

Prevalence of anxiety, depression, and stress among parents of neonates admitted to neonatal intensive care unit: a systematic review and meta-analysis

Asha P. Shetty, M.Phil, PhD¹, Kurvatteppa Halemani, M.Phil, PhD², Alwin Issac, MSc, M.Phil¹, Latha Thimmappa, MSc, PhD³, Sanjay Dhiraaj, MD⁴, Radha K, M.Phil, PhD⁵, Prabhaker Mishra, PhD⁶, Vijai Datta Upadhyaya, MS, MCh⁷

¹College of Nursing, All India Institute of Medical Sciences, Bhubaneswar, Odish, India; ²College of Nursing, All India Institute of Medical Sciences, Raeberali, Uttar Pradesh, India; ³College of Nursing, All India Institute of Medical Sciences, Kalyani, West-Bengal, India; ⁴Department of Anesthesiology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India; ⁵College of Nursing, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India; ⁶Department of Biostatistics & Health Informatics, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India; ⁷Department of Pediatric Surgery Super-Speciality, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India

Background: Neonatal intensive care unit (NICU) admission causes significant distress that can hinder the successful transition into parenthood, child-parent relations, and child development.

Purpose: This systematic review and meta-analysis aimed to understand parental psychological phenomena. Here we assessed the emotional response of parents of newborns during NICU admission.

Methods: Two authors independently searched the PubMed, Cumulative Index to Nursing and Allied Health Literature, Embase, Clinical Key, and Google Scholar databases for studies published between January 01, 2004, and December 31, 2021. The review followed Cochrane collaboration guidelines and the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) statement. The quality of the included studies was assessed using the modified Newcastle-Ottawa Scale. Stata software (version 16) was used to compute the results.

Results: This review comprised 6,822 parents (5,083 mothers, 1,788 fathers; age range, 18–37 years) of NICU patients. The gestational ages and neonatal weights were 25.5–42 weeks and 750–2,920 g, respectively. The pooled prevalence of anxiety was higher among mothers (effect size [ES], 0.51; 95% confidence interval [CI], 0.41–0.61; and heterogeneity [I^2]=97.1%; $P<0.001$) than among fathers (ES, 0.26; 95% CI, 0.11–0.42; $I^2=96.6%$; $P<0.001$). Further, the pooled prevalence of depression was higher among mothers (ES, 0.31; 95% CI, 0.24–0.38; $I^2=91.5%$; $P<0.001$) than among fathers (ES, 0.12; 95% CI, 0.03–0.22; $I^2=85.6%$; $P<0.001$). Similarly, the pooled prevalence of stress was higher among mothers (ES, 0.41; 95% CI, 0.31–0.51; $I^2=93.9%$; $P<0.001$) than among fathers (ES, 0.22; 95% CI,

0.09–0.34; $I^2=85.2%$; $P<0.001$).

Conclusion: NICU admission is more stressful for mothers than fathers and can affect mental health and quality of life. Mothers reported a higher pooled prevalence of stress, anxiety, and depression than fathers, possibly attributable to their feelings about birthing a sick child.

Key words: Anxiety, Depression, Stress, Parents, Newborn, Neonatal intensive care unit

Key message

Question: What emotions do parents experience when their newborns are admitted to the neonatal intensive care unit (NICU)?

Finding: Mothers experienced more anxiety (51%), depression (31%), and stress (41%) symptoms than fathers (26%, 12%, and 22%, respectively).

Meaning: Parents often experience anxiety, stress, and depression following NICU admission. Healthcare workers are responsible for providing regular parental counseling.

Introduction

The diagnosis of an illness in a child causes significant distress to parents. The grief is further aggravated when an infant is admitted to a neonatal intensive care unit (NICU). The NICU provides specialized and integrated care to infant who require close supervision and life support equipment to ensure normal body function. Parents fear the diagnosis and prognosis of illness, the associated medical risks, being

Corresponding author: Kurvatteppa Halemani, M.Phil, PhD. College of Nursing, All India Institute of Medical Science, Raeberali, Uttar Pradesh, India

✉ Email: kurru.hali@gmail.com, <https://orcid.org/0000-0002-6603-5121>

Received: 25 March 2023, Revised: 9 August 2023, Accepted: 10 August 2023

This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

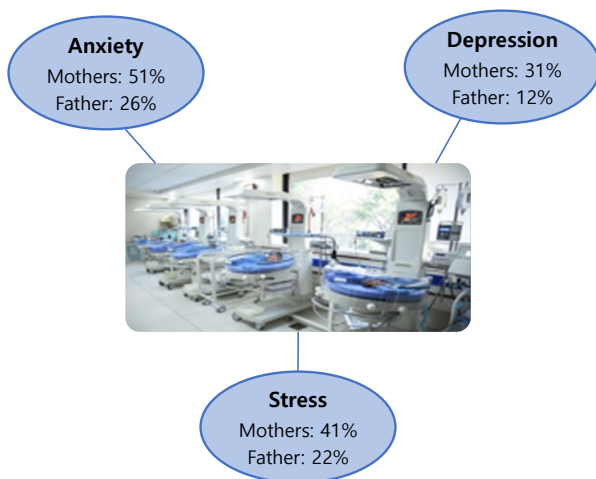
Copyright © 2024 by The Korean Pediatric Society

separated from their child, the unfamiliar hospital environment, and hindrances accessing information and communicating with healthcare professionals. Although resilience varies among parents, distress can negatively impact the successful transition into parenthood, child-parent relationship, and child development.^{1,2)}

Earlier studies reported mental health problems among parents of NICU infants, while recent studies reported the prevalence of anxiety and posttraumatic stress among parents of NICU babies.^{1,2)} Healthcare centers tend to ignore the mental health of primary caregivers of hospitalized patients. However, sick newborns require immediate intervention to reduce complications. Most infants admitted to the NICU require long-term care. Therefore, parental involvement and effective communication during NICU admis-

sion may increase their satisfaction and lead to continued care after discharge.

To the best of our knowledge, this is the first systematic review and meta-analysis of recent studies published worldwide. In contrast to previous studies, this review focused on mental health problems among parents of neonates admitted to the NICU. However, understanding parental reactions to hospitalization is essential to healthcare providers offering appropriate interventions. Furthermore, we recognized the importance of separately examining anxiety, depression, and stress levels in mothers and fathers. This systematic review and meta-analysis aimed to understand the psychological phenomena experienced by parents of newborns during NICU admission.



Graphical abstract

Methods

1. Protocol and registration

This systematic review and meta-analysis adhered to the Cochrane Collaboration guidelines the PRISMA (preferred reporting items for systematic review and meta-analyses) statement.^{3,4)} The review protocol was prospectively registered with PROSPERO (CRD42022301340).

2. Search strategy and study selection

The search strategy was developed using a combination of MeSH (medical subject heading) terms and keywords (mother OR father OR parents OR maternal OR NICU mother OR NICU father OR lactation mother OR newborn mother OR NICU parents OR preterm mother) AND (anxiety OR fear OR nervousness OR depression OR hope-

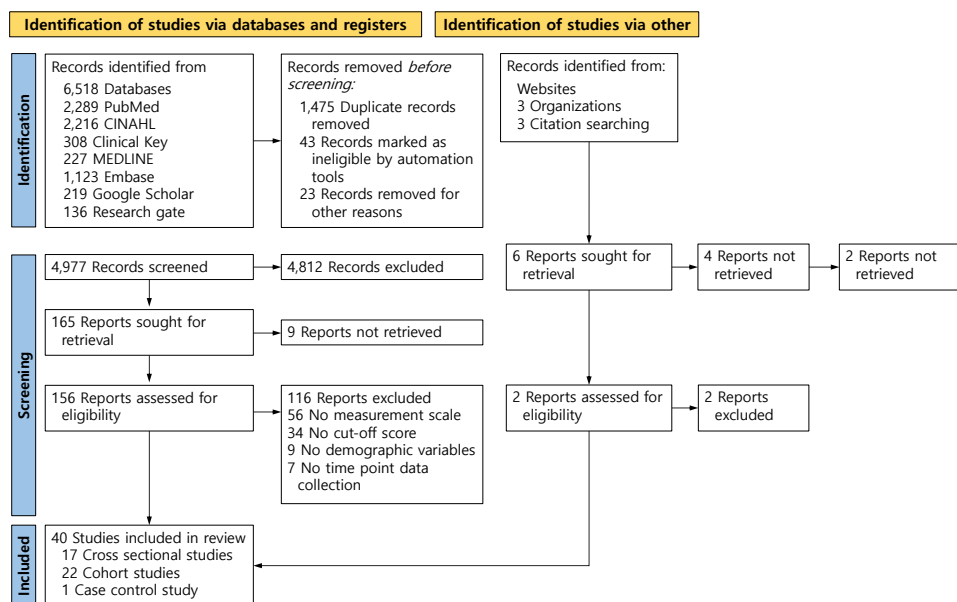


Fig. 1. PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) flow diagram of study selection process.

lessness OR sleep problem OR afraid OR sttabress OR uneasiness) AND (NICU unit OR hospitalization OR NICU OR neonatal unit). The first 2 authors independently searched the PubMed, Cumulative Index to Nursing and Allied Health Literature, Embase, Clinical Key, and Google Scholar databases for studies published between January 01, 2004, and December 31, 2021. The reference lists of all relevant studies that fulfilled the inclusion criteria as well as related systematic reviews, meta-analyses, and review

articles were manually searched. Duplicate records were excluded by title and abstract screening. The remaining original full-text articles were screened against the inclusion criteria.

Articles that fulfilled the following criteria were included in the review: observational studies whose participants were parents of children undergoing NICU treatment; studies that adopted standardized measurement tools; and studies that reported cutoff scores for anxiety, depression,

Table 1. Quality appraisal of the included studies using the modified Newcastle-Ottawa Scale

Study	Country	Representativeness of samples >70% response (1)	Sample size >200 (2)	Response rate >80% (3)	Validated tool with cutoff (4)	Detail statistical information, not required further calculations (5)	Total Scores	Study quality
Carter et al. ⁴⁴⁾ (2007)	NZ	*	*	*	*	*	5/5	Low risk
Yurdakul et al. ⁶⁾ (2009)	Turkey	*	-	*	-	*	3/5	Low risk
Vanderbilt et al. ²²⁾ (2009)	USA	*	-	*	-	*	3/5	Low risk
Holditch-Davis et al. ²³⁾ (2009)	USA	*	*	*	*	*	5/5	Low risk
Holditch-Davis et al. ²⁴⁾ (2015)	USA	*	-	*	*	*	4/5	Low risk
Lefkowitz et al. ²⁵⁾ (2010)	USA	*	-	*	-	*	3/5	Low risk
Barr ²⁶⁾ (2010)	Australia	*	-	*	*	*	4/5	Low risk
Dantas et al. ⁵²⁾ (2012)	Brazil	*	-	*	*	*	4/5	Low risk
Jubenville et al. ²⁷⁾ (2012)	Canada	*	-	*	*	*	4/5	Low risk
Kong et al. ⁷⁾ (2013)	China	*	*	*	-	*	4/5	Low risk
Alkozei et al. ⁸⁾ (2014)	USA	*	-	*	-	*	3/5	Low risk
Eutrope et al. ²⁸⁾ (2014)	France	*	-	*	-	*	3/5	Low risk
Mulder et al. ²⁹⁾ (2014)	NZ	*	-	*	-	*	3/5	Low risk
Margaret et al. ⁹⁾ (2014)	India	*	-	*	*	*	4/5	Low risk
Segre et al. ¹⁰⁾ (2014)	USA	*	*	*	-	*	4/5	Low risk
Garfield et al. ¹¹⁾ (2015)	USA	*	-	*	*	*	4/5	Low risk
Umasankar et al. ¹²⁾ (2016)	Sri Lanka	*	-	*	-	*	3/5	Low risk
Pace et al. ³⁰⁾ (2016)	Australia	*	*	*	-	*	4/5	Low risk
Lim et al. ¹³⁾ (2017)	Malaysia	*	*	*	-	*	4/5	Low risk
Harris et al. ³¹⁾ (2018)	USA	*	-	*	*	*	4/5	Low risk
Salah et al. ¹⁴⁾ (2018)	Palestine	*	-	*	*	*	4/5	Low risk
Vinall et al. ³²⁾ (2018)	Canada	*	-	*	-	*	3/5	Low risk
Trumello et al. ³³⁾ (2018)	Italy	*	-	*	*	*	4/5	Low risk
Valizadeh et al. ¹⁵⁾ (2019)	Iran	*	-	*	*	*	4/5	Low risk
Ong et al. ³⁴⁾ (2019)	Malaysia	*	-	*	*	*	4/5	Low risk
González-Hernández et al. ³⁵⁾ (2019)	Mexico	*	*	*	-	*	4/5	Low risk
Toly et al. ³⁶⁾ (2019)	USA	*	-	*	*	*	4/5	Low risk
Ganguly et al. ¹⁶⁾ (2020)	India	*	-	*	-	*	3/5	Low risk
Bonacquisti et al. ⁴³⁾ (2020)	USA	*	-	*	-	*	3/5	Low risk
Soghier et al. ¹⁷⁾ (2020)	USA	*	-	*	*	*	4/5	Low risk
Axelin et al. ³⁷⁾ (2021)	Finland	*	-	*	*	*	4/5	Low risk
Cajiao-Nieto et al. ³⁸⁾ (2021)	Spain	*	-	*	-	*	3/5	Low risk
Das et al. ¹⁸⁾ (2021)	USA	-	-	*	*	*	3/5	Low risk
Garfield et al. ³⁹⁾ (2021)	USA	*	-	*	*	*	4/5	Low risk
Souza et al. ¹⁹⁾ (2021)	Brazil	*	-	*	*	*	4/5	Low risk
Greene et al. ⁴⁰⁾ (2015)	USA	-	-	*	*	*	3/5	Low risk
Rogers et al. ⁴¹⁾ (2013)	USA	*	-	*	*	*	4/5	Low risk
Surmeli Onay et al. ²⁰⁾ (2021)	Turkey	*	-	*	*	*	4/5	Low risk
Naeem et al. et al. ⁴²⁾ (2019)	Iran	*	-	*	*	-	3/5	Low risk

Three stars or more are considered high-quality studies.

*one; -, zero.

and stress among NICU parents. Studies that evaluated the efficacy of various interventions for stress, anxiety, and depression among parents of NICU patients were excluded.

Any disagreements between the first 2 authors (AS and KH) regarding the data extracted from the articles were referred to the third author (AI), and dissimilarities were resolved in discussion with the third reviewer. The data extraction form included the first author's name, year of study, country in which the study was conducted, sample size, parental age and educational level, infant's gestational age and birth weight, instruments used during data collection with cutoff scores, and study outcomes.

3. Search outcome

The search identified 6,518 studies from online databases and 6 from printed materials. A total of 1,541 duplicate records were removed before the first screening. Further, 4,812 were rejected for not meeting the inclusion criteria. The full-text review eliminated 131 articles. The reasons for exclusion included a lack of sample size, time of data collection (when the neonate was admitted to/discharged from the NICU), participant characteristics, measurement tools, cutoff scores, and study outcomes. Finally, 41 articles were included in this meta-analysis. A summary of the study selection process is shown in Fig. 1.

4. Quality assessment of included studies

The quality of the included studies was assessed using the modified Newcastle-Ottawa Scale.⁵⁾ Each included study was appraised for selection, comparability, and outcomes. The scores on the assessment tool were 0–5. Studies

that achieved a score of ≥ 3 were considered to have a low risk of bias. The appraisals of the included studies are presented in Table 1.

5. Parental anxiety, depression, and stress

Parents of NICU patients often experience mental distress due to being away from their newborns, financial obligations, and family responsibilities. Anxiety, depression, and stress were the primary outcomes of the included studies. The authors of the primary studies employed various scales to evaluate parental anxiety, including the State-Trait Anxiety Inventory, Hospital Anxiety and Depression Scale, Beck's Anxiety Inventory, Hamilton Anxiety Rating, and Self-Rating Anxiety Scale.

Similarly, depression and stress were assessed using the Edinburgh Postnatal Depression Scale; Beck's Depression Inventory; Center for Epidemiologic Study Depression, Anxiety and Stress Scale; Parental Stress Scale; Posttraumatic Stress Disorder Questionnaires; Stanford Acute Stress Reaction Questionnaires; and Stress Disorder Checklist for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, respectively.

6. Statistical analysis

The first 2 authors (AS and KH) manually calculated the pooled prevalence across studies using Microsoft Excel. We then computed the pooled estimated prevalence using a random-effects model with 95% confidence interval (CI). Categorical or dichotomous variables are reported as percentages with values of $P < 0.05$ considered significant. Study heterogeneity was evaluated using I^2 values: high, >75 ;

Table 2. Study characteristics

Study	Country	Study design	Sample size	Characteristics parents			Characteristics of newborn		Measurement tool			Outcome of individual studies
				Parti- cipants	Mean age in years range b/w	Mean educa- tion above HS	Mean GA range b/w (wk)	Mean weight range b/w (kg)	Name of scale	Cutoff score	Point of data collection	
Carter et al. ⁴⁴⁾ (2007)	NZ	Cohort	447 M-242 F-205	Parents	M-30.1 F-33.1	*	35.1	2.47	HADS	>12	<3 Weeks	After 9 months of hospitalization parents were not reported anxiety or depression symptoms.
Yurdakul et al. ⁶⁾ (2009)	Turkey	CS	88	NICU Mother	30	60	32.6	1.95	EPDS	>13	<4 Weeks	Depression and anxiety correlated each other among NICU mothers.
Vanderbilt et al. ²²⁾ (2009)	USA	Cohort	59	Mother	29	39	34	2.35	PPQ	>6	<7 days	Early intervention was reduced the post-traumatic stress.
Holditch-Davis et al. ²³⁾ (2009)	USA	Cohort	177	Mother	25.8	*	28.3	1.10	PPQ	>6	During admis	GA, away from home and hospitalization were trigger factors heighten the mental stress in NICU mother.
Holditch-Davis et al. ²⁴⁾ (2015)	USA	Cohort	232	Mother	27	31	27.2	1.06	STAI PPQ	>47 >6	During admis	Neonate mother indicating different kind of psychological distress to NICU units.
Lefkowitz et al. ²⁵⁾ (2010)	USA	Cohort	128 M-87 F-41	Parents	M-29 F-33	M-21 F-9	<30	*	ASD	>1	<7 days symp- tom	Parents were reported depression and anxiety during hospitalization of their newborn infants.

(Continued)

Table 2. Study characteristics (Continued)

Study	Country	Study design	Sample size	Characteristics parents			Characteristics of newborn		Measurement tool			Outcome of individual studies
				Parti- pants	Mean age in years range b/w	Mean educa- tion above HS	Mean GA range b/w (wk)	Mean weight range b/w (kg)	Name of scale	Cutoff score	Point of data collection	
Dantas et al. ⁵²⁾ (2012)	Brazil	CS	60	Mother	26.5	11	31.5	1.49	STAI	>40	During admission	Mother reported high prevalence of anxiety during admission of their newborn baby in NICU unit.
Jubinville et al. ²⁷⁾ (2012)	Canada	Cohort	40	Mother	29.2	24	29	1.37	SASRQ	>38	<7 days	Safe hospital environment may reduce the psychological distress among NICU parents.
Alkozei et al. ⁸⁾ (2014)	USA	CS	85	Mother	31.9	51	30.1	1.37	EPDS PSS (NICU)	>10 >3	<7 days	NICU mother already psychological disturbed, addition stressor factors including away from home further increases the anxiety & depression.
Eutrope et al. ²⁸⁾ (2014)	France	Cohort	100	Mother	29.8	79	<32	1.32	PPQ HADS	>19 >8	<7 days	Known history of trauma & present birth weight significantly increased anxiety & depression in NICU mother.
Mulder et al. ²⁹⁾ (2014)	NZ	Cohort	447 M-242 F-205	Parents	M-30.1 F-33.1	M-126 F.*	35	2.47	HADS	>11	During admission	There was no long-term mental distress among mother of NICU babies.
Margaret et al. ⁹⁾ (2014)	India	CS	20	Mother	20-35	12	30-34	0.75-3.5	STAI	>40	<7 days	Mothers exhibit anxiety towards hospitalization.
Segre et al. ¹⁰⁾ (2014)	USA	CS	200	Mother	28.1	14	34	0.37-3.7	BAI	>16	2 Weeks	The risk factors like premature, infant illness were prime reason for anxiety and depression in NICU mother.
Garfield et al. ¹¹⁾ (2015)	USA	CS	113	Mother	24.7	49	<37	1.07	STAI PSS	* >6	<4 Weeks	Low income & poor family support demonstrated higher psychological problems in NICU mother.
Umasankar et al. ¹²⁾ (2016)	Sri Lanka	CS	75	Mother	30 Ma- nually	*	30-36	1.5	PSS (NICU)	>3	<7 days	Alteration in parenteral role & hospitalization heighten the stress among NICU mother.
Pace et al. ³⁰⁾ (2016)	Australia	Cohort	214 M-113 F-101	Parents	M-32.7 F-34.7	92	27.7	1.02	HADS	>8	Before D/C	The anxiety and depression elevated in beginning of NICU and it became declines over period of times.
Lim et al. ¹³⁾ (2017)	Malaysia	CS	104 M-62 F-42	Parents	30.1	49	*	*	PSS (NICU)	>3	<7 days	Considerably more stress reported in NICU mother than father of newborn admitted in NICU.
Harris et al. ³¹⁾ (2018)	USA	Cohort	37	Mother	29.7	*	32	1.10	STAI	>33	<7 days	There was no psychological difference between termed and preterm babies of NICU mother.
Salah et al. ¹⁴⁾ (2018)	Palestine	CS	195	Mother	28.2	90	*	2.76	BDI HAM-A	>10 >17		Social factors increase the psychological distress in NICU mother.
Vinall et al. ³²⁾ (2018)	Canada	Cohort	36	Mother	31	*	<37	*	PCL	>33	Before/C	Traumatic procedure in neonatal unit increased the maternal stress among NICU mother.
Trumello et al. ³³⁾ (2018)	Italy	Cohort	62	Mother	34	20	<32-37	1.68	STAI	>39	<7 days	Newborn admission was negatively impact and increases emotional distress.
Valizadeh et al. ¹⁵⁾ (2019)	Iran	CS	100	Mother	±31	56	34	1.85	STAI	>40	<7 days	Mother with higher education and prematurity babies demonstrated state anxiety during hospitalization.
Ong et al. ³⁴⁾ (2019)	Malaysia	Cohort	180	Mother	29.3	104	31.1	1.46	STAI PSS (NICU)	>40 *	After first week	Mothers exhibit high anxiety symptoms during NICU admission of their babies.
González-Hernández et al. ³⁵⁾ (2019)	Mexico	Cohort	188	Mother	24.7	9	*	*	HAM-A BDI	>18 >10	<2 Weeks	Age and occupation were significance with anxiety and depression of NICU mother.
Toly et al. ³⁶⁾ (2019)	USA	Cohort	19	Mother	25.6	11	29.7	1.54	PPQ	>19	During admission	Significance difference between depression and stress among mother of premature babies admitted in NICU unit.

(Continued)

Table 2. Study characteristics (Continued)

Study	Country	Study design	Sample size	Characteristics parents			Characteristics of newborn		Measurement tool			Outcome of individual studies
				Parti- cipants	Mean age in years range b/w	Mean educa- tion above HS	Mean GA range b/w (wk)	Mean weight range b/w (kg)	Name of scale	Cutoff score	Point of data collection	
Ganguly et al. ¹⁶⁾ (2020)	India	CS	100	Parents	F-27 M-30	36	*	1.5	PSS (NICU)	*	After 24 hr of admission	Stress was not significance between mother and father but length of hospitalization significances to stress among NICU parents.
Bonacquisti et al. ⁴³⁾ (2020)	USA	Cohort	127	Mother	29.6	26%	*	*	DASS	>.21	During admission	Mother and newborn separation increases the psychological symptoms among NICU mothers.
Ganguly et al. ¹⁶⁾ (2020)	India	CS	100	Parents	F-27 M-30	36	*	1.5	PSS (NICU)	*	After 24 hr of admission	Stress was not significance between mother and father but length of hospitalization significances to stress among NICU parents.
Bonacquisti et al. ⁴³⁾ (2020)	USA	Cohort	127	Mother	29.6	26%	*	*	DASS	>.21	During admission	Mother and newborn separation increases the psychological symptoms among NICU mothers.
Soghier et al. ¹⁷⁾ (2020)	USA	CS	300 M-267 F-33	Parents	30	225	28-37	1-2.5	CESD-10 PSS	>10 >3	Before D/C	Even term infant parents demonstrated high depression. Social support inversely proportional to depression.
Axelin et al. ³⁷⁾ (2021)	Finland	Cohort	1101 M-635 F-466	Parents	M-31 F-33	M-337 F-231	31.8	1.58	EPDS	>13	During D/C	Provision of family center care may improve mental wellbeing of parents of newborn admitted in NICU unit.
Cajiao-Nieto et al. ³⁸⁾ (2021)	Spain	Cohort	51	Father	20-45	39	<37	*	STAI	*	3rd day	Father reported anxiety towards parenthood and NICU unit during hospitalization.
Das et al. ¹⁸⁾ (2021)	USA	CS	96	Mother	28.4	*	35.2	2.33	DASS PHQ	>.21 >9	Before 44 weeks	Early screening may reduce the psychological symptoms among NICU mothers.
Garfield et al. ³⁹⁾ (2021)	USA	Cohort	431 M-230 F-201	Parents	M-33 F-35.1	M-175 F-149	31.5	1.87	EPDS	>13	<7 days	Parents were demonstrated depression symptoms during NICU admission of their babies.
Souza et al. (2021)	Brazil	CS	91	Mother	>18	48	37	2.69	BAI BDI	>1 >10	Before D/C	Social factors heighten the psychological discomfort among NICU parents.
Greene et al. ⁴⁰⁾ (2015)	USA	Long Cohort	69	Moher	27	52	27.5	0.95± 0.24	STAI CES-D	>40 >16.6 >19	Before 2nd Weeks	Psychological problems often reported in primipara mothers than multipara. Therefore, distractive intervention targeting these populations.
Rogers et al. ⁴¹⁾ (2013)	USA	Long Cohort	73	Mother	27.2	39	25.5	*	STAI *	>40 *	At time of D/C	Factors related to family, marital status, parental role and newborn characteristic increased the psychological problems among NICU mothers. Therefore, planned intervention may reduce these problems.
Surmeli Onay et al. ²⁰⁾ (2021)	Turkey	CS	93	Mother	30.6	28	28	2.5	STAI	>40	<7 days	Tendency of psychological symptoms of NICU mothers were not affect the EBF in preterm infants.
Naeem et al. et al. ⁴²⁾ (2019)	Iran	Cohort	80	Parents	*	M-47 F-33	34-36	*	PPQ	>19	3-5 Days after birth	GA was major reason for psychological symptoms NICU parents. Onset psychological symptom earlier in mothers than fathers. fathers indicated delayed onset of PTSD symptoms.

b/w, between; M, mother; F, father; HS, higher secondary; GA, gestational age; NZ, New Zealand; CS, cross-sectional study; NICU, neonatal intensive care unit; HADS, Hospital Anxiety and Depression Scale; EPDS, Edinburgh Postnatal Depression Scale; PPQ, perinatal posttraumatic stress disorder; STAI, State-Trait Anxiety Inventory; ASD, acute stress disorder; SASRQ, Stanford Acute Stress Reaction Questionnaire; SAS, Self-Rating Anxiety Scale; PSS, Parental Stressor Scale; BAI, Beck's Anxiety Inventory; BDI, Beck Depression Inventory; CES-D, Center for Epidemiological Studies Depression Scale; HAM-A, Hamilton Anxiety Rating Scale; PCL, posttraumatic checklists; DASS, Depression Anxiety and Stress Scale; CESD-10, Center for Epidemiological Studies Depression Scale; PHQ, Patient Health Questionnaire.

*Not reported.

medium, 50–75; and low, <50.3) Furthermore, a subgroup analysis was performed across the included studies. All analyses were performed using Poisson distribution under the Metaprop function of Stata 16 (Stata Corp LP, College Station, TX, USA).

Results

1. Study characteristics

Pooled data from the included studies were organized for a systematic review and meta-analysis. A total of 39 studies met our inclusion criteria. Among the 39 included studies, 17 adopted a cross-sectional design and 22 used a prospective or longitudinal cohort design (Table 2).⁶⁻⁴³

2. Participant characteristics

The review studies involved 6,822 participants (age range, 18–37 years), of whom 5,083 were mothers and 1,788 were fathers. The gestational age and neonatal weight ranges were 25.5–42 weeks and 750–2,920 g, respectively. Among the included studies, most participants were mothers, while

one study included only fathers (Table 2).³⁹

Among the included studies, 22 primary studies reported anxiety in the mother, 3 studies reported both fathers and mothers as participants, and one study reported anxiety in the father.^{29,38} The pooled prevalence of anxiety was higher among mothers (effect size [ES], 95% CI, and heterogeneity [I^2] (ES, 0.51; 95% CI, 0.41–0.61; $I^2=97.1\%$; $P<0.001$)^{7,9-11,14,15,18-20,24,28-31,33-35,40,41,44}) than fathers (ES, 0.26; 95% CI, 0.11–0.42; $I^2=96.6\%$; $P<0.001$) of NICU babies.^{29,30,38,44} An overall subgroup analysis revealed that approximately 47% of parents were anxious about NICU admissions (ES, 0.47; 95% CI, 0.38–0.56; $I^2=97.1\%$; $P<0.001$) (Fig. 2).

The highest and lowest prevalence of anxiety in the included studies were reported among mothers of newborns admitted to the NICU at 13% and 93% respectively.^{22,31} Similarly, the highest and lowest prevalence of anxiety among fathers of newborns admitted to the NICU were 0.09% and 46%, respectively (Fig. 2).^{29,30}

3. Depression

Fathers typically experienced fewer depressive symptoms (ES, 0.12; 95% CI, 0.03–0.22; $I^2=85.6\%$; $P<0.00$) than mothers (ES, 0.31; 95% CI, 0.24–0.38; $I^2=91.5\%$; $P<0.001$) whose newborns were in the NICU.^{6,8,14,17-19,35,37,39-41,43} An overall subgroup analysis revealed that 28% of parents were depressed about NICU admissions (ES, 0.28; 95% CI, 0.21–0.35; $I^2=94.6\%$; $P<0.001$) (Fig. 3).

The highest and lowest rates of depression among mo-

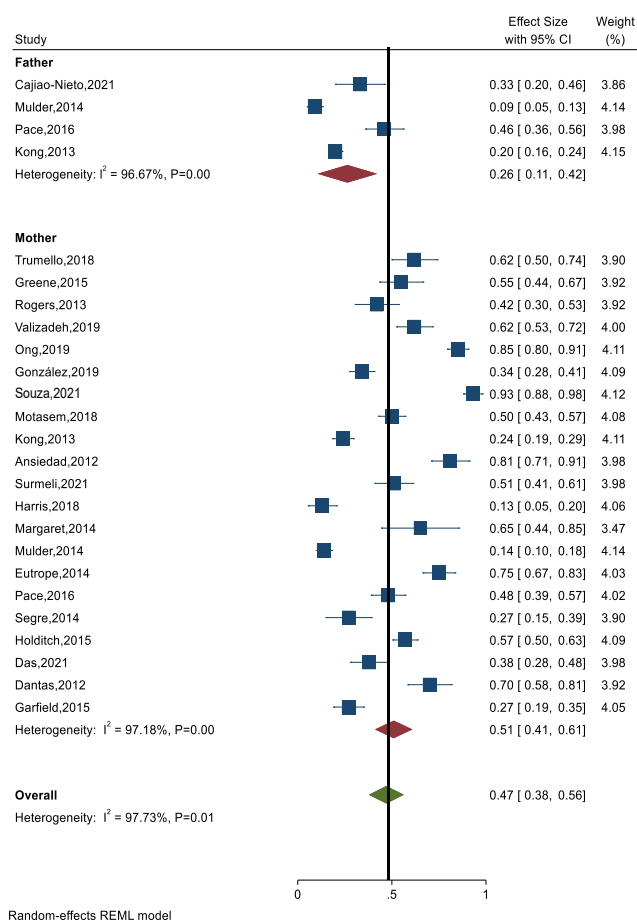


Fig. 2. Prevalence of anxiety among parents of newborns in neonatal intensive care unit. CI, confidence interval; REML, restricted maximum likelihood.

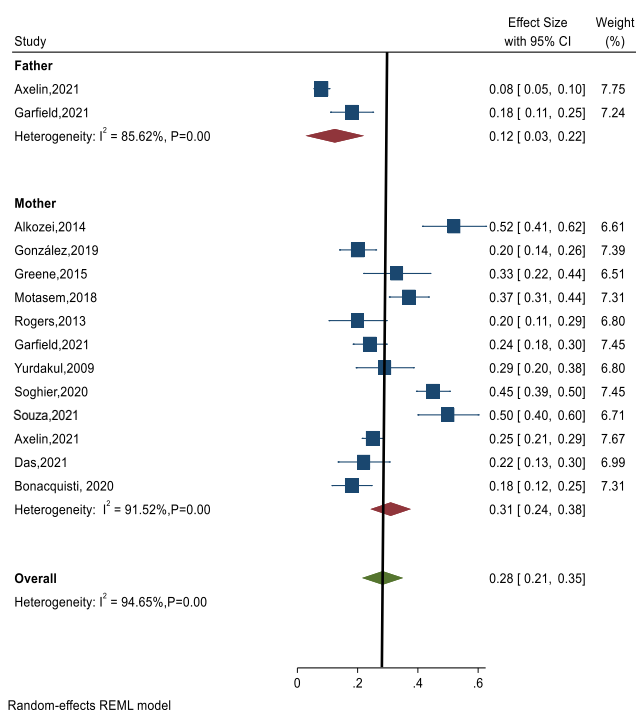


Fig. 3. Prevalence of depression among parents of newborns in neonatal intensive care unit. CI, confidence interval; REML, restricted maximum likelihood.

thers in the included studies were 52% and 18%, respectively.^{8,43} Similarly, the highest and lowest rates of depression among fathers in the included studies were 18% and 0.08%, respectively (Fig. 3).^{39,43}

4. Stress

Mothers of newborns admitted to the NICU are more likely to experience stress (ES, 0.41; 95% CI, 0.31–0.51; $I^2=93.9\%$; $P<0.001$) than fathers (ES, 0.22; 95% CI, 0.09–0.34; $I^2=85.2\%$; $P<0.001$).^{8,12,13,16,17,21-28,32,34,36,42} Overall, these findings demonstrate that parents experienced stress during the hospitalization of their newborns in the NICU (ES, 0.37; 95% CI, 0.27–0.47; $I^2=94.1\%$; $P<0.001$) (Fig. 4).

Among the included studies, the highest and lowest rates of stress among mothers were 76% and 23%, respectively.^{12,32} Similarly, the highest and lowest rates of stress among fathers were 0.06% and 35%, respectively (Fig. 4).^{21,44}

5. Measurement tools with cutoff scores

Among the 22 studies that assessed the prevalence of anxiety among parents of newborns admitted to the NICU, 13 used the State-Trait Anxiety Inventory scale (ES, 0.53; 95% CI, 0.39–0.60; $I^2=95.3\%$; $P<0.001$).^{9,11,15,20,24,31,33,34,38,40,41} Three studies used the Hospital Anxiety and Depression Scale (ES, 0.45; 95% CI, 0.11–0.80; $I^2=98.6\%$; $P<0.001$).^{28-30,44} Two studies used Beck's Anxiety Inventory scale (ES,

0.60; 95% CI, 0.04–1.25; $I^2=98.9\%$; $P<0.001$).^{10,19} Two studies used the Hamilton Anxiety Rating scale (ES, 0.42; 95% CI, 0.26–0.58; $I^2=90.7\%$; $P<0.001$).^{14,35} One study used the Self-Rating Anxiety Scale (Fig. 5).⁷

Among the 11 studies that assessed the prevalence of depression among parents of newborns in the NICU, 4 used the Edinburgh Postnatal Depression Scale (ES, 0.35; 95% CI, 0.18–0.52; $I^2=93.2\%$; $P<0.001$).^{6,8,37,39} 3 used the Beck's Depression Inventory scale (ES, 0.35; 95% CI, 0.18–0.52; $I^2=93.8\%$; $P<0.001$).^{14,19,35} 2 used the Centre for Epidemiologic Study Depression Scale (ES, 0.40; 95% CI, 0.28–0.52; $I^2=72.6\%$; $P<0.001$).^{17,40} and 2 used the Depression, Anxiety and Strs Scale (ES, 0.19; 95% CI, 0.14–0.25; $I^2=0.03\%$; $P<0.001$) (Fig. 6).^{18,43}

Among the 18 studies that assessed the prevalence of stress among parents of newborns in the NICU, 6 used the Parental Stress Scale (ES, 0.57; 95% CI, 0.46–0.69;

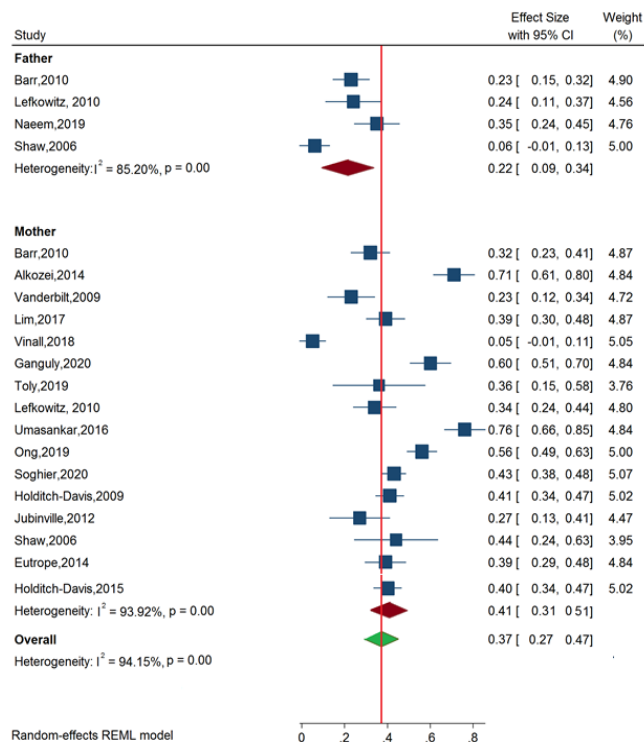


Fig. 4. Prevalence of stress among parents of newborns in the neonatal intensive care unit. CI, confidence interval; REML, restricted maximum likelihood.

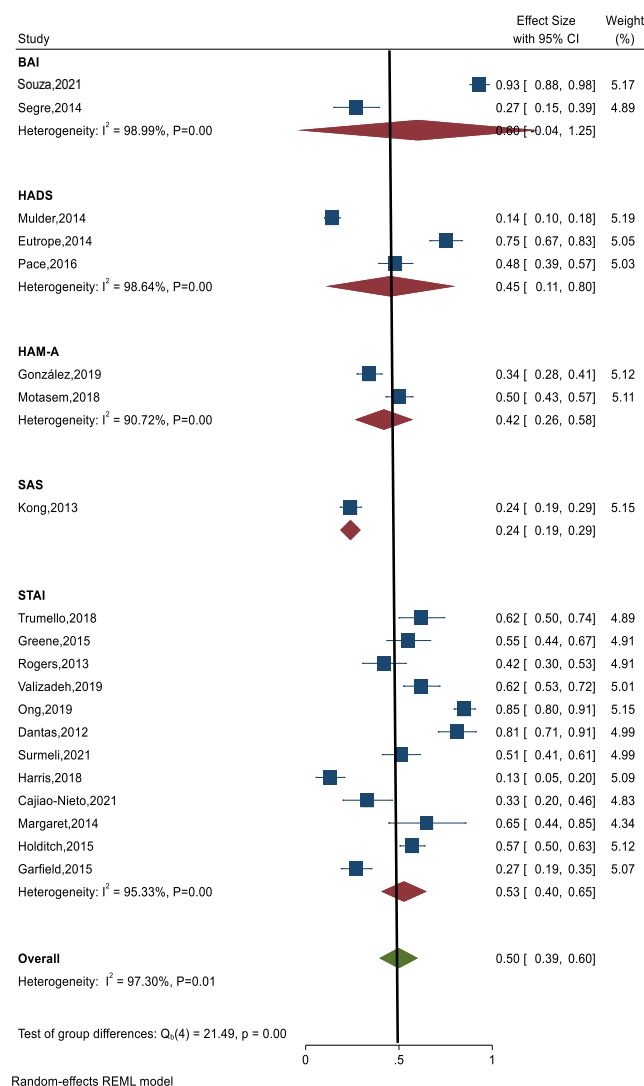


Fig. 5. Subgroup analysis of anxiety scales used by studies included in the meta-analysis. CI, confidence interval; REML, restricted maximum likelihood.

$I^2=92.2\%$; $P<0.001$),^{8,12,13,16,17,34} 6 used the Perinatal Post-traumatic Stress Disorder Questionnaires (ES, 0.37; 95% CI, 0.31–0.42; $I^2=46.1\%$; $P<0.001$),^{22-24,28,36,42} 3 used the Stanford Acute Strs Reaction Questionnaires (ES, 0.32; 95% CI, 0.25–0.39; $P<0.001$),^{24,30,31} and 2 used the Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (ES, 0.19; 95% CI, -0.09 to 0.48; $I^2=95.7\%$; $P<0.001$)^{25,32} (Fig. 7).

The pooled prevalence of the participants was calculated as 95% CI. The participants were divided into 2 age groups: <30 years (n=2,941) (ES, 0.51; 95% CI, 0.50 to -0.52) and >30 years (n=3,364) (ES, 0.48; 95% CI, 0.47–0.49). Similarly, the majority of participants were mothers (n=5,102) (ES, 0.73; 95% CI, 0.72–0.74) than fathers of newborns (n=1,803) (ES, 0.26; 95% CI, 0.25–0.27). Further, most of the babies were born after 30 weeks' gestation (n=5,358) (ES, 0.83; 95% CI, 0.82–0.84) and weighed more than 1.5 kg (n=4,633) (ES, 0.77; 95% CI, 0.76–0.78). The existing original studies adopted a cohort (n=4,542) (ES, 0.6; 95% CI, 0.64–0.66) and cross-sectional research design (n=2,363) (ES, 0.34; 95% CI, 0.33–0.35). Twenty-two studies were conducted in South and North America (n=2,644) (ES, 0.38; 95% CI, 0.37–0.39), 11 in Asia (n=1,635) (ES, 0.23; 95% CI, 0.22–0.24), 4 in Europe (n=1,314) (ES, 0.19; 95% CI, 0.18–0.20), and 4 in Australia (n=1,312) (ES, 0.19; 95% CI, 0.18–0.20). The pooled prevalence of anxiety, depression, stress, and measurement tools is summarized in Table 3.

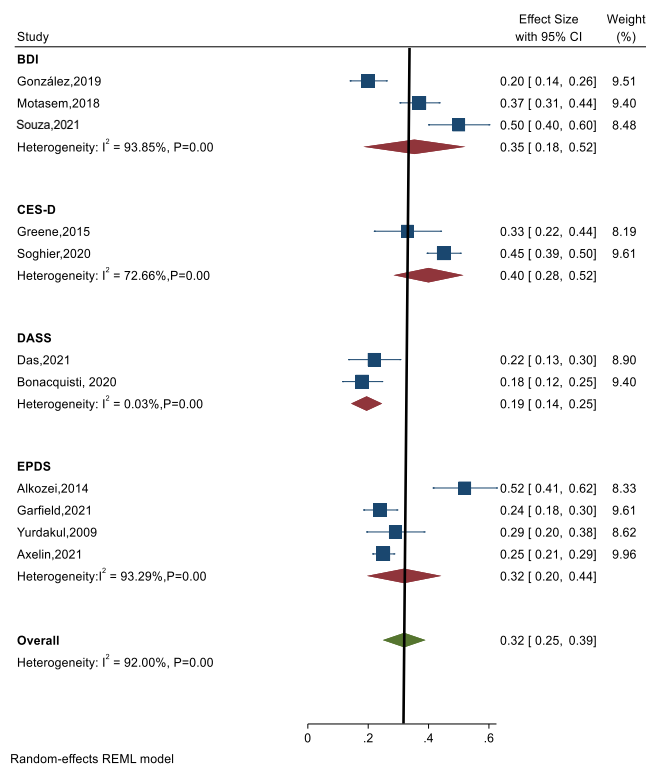


Fig. 6. Subgroup analysis of depression scales used by studies included in the meta-analysis. CI, confidence interval; REML, restricted maximum likelihood.

Discussion

This is the first systematic review and meta-analysis to report the pooled prevalence of anxiety, depression, and stress among parents of neonates in the NICU. Our findings showed that 49% of mothers and 23% of fathers felt anxious when their newborns were admitted to the NICU. Previous studies found similar results: 40% of mothers and 20% of fathers experienced anxiety symptoms during their newborns' NICU hospitalization.^{43,46} However, proper counseling and parental involvement during hospitalization improved parental satisfaction.⁴⁵

Depression is another major issue among parents of NICU patients. Our meta-analysis revealed that 31% of mothers and 12% of fathers experienced depressive symptoms. Although postpartum depression is common among new mothers, parents reported reduced depression symptoms (from 33.3% to 11.7%) by the fourth week of the NICU admission.⁴⁷

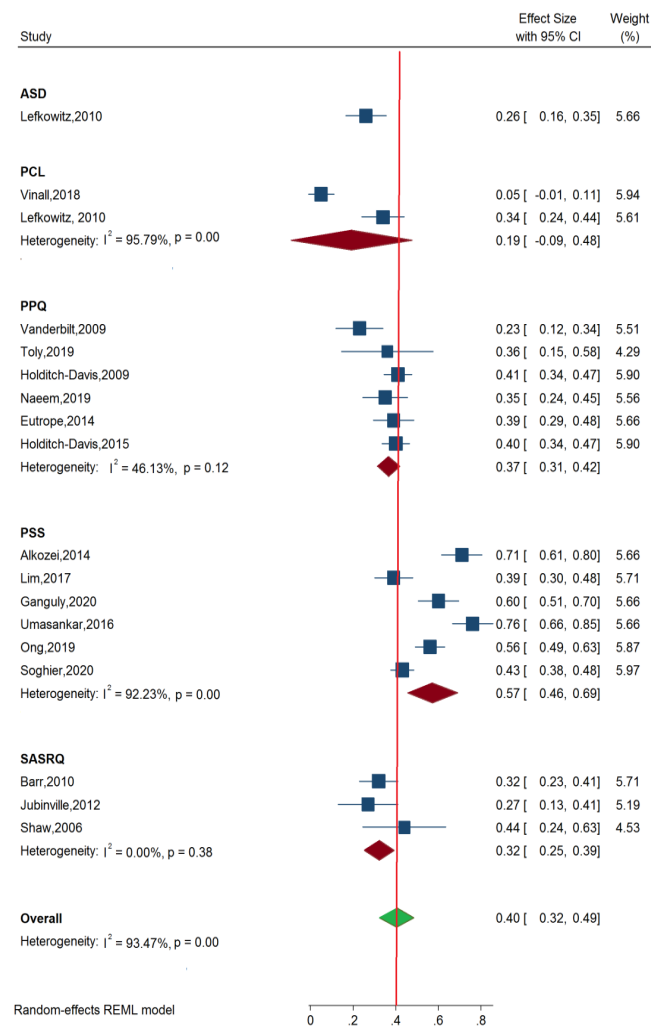


Fig. 7. Subgroup analysis of stress scales used by studies included in the meta-analysis. CI, confidence interval; REML, restricted maximum likelihood.

Table 3. Pooled prevalence of participant variables among included studies

Variable	No. of studies	Samples (n)	Effect size (95% CI)	I ² in percentages
Age of parents (yr)				
<30	27	2,941	0.51 (0.50–0.52)	94.2
>30	13	3,364	0.48 (0.47–0.49)	
Gender				
Mother	30	5,102	0.73 (0.72–0.74)	99.9
Father	10	1,803	0.26 (0.25–0.27)	
Gestational age (wk)				
<30	10	1,028	0.16 (0.15–0.17)	99.9
>30	27	5,358	0.83 (0.82–0.84)	
Weight (kg)				
<1.5	12	1,442	0.23 (0.22–0.24)	99.9
>1.5	20	4,633	0.77 (0.76–0.78)	
Study setting				
South & North America	22	2,644	0.38 (0.37–0.39)	99.6
Europe	4	1,314	0.19 (0.18–0.20)	
Asia	11	1,635	0.23 (0.22–0.24)	
Australia	4	1,312	0.19 (0.18–0.20)	
Study design				
Cross sectional	17	2,363	0.34 (0.33–0.35)	99.9
Cohort	24	4,542	0.65 (0.64–0.66)	
Measurement tool-Anxiety				
STAI	13	1,141	0.50 (0.39–0.61)	96.8
HADS	4	574	0.41 (0.15–0.67)	
HAM-A	2	383	0.42 (0.26–0.58)	
BAI	2	281	0.60 (0.04–1.25)	
SAS	1	200	0.24 (0.19–0.29)	
Measurement tool-Depression				
BDI	4	520	0.33 (0.20–0.46)	90.91
EPDS	4	1,038	0.32 (0.20–0.44)	
CES-D	2	369	0.40 (0.28–0.52)	
DASS	2	223	0.19 (0.14–0.25)	
Measurement tool-Stress				
PPQ	6	479	0.37 (0.31–0.42)	93.4
PSS	6	844	0.57 (0.46–0.69)	
SASRQ	3	165	0.32 (0.25–0.39)	
PCL	2	123	0.19 (0.09–0.48)	
ASD	1	86	0.26 (0.16–0.35)	
Parents' response to NICU unit				
Anxiety	24	3,664	0.45 (0.36–0.53)	97.7
Depression	14	2,890	0.28 (0.24–0.37)	93.9
Stress	18	2,090	0.37 (0.29–0.45)	94.1

CI, confidence interval; STAI, State-Trait Anxiety Inventory; HADS, Hospital Anxiety and Depression Scale; HAM-A, Hamilton Anxiety Rating Scale; BAI, Beck's Anxiety Inventory; SAS, Self-Rating Anxiety Scale; BDI, Beck Depression Inventory; EPDS, Edinburgh Postnatal Depression Scale; CES-D, Center for Epidemiological Studies Depression Scale; DASS, Depression Anxiety and Stress Scale; CESD-10, Center for Epidemiological Studies Depression Scale; PPQ, perinatal posttraumatic stress disorder; PSS, Parental Stressor Scale; SASRQ, Stanford Acute Stress Reaction Questionnaire; PCL, posttraumatic checklists; ASD, acute stress disorder; NICU, neonatal intensive care unit.

Similarly, many NICU parents often report high levels of stress from being physically separated from their newborn and the financial burden compared to parents of healthy

babies. Our meta-analysis revealed that 41% of mothers and 21% of fathers experienced psychological stress. The NICU intervention modality and parent-centered care significantly reduced parental stress.⁴⁸⁾ Newborns are admitted to the NICU for various reasons, including premature birth, low birth weight, infection, and congenital anomalies.⁴⁹⁾ Faced with medical challenges, parents struggle to embrace parenthood.⁵⁰⁾ This could be attributed to the mother's feelings about birthing a sick child and being more concerned about their child's future growth and development.⁵¹⁾ In addition to being away from family, hospitalization significantly increases the clinical symptoms of stress, anxiety, and depression among the parents of neonates in the NICU.^{10,12,15,16,43)}

However, there was no significant correlation between neonatal sex and the psychological symptoms experienced by the parents of neonates admitted to the NICU.¹⁶⁾ Social support, family income, and parental education level were significantly negatively correlated with anxiety and depression among mothers of neonates in the NICU.¹⁹⁾

A similar systematic review and meta-analysis evaluated parent-centered communication regarding parental satisfaction during newborn NICU admission. They concluded that good communication and parental support boosted parental satisfaction. Furthermore, our study results urge healthcare workers to provide timely and effective parent-centered counseling for parents of neonates in the NICU. However, identifying the negative factors that reduce the psychological problems experienced by parents of NICU patients remains challenging for healthcare workers. Family-centered instructional interventions can reduce distress symptoms among mothers and fathers of preterm infants to a similar magnitude. Timely counseling of parents may help them better adjust to the hospital environment and enhance their mental wellbeing.³⁹⁾

The main strength of our review is that it assessed the pooled prevalence of stress, anxiety, and depression and included a subgroup analysis of the pooled prevalence of stress, anxiety, and depression in NICU mothers and fathers.

Our review has some limitations. The majority of neonates were discharged before 1 month of age. Therefore, the prevalence of psychological symptoms among parents was examined between only the first and fourth weeks of hospitalization. Second, most of the studies were conducted in high-income countries. Therefore, we could not perform a subgroup analysis of the variations in the prevalence of stress, anxiety, and depression between low- and high-income countries.

In conclusion, NICU admission can affect parents' psychological health, which could have a detrimental effect on the parent-child interaction. Parents of neonates in the NICU require counseling, empathy about the neonate's con-

dition, and encouragement to visit their child in the NICU. More qualitative studies with longitudinal follow-up are needed to address this issue.








Footnotes

Conflicts of interest: No potential conflict of interest relevant to this article was reported.

Funding: This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author contribution: Conceptualization: KH, APS; Data curation: AI, LT; Formal analysis: PM; Methodology: KH, APS, LT; Project administration: VDU, SD; Visualization: VDU, SD, PM; Writing-original draft: APS, KH, AI; Writing-review & editing: SD, RKM, LT

ORCID:

Asha P. Shetty  <https://orcid.org/000-0001-5438-4722>
Kurvatteppa Halemani  <https://orcid.org/0000-0002-6603-5121>
Alwin Issac  <https://orcid.org/0000-0002-4528-8787>
Latha Thimmappa  <https://orcid.org/0000-0003-0856-4380>
Sanjay Dhiraaj  <https://orcid.org/0000-0001-7591-3013>
Radha K  <https://orcid.org/0000-0002-4229-206X>
Prabhaker Mishra  <https://orcid.org/0000-0003-4769-9106>
Vijay Datta Upadhyaya  <https://orcid.org/0000-0002-6358-8126>

References

1. Stremler R, Haddad S, Pullenayegum E, Parshuram C. Psychological outcomes in parents of critically ill hospitalized children. *J Pediatr Nurs* 2017;34:36-43.
2. Roque ATF, Lasiuk GC, Radünz V, Hegadoren K. Scoping review of the mental health of parents of infants in the NICU. *J Obstet Gynecol Neonatal Nurs* 2017;46:576-87.
3. Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, editors. *Cochrane Handbook for Systematic Reviews of Interventions* version 6.2 [Internet]. Cochrane; 2021 [cited 2022 Jan 24]. Available from: <http://www.training.cochrane.org/handbook>.
4. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71.
5. Wells GA, Shea B, O'Connell D, Robertson J, Peterson J, Welch V, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses. Ottawa (ON): Ottawa Hospital Research Institute, 2014.
6. Yurdakul Z, Akman I, Ku çu MK, Karabekiroglu A, Yaylahı G, Demir F, et al. Maternal psychological problems associated with neonatal intensive care admission. *Int J Pediatr* 2009;2009:591359.
7. Kong LP, Cui Y, Qiu YF, Han SP, Yu ZB, Guo XR. Anxiety and depression in parents of sick neonates: a hospital-based study. *J Clin Nurs* 2013;22:1163-72.
8. Alkozei A, McMahon E, Lahav A. Stress levels and depressive symptoms in NICU mothers in the early postpartum period. *J Matern Fetal Neonatal Med* 2014;27:1738-43.
9. Margaret BE, Shetty S, Lewis L, Bhat RY. Maternal anxiety and family support among mothers of neonates admitted in neonatal intensive care unit. *IOSR J Nurs Health Sci* 2014;3:40-3.
10. Segre LS, McCabe JE, Chuffo-Siewert R, O'Hara MW. Depression and anxiety symptoms in mothers of newborns hospitalized on the neonatal intensive care unit. *Nurs Res* 2014;63:320-32.
11. Garfield L, Holditch-Davis D, Carter CS, McFarlin BL, Schwertz D, Seng JS, et al. Risk factors for postpartum depressive symptoms in low-income women with very low-birth-weight infants. *Adv Neonatal Care* 2015;15:E3-8.
12. Umasankar N, Sathiadhas MG. Maternal stress level when a baby is admitted to the neonatal intensive care unit at Teaching Hospital Jaffna and the influence of maternal and infant characteristics on this level. *Sri Lanka J Child Health* 2016;45:90-4.
13. Lim CJ, Pubalan JK, Keng SL. Parental stress and its influencing factors in the neonatal intensive care unit. *Int J Pub Health Clin Sci* 2017;4:55-65.
14. Salah M, Breaka R, Alkassheh A. Prevalence of anxiety and depression among mothers of newborns admitted to neonatal intensive care units in Gaza strip. *Edelweiss Psychiatr Open Access* 2018;10:10-4.
15. Valizadeh L, Arani MM, Hosseini MB, Asgari M, Mansourian M, Ziapour A, et al. Evaluation of maternal anxiety in mothers of infants admitted to the evaluation of maternal anxiety in mothers of infants admitted to the neonatal intensive care unit. *Int J Pediatr* 2019;7:10215-24.
16. Ganguly R, Patnaik L, Sahoo J, Pattanaik S, Sahu T. Assessment of stress among parents of neonates admitted in the neonatal intensive care unit of a tertiary care hospital in Eastern India. *J Educ Health Promot* 2020;9:288.
17. Soghier LM, Kritikos KI, Carty CL, Glass P, Tuchman LK, Streisand R, et al. Parental depression symptoms at neonatal intensive care unit discharge and associated risk factors. *J Pediatr* 2020;227:163-9.
18. Das A, Gordon-Ocejo G, Kumar M, Kumar N, Needlman R. Association of the previous history of maternal depression with post-partum depression, anxiety, and stress in the neonatal intensive care unit. *J Matern Fetal Neonatal Med* 2021;42:e20200388.
19. de Souza LG, de Queiroz VC, da Andrade SS, César ESR, Melo VFC de, Oliveira SHDS. Anxiety and depression in mothers of newborns in intensive care units. *Rev Gaucha Enferm* 2021;42:e20200388.
20. Surmeli Onay O, Sarilar TD, Taskiran Tepe H, Ozen H, Tekin N. The relationship of breastfeeding patterns in the neonatal intensive care unit to maternal symptoms of anxiety and depression. *Breastfeed Med* 2021;16:251-7.
21. Shaw RJ, Deblois T, Ikuta L, Ginzburg K, Fleisher B, Koopman C. Acute stress disorder among parents of infants in the neonatal intensive care nursery. *Psychosomatics* 2010;15:106-22.
22. Vanderbilt D, Bushley T, Young R, Frank DA. Acute posttraumatic stress symptoms among urban mothers with newborns in the neonatal intensive care unit: a preliminary study. *J Dev Behav Pediatr* 2009;30:50-6.
23. Holditch-Davis D, Miles MS, Weaver MA, Black B, Beeber L,

- Thoyre S, et al. Patterns of distress in African-American mothers of preterm infants. *J Dev Behav Pediatr* 2009;30:193-205.
24. Holditch-Davis D, Santos H, Levy J, White-Traut R, O'Shea TM, Geraldo V, et al. Patterns of psychological distress in mothers of preterm infants. *Infant Behav Dev* 2015;41:154-63.
 25. Lefkowitz DS, Baxt C, Evans JR. Prevalence and correlates of posttraumatic stress and postpartum depression in parents of infants in the neonatal intensive care unit (NICU). *J Clin Psychol Med Settings* 2010;17:230-7.
 26. Barr P. Acute traumatic stress in neonatal intensive care unit parents: relation to existential emotion-based personality predispositions. *J Loss Trauma* 2010;15:106-22.
 27. Jubinville J, Newburn-Cook C, Hegadoren K, Lacaze-Masmon-teil T. Symptoms of acute stress disorder in mothers of pre-mature infants. *Adv Neonatal Care* 2012;12:46-53.
 28. Eutrope J, Thierry A, Lempp F, Aupetit L, Saad S, Dodane C, et al. Emotional reactions of mothers facing premature births: study of 100 mother-infant dyads 32 gestational weeks. *PLoS One* 2014;9:e104093.
 29. Mulder RT, Carter JD, Frampton CMA, Darlow BA. Good two-year outcome for parents whose infants were admitted to a neonatal intensive care unit. *Psychosomat* 2014;55:613-20.
 30. Pace CC, Spittle AJ, Molesworth CML, Lee KJ, Northam EA, Cheong JLY, et al. Evolution of depression and anxiety symptoms in parents of very preterm infants during the newborn period. *JAMA Pediatr* 2016;170:863-70.
 31. Harris R, Gibbs D, Mangin-Heimos K, Pineda R. Maternal mental health during the neonatal period: relationships to the occupation of parenting. *Early Hum Dev* 2018;120:31-9.
 32. Vinall J, Noel M, Disher T, Caddell K, Campbell-Yeo M. Memories of infant pain in the neonatal intensive care unit influence posttraumatic stress symptoms in mothers of infants born preterm. *Clin J Pain* 2018;34:936-43.
 33. Trumello C, Candelori C, Cofini M, Cimino S, Cerniglia L, Paciello M, et al. Mothers' depression, anxiety, and mental representations after preterm birth: a study during the infant's hospitalization in a neonatal intensive care unit. *Front Pub Health* 2018;6:359.
 34. Ong SL, Abdullah KL, Danaee M, Soh KL, Soh KG, Japar S. Stress and anxiety among mothers of premature infants in a Malaysian neonatal intensive care unit. *J Reprod Infant Psychol* 2019;37:193-205.
 35. González-Hernández A, González-Hernandez D, Fortuny-Falconi CM, Tovilla-Zárate CA, Fresan A, Nolasco-Rosales GA, et al. Prevalence and associated factors to depression and anxiety in women with premature babies hospitalized in a neonatal intensive care unit in a Mexican population. *J Pediatr Nurs* 2019;1:53-6.
 36. Toly VB, Blanchette JE, Liu W, Sattar A, Musil CM, Bieda A, et al. Maternal stress and mental health prior to their technology-dependent infant's discharge home from the NICU. *J Perinat Neonatal Nurs* 2019;33:149-59.
 37. Axelin A, Feeley N, Campbell-Yeo M, Silnes Tandberg B, Szczapa T, Wielenga J, et al. Symptoms of depression in parents after discharge from NICU associated with family-centered care. *J Adv Nurs* 2022;78:1676-87.
 38. Cajiao-Nieto J, Torres-Giménez A, Merelles-Tormo A, Botet-Mussons F. Paternal symptoms of anxiety and depression in the first month after childbirth: a comparison between fathers of full term and preterm infants. *J Affect Disord* 2021;282:517-26.
 39. Garfield CF, Lee YS, Warner-Shifflett L, Christie R, Jackson KL, Miller E. Maternal and paternal depression symptoms during NICU stay and transition home. *Pediatrics* 2021;148:e2020042747.
 40. Greene MM, Rossman B, Patra K, Kratovil AL, Janes JE, Meier PP. Depressive, anxious and perinatal post-traumatic distress in mothers of very low birth weight infants in the NICU. *J Dev Behav Pediatr* 2015;36:362-70.
 41. Rogers CE, Kidokoro H, Wallendorf M, Inder TE. Identifying mothers of very preterm infants at-risk for postpartum depression and anxiety before discharge. *J Perinatol* 2013;33:171-6.
 42. Naeem AT, Shariat M, Zarkesh MR, Abedinia N, Teimoori-bakhsh S, Nayeri F. Posttraumatic stress disorder and associated risk factors among parents of hospitalized term and preterm neonates. *Iran J Pediatr* 2019;29:1-6.
 43. Bonacquisti A, Geller PA, Patterson CA. Maternal depression, anxiety, stress, and maternal-infant attachment in the neonatal intensive care unit. *J Reprod Infant Psychol* 2020;38:297-310.
 44. Carter JD, Mulder RT, Frampton CMA, Darlow BA. Infants admitted to a neonatal intensive care unit: parental psychological status at 9 months. *Acta Paediatr* 2007;96:1286-9.
 45. Voulgaridou A, Paliouras D, Deftereos S, Skarentzos K, Tsergoula E, Miltsakaki I, et al. Hospitalization in neonatal intensive care unit: parental anxiety and satisfaction. *Pan African Med J* 2023;44:55.
 46. Issac A, Dhiraaj S, Halemani K, Thimmappa L, Mishra P, Kumar B, et al. Efficacy of early enteral nutrition on gastrointestinal surgery outcomes: a systematic review and meta-analysis. *Eur J Pediatr Surg* 2023;33:454-62.
 47. Gönülal D, Yalaz M, Altun-Köroğlu Ö, Kültürsay N. Both parents of neonatal intensive care unit patients are at risk of depression. *Turk J Pediatr* 2014;56:171-6.
 48. Bernardo J, Rent S, Arias-Shah A, Hoge MK, Shaw RJ. Parental stress and mental health symptoms in the NICU: recognition and interventions. *Neorev* 2021;22:e496-505.
 49. Halemani K, Issac A, Dhiraaj S, Mishra P. Efficacy of body position on gastric residual in preterm infant: a systematic review and meta-analysis. *Clin Exp Pediatr* 2023;66:262-70.
 50. Dhiraaj S, Thimmappa L, Issac A, Halemani K, Mishra P, Mavinatop A. The impact of early enteral nutrition on post-operative hospital stay and complications in infants undergoing congenital cardiac surgery: a systematic review and meta-analysis. *J Caring Sci* 2022;12:14-24.
 51. Caporali C, Pisoni C, Gasparini L, Ballante E, Zecca M, Orcesi S, et al. A global perspective on parental stress in the neonatal intensive care unit: a meta-analytic study. *J Perinatol* 2020;40:1739-52.
 52. Dantas C, Cristhina P, Araújo B De, Maria L, Santos DO. Symptoms of anxiety and depression in mothers of hospitalized premature infants. *Rev Enferm UFPE* 2012;6:279-87.

How to cite this article: Shetty AP, Halemani K, A Issac, Thimmappa L, Dhiraaj S, K R, et al. Prevalence of anxiety, depression, and stress among parents of neonates admitted to neonatal intensive care unit: a systematic review and meta-analysis. *Clin Exp Pediatr* 2024;67:104-15.