–17.
- Mutua J, Kigamwa P, Ng'anga P, *et al.* A comparative study of postpartum anxiety and depression in mothers with pre-term births in Kenya. *J Affect Disord Rep* 2020;2:100043.
- Malouf R, Harrison S, Burton HAL, *et al.* Prevalence of anxiety and post-traumatic stress (PTS) among the parents of babies admitted to neonatal units: A systematic review and meta-analysis. *E Clin Med* 2022;43:101233.
- Ong SL, Abdullah KL, Danaee M, *et al.* Stress and anxiety among mothers of premature infants in a Malaysian neonatal intensive care unit. *J Reprod Infant Psychol* 2019;37:193–205.
- Waqas A, Zubair M, Zia S, *et al.* Psychosocial predictors of antenatal stress in Pakistan: perspectives from a developing country. *BMC Res Notes* 2020;13:160:160.
- Barber KS, Brunner Huber LR, Portwood SG, *et al.* The Association between Having a Preterm Birth and Later Maternal Mental Health: An Analysis of U.S. Pregnancy Risk Assessment Monitoring System Data. *Womens Health Issues* 2021;31:49–56.
- Franck LS, Gay CL, Hoffmann TJ, *et al.* Maternal mental health after infant discharge: a quasi-experimental clinical trial of family integrated care versus family-centered care for preterm infants in U.S. NICUs. *BMC Pediatr* 2023;23:396.
- Lalani S, Premji SS, Shaikh K, *et al.* Individual and collective contribution of antenatal psychosocial distress conditions and preterm birth in Pakistani women. *PLoS ONE* 2023;18:e0282582.
- Lalani S, Dosani A, Forchheh N, *et al.* Maternal-infant Global Health Team (MiGHT) Collaborators in Research. Perceived stress may mediate the relationship between antenatal depressive symptoms and preterm birth: A pilot observational cohort study. *PLoS ONE* 2021;16:e0250982.
- Engidaw NA, Mekonnen AG, Amogne FK. Perceived stress and its associated factors among pregnant women in Bale zone Hospitals, Southeast Ethiopia: a cross-sectional study. *BMC Res Notes* 2019;12:356.
- Mossie TB, Sibhatu AK, Dargie A, *et al.* Prevalence of Antenatal Depressive Symptoms and Associated Factors among Pregnant Women in Maichew, North Ethiopia: An Institution Based Study. *Ethiop J Health Sci* 2017;27:59–66.
- Qian G, Mei J, Tian L, *et al.* Assessing Mothers' Parenting Stress: Differences Between One- and Two-Child Families in China. *Front Psychol* 2020;11:609715.
- Dutta S, Mahajan R, Agrawal SK, *et al.* Stress in Fathers of Premature Newborns Admitted in a Neonatal Intensive Care Unit. *Indian Pediatr* 2016;53:311–3.