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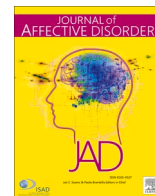
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## Review article

# Parental stress and mental health outcomes following very preterm birth: A systematic review of recent findings

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## ABSTRACT

**Background:** In recent years, there has been a wide array of research studies published on parental mental health and stress following very preterm birth. This review aims at reviewing the prevalence and risk factors of long-term parental depression, anxiety, post-traumatic stress symptoms and parenting stress following very preterm birth.

**Methods:** We searched PubMed, PsychINFO and Web of Science for descriptive, cross-sectional and longitudinal studies published between January 2013 and August 2022.

**Results:** 45 studies met our inclusion criteria. In the first two years, depression, anxiety, post-traumatic stress symptoms and parenting stress were present in ~20 % of mothers of extreme and very low birth weight (E/VLBW) infants. Long-term psychological distress symptoms could be observed, although few studies have focused on symptoms into school age and longer. Fathers of VLBW infants might experience more psychological distress as well, however, they were only included in ten studies. We found that parental distress is more common when the co-parent is struggling with mental health symptoms. Many risk factors were identified such as social risk, history of mental illness, interpersonal factors (i.e. social support) and child-related factors (i.e. intraventricular hemorrhage, disability, use of medical equipment at home).

**Limitations:** Several studies have methodological issues, such as a lack of control of known confounders and there is a large variety of measures employed.

**Conclusion:** Important risk factors for stress and mental health symptoms were identified. More evidence is needed to determine if long-term symptoms persist into school age. Research should focus on taking a family-based approach in order to identify preventive strategies and resilience factors in parents of VLBW infants.

## 1. Introduction<sup>1</sup>

Parents who experience preterm birth are exposed to internal and external stress factors that could lead to dysfunctional parent-infant interactions, bonding difficulties and disrupted representations of the child (Forcada-Guex et al., 2011; Ionio et al., 2017; Korja et al., 2012). Literature reviews have indicated that parents are more vulnerable to mental health illnesses and psychological distress in the two years

following birth (Treyvaud, 2014; Vigod et al., 2010) but have noted that evidence was lacking regarding long-term outcomes and that fathers had been mostly disregarded in the literature. Moreover, in recent years, family-centered and developmental neonatal care has been increasingly practiced and we know little about the potential impact on parents' psychological well-being. Furthermore, most reviews have focused on parental distress during hospitalization and in the short term rather than in the long term (Schappin et al., 2013; Treyvaud, 2014). This was

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<sup>1</sup> Abbreviations: VPT: very preterm, EPT: extreme preterm, VLBW: Very low birth weight, ELBW: extremely low birth weight, GW: gestational weeks, GA: gestational age, PTSD: post-traumatic stress disorder, PTSS: post-traumatic stress symptoms, NICU: neonatal intensive care unit.

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illustrated by two recent literature reviews which found that mothers are at greater risk of post-partum depression in the 6 months that follow the birth (de Paula Eduardo et al., 2019) and that they experience significant distress during hospitalization (Staver et al., 2021). Parental post-traumatic stress symptoms, depressed mood, anxiety and stress could compromise parent-child interactions and attachment if they persist in time. An updated review focalizing on long-term consequences of very preterm birth is therefore justified. Almost a decade ago, Treyvaud (2014) urged for more research to be conducted in order to determine long-term parental mental health outcomes, stating that more evidence was needed regarding potential risk and resilience factors in parents, and advocating for including the father’s perspective as well as the mother’s. In response to these questions, this article aims at reviewing the literature published since Treyvaud’s (2014) initial review, in order to identify current gaps and future directions.

2. Methods

This review follows the 2019 PRISMA statements for performing a

systematic review (Moher et al., 2015). As a first step, studies dealing with parenting stress and mental health of parents of children born very premature were identified thanks to a computerized search in PubMed, PsychINFO and Web of Science using the following keywords: (Stress OR depression OR anxiety OR post-traumatic stress OR mental health) AND (preterm OR premature) AND (maternal OR paternal OR parent\*). From all databases we retrieved articles published between January 1st, 2013 and July 1st, 2022. In PubMed and PsychINFO we used the additional filter for participant age 19+ years, which lead to 720 hits in PubMed, 170 in PsychINFO and 1692 in Web of Science.

All articles found were registered using the reference management software Zotero. Duplicates were checked not only digitally, but also manually in order to remove duplicates that could have been missed by the software.

As a second step, the articles previously found were selected using inclusion and exclusion criteria. Inclusion criteria included: 1) quantitative results; 2) articles reporting longitudinal, cross-sectional and descriptive studies; 3) articles reporting studies with a population composed of parents of children born very preterm (<33 GW or 1500 g)

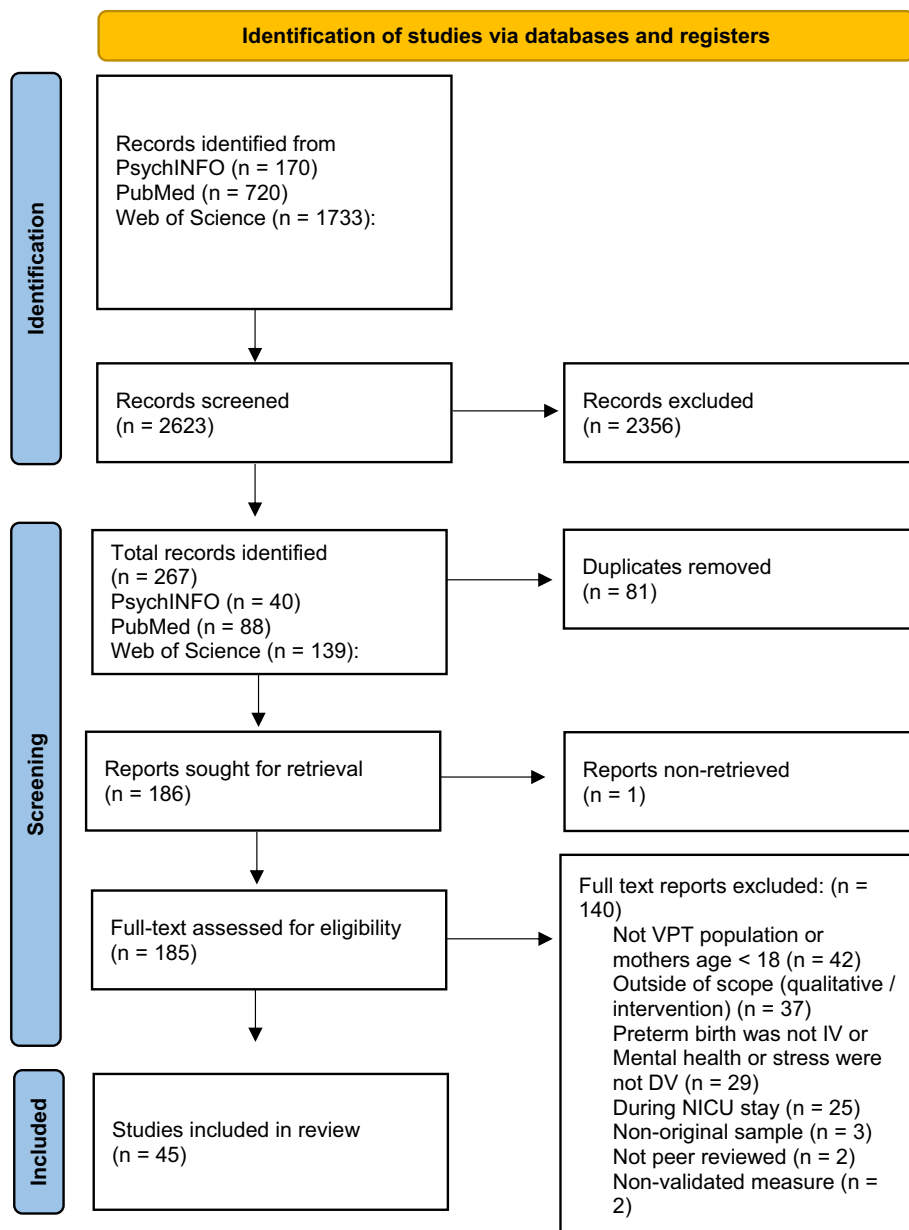


Fig. 1. PRISMA 2020 flow diagram representing identification, screening and inclusion of studies.

or extremely preterm (<28 GW or 1000 g), and 4) mental health or stress evaluation done after hospital discharge (PsychINFO last consulted on June 23, 2022; PubMed last consulted on June 29, 2022; Web of Science last consulted on August 22, 2022).

Articles reporting results for non-adults (age < 18 years), literature reviews, case reports and non-original results were excluded. The non-clinical nature of this systematic review excluded studies reporting results of major psychiatric illnesses. In order to summarize the data, three groups of articles were created, those concerned with: 1) parenting stress, 2) depression and anxiety, and 3) post-traumatic stress symptoms (PTSS).

During the review phase of the articles, data was summarized by the first author (RS) who extracted the data in a dedicated table. Our local research ethics committee did not consider that their approval was needed for this systematic review.

The PRISMA flow diagram of this bibliographic search is shown in Fig. 1.

### 2.1. Assessment of the risk of bias

Author RS conducted the quality assessments of the selected studies. The present review uses the adapted Newcastle-Ottawa Scale for cross-sectional studies (Herzog et al., 2013) to critically evaluate the risk of bias in the included studies. The original NOS scales cover three domains: selection, comparability and outcome. Within these domains, the scale includes questions on representativeness of the population, selection or sample(s), ascertainment of exposure and outcome, control variables, assessment of outcome and adequacy of follow-up. Similar to the original scale, the adapted version covers selection, comparability and outcome. Two main differences can be noted: Firstly, where selection covers 4 items (representativeness, sample size, non-respondents and exposure), the outcome domain awards one point for self-report measures as opposed to none in the original scale. We chose to keep this modification as stress and mental health are subjective experiences in which parents' point of view is central. Secondly, an article could receive a maximum of five points for selection (versus four in the original scale), two points for comparability and three for outcome. The scale's highest score is 10. The NOS classification has been used in similar systematic reviews (Herzog et al., 2013; Moore et al., 2021).

## 3. Results

### 3.1. Study characteristics

Forty-five quantitative studies were included. Twenty-two studies were concerned with anxiety or depression, six with PTSS/PTSD, and five with both of these outcomes. Eighteen studies looked at parenting stress. When considering the evaluation of parental stress, we found that the most commonly used questionnaires were the Parenting Stress Index (PSI and PSI-SF, Abidin, 1995,  $n = 8$  et  $n = 7$  respectively) whereas a modified Swedish version of the PSI (SPSQ, Östberg et al., 1997), the Parental Stressor Scale (PSS, Cohen et al., 1983) and the Parent Daily Hassles scale (PDH, Crnic and Greenberg, 1990) were used in individual studies. Articles reporting on psychological distress, depression, anxiety and post-traumatic stress were grouped together because they were often evaluated on the same populations (see Table 2). For depression and anxiety, the Edinburgh Postnatal Depression Scale (EPDS, Cox et al., 1987,  $n = 11$ ), the Beck Depression Inventory (BDI, Beck et al., 1996,  $n = 7$ ), the Center for Epidemiologic Studies Depression Scale (C-ESD, Radloff, 1977) ( $n = 5$ ), and the Hospital Anxiety Depression Scale (HADS, Zigmond and Snaith, 1983,  $n = 3$ ) were the most commonly used measures. Furthermore, the General Health Questionnaire (GHQ, Goldberg et al., 1988,  $n = 2$ ) as well as the Rutter Malaise Inventory modified (RMI-m, Rutter et al., 1970  $n = 1$ ) were used in a few studies. The most common measure used to evaluate parental anxiety was the State-Trait Anxiety Inventory (STAI, Spielberger, 1983,  $n = 7$ ), followed

by the HADS ( $n = 3$ ), GHQ ( $n = 2$ ) and the Penn State Worry Questionnaire (PSWQ, Meyer et al., 1990,  $n = 1$ ). The Perinatal post-traumatic stress disorder Questionnaire (mPPQ,  $n = 3$ , PPQ, Callahan and Hynan, 2002; Quinell and Hynan, 1999,  $n = 3$ ) was the most commonly used measure to evaluate post-traumatic stress. The Impact of Event scale – revised, (IES-r, Maercker and Schutzwohl, 1998  $n = 2$ ), the PTSD checklist (PCL-C or PCL-S, Weathers and Ford, 1996  $n = 2$ ), and The Davidson Trauma Scale (DTS, Davidson et al., 1997,  $n = 1$ ) were also employed. Two studies used the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition) and the ICD-10 (WHO, 1993) as diagnostic tools for clinical PTSD (Barthel et al., 2020; Misund et al., 2013).

Data from the selected articles was extracted and reported in two evidence tables (Tables 1 and 2). Three groups of studies reported on the same cohort population so these populations were reported a single time to prevent double-reporting of participants and marked with annotations in the tables. The studies have been conducted in Italy ( $n = 11$ ), the USA ( $n = 11$ ), Australia ( $n = 6$ ), Finland ( $n = 2$ ), the Netherlands ( $n = 2$ ), Switzerland ( $n = 2$ ), Argentina ( $n = 1$ ), Canada ( $n = 1$ ), France ( $n = 1$ ), Germany ( $n = 1$ ), Hungary ( $n = 1$ ) Norway ( $n = 1$ ), Spain ( $n = 1$ ), Sweden ( $n = 1$ ), Taiwan ( $n = 1$ ), Turkey ( $n = 1$ ) and the UK ( $n = 1$ ).

### 3.2. Synthesized findings

#### 3.2.1. Parenting stress

Table 1 synthesizes the studies on parenting stress in specific domains and trajectories.

**3.2.1.1. Maternal stress.** The literature indicated that between 15 % and 56 % of parents in the VLBW and ELBW groups report elevated stress in the first two years after birth (Coletti et al., 2015; Dempsey and Keller-Margulis, 2020; Sierra-García et al., 2018). What is more, from hospital discharge up to two years after birth, five studies reported higher stress levels in parents of VPT compared with later gestational age groups or found a negative correlation between gestational age and stress (Coletti et al., 2015; De Stasio et al., 2018; Gray et al., 2018; Howe et al., 2014; Schmöker et al., 2020). Two smaller studies by Coletti et al. (2015) ( $n = 40$ ) and De Stasio et al. (2018) ( $n = 34$ ) found that at 12 months, mothers of VPT had higher stress scores in the child-related domains “difficult child” and “difficult parent-child interactions”. Although using a modified version of the PSI, a larger study by Schmöker et al. (2020) confirmed this by questioning 495 mothers and 329 fathers of VPT at 3, 6 and 12 months. They observed that birth before 32 GW was associated with higher parenting stress, and particularly with the feeling of being restricted by the parental role. Likewise, two years after preterm birth, researchers have found that VPT parents in Taiwan experienced higher stress in the role restriction (34.2 % vs. 9.9 %) and the adaptability (19.3 % vs 9.9 %) scale (Howe et al., 2014). Following EPT birth, mothers reported high scores in the “parental distress” (30 % vs 11 %), “difficult child” (28 % vs 8 %) and “parent-child difficult interactions” (16 % vs 2 %) scales compared to mothers of FT at two years (Gray et al., 2018). However, child-related factors could play an important role as well; indeed, Pisoni et al. (2019) showed an association between higher perinatal risk scores as well as neurocognitive development and parenting stress at three months corrected age (Pisoni et al., 2019). What is more, at two years, Kenyhercz and Nagy (2020) reported that lower birth weight was associated with higher parenting stress in 112 mothers of ELBW and VLBW infants. Similarly, two studies found higher stress in mothers of VPT and EPT vs. mothers of FT seven years after birth (Linden et al., 2015; Treyvaud et al., 2014). The latter showed that stress remained higher in parents of EPT vs. FT even after controlling for social risk and child neurocognitive disability (Treyvaud et al., 2014). Contrary to the previously presented studies, two independent Italian studies who compared stress levels of mothers of ELBW, VPT and FT at 6 and 9 months did not find that stress was elevated in the two former

**Table 1**  
Characteristics of studies included in the systematic review.

Parenting stress									
Reference	Year	Population	Location	Measure	Birth weight <i>M (SD)</i> , g	Gestational age <i>M (SD)</i> , wk	age, months	Main results	QA score
Coletti et al.,	2015	40 infants VPT/39 LPT	Italy	PSI-SF	1247.15 (409.97)	28.93 (2.66)	12 CA	Group comparison between late and very preterm show higher maternal stress in Difficult Child domain. Prevalence: 15 % of VPT mothers had elevated stress levels compared to 3 % in the late preterm group.	7
De Stasio et al.	2018	34 infants VPT/40 infants born with congenital heart disease/26 infants born FT	Italy	PSI - SF	1333.5 (444.2)	28.9 (1.8)	11.5 (1.59)	Group comparison show higher maternal stress in Parent-Child Dysfunctional Interaction domain. Risk factor: maternal education.	5
Dempsey & Keller-Margulis	2020	53 mother-child dyads (child born <VPT)	USA	PSI-SF	775.11 (147.5)	25.13 (1.47)	18–31	Prevalence: 24 % of mothers had an elevated score in at least one domain. 18 % of the mothers had elevated scores in Difficult Child domain. Risk factor: receipt of early intervention services predicted increased parenting stress among mothers of toddlers born very preterm	7
Gerstein & Poehlmann-Tynan	2015	82 mother-infant dyads (child born <VPT)/91 LPT	USA	PDH	1712.46 (577.23)	31.34 (3.03)	24, 36, 6y	Correlations showed that lower neonatal risk was associated with higher stress. Risk factors: greater NICU stress was associated with a smaller income-to-needs ratio, less maternal education, and lower child IQ.	8
Gray et al. <sup>c</sup>	2018	79 preterm mothers (96 babies)/64 mothers of FT (77 babies)	Australia	PSI-SF; DASS	1114 (342)	27.7 (2.0)	4, 12, 24	Group comparisons show higher maternal stress in Total stress, Parental Distress and Parent-Child Dysfunctional Interaction.	7
Schuetz Haemmerli et al.	2020	85 children born <37wk of which 53 < 32wk/105 FT	Switzerland	PSI	1249.26 (390.43)	29.26 (1.8)	24–36	Group comparison showed no difference between groups of preterm and full-term. Fathers had lower averaged scores than mothers for depression. In the child domain, acceptability differed between fathers and mothers, where fathers had higher scores.	7
Howe et al.	2014	297 parents with preterm children (239 mothers; 58 fathers)/208 FT (181 mothers; 27 fathers)	Taiwan	PSI	1150.7 (247.3)	29.3 (2.6)	0–24	Group comparisons for preterm vs full-term showed a difference in the child domain (notably the demandingness and adaptability scales and in the parent-stress domain: depression and role restriction). Fathers had higher stress than mothers but only in the attachment subscale of stress (parent domain).	7
Huhtala et al.	2014	201 families of VPT children	Finland	BDI; PSI;	1076 (283)	28.8 (2.8)	4y; 5y	Mothers report higher stress than fathers in the parent domain.	6
Kenyhercz & Nagy	2020	Mothers of children born with ELBW ( <i>N</i> = 38)/VLBW ( <i>N</i> = 30)/LBW ( <i>N</i> = 44)	Hungary	BDI; PSS; SWLS	ELBW: 772.63 (169.23) VLBW: 1386.03 (124.04)	26.95 (2.52) 32.07 (2.53)	24–28	Correlation results show that lower birth weight is associated with higher stress. Risk factor: maternal education	4
Korja et al.	2014	125 mothers and 111 fathers of children born with VLBW	Finland	PSI	1078 (282.2)	28.0 (2.8)	24, 4y	Regression analysis showed no association between infant factors or family factors and PSI scores. Risk factors: married mothers reported less child-related stress (PSI) than unmarried mothers.	8
Lau et al.	2020	49 mothers of children born VPT	USA	PSI	1018 (243)	28.30 (1.95)	1, 12 CA	Trajectory: no difference in stress between the paired groups at 1 and 12 months	4
Linden et al.	2015	Parents of 106 children born VPT/parents of 50 FT born children	Canada	PSI; BDI; STAI	1322 (434)	29.6 (2.4)	7y	Group comparison between mothers of preterm and full-term showed higher depression, anxiety, and stress in the former group. Risk factors: Parents of preterm girls expressed higher levels of stress than those of boys. Parent Escape-Avoidance coping, child sex and Externalizing	5

(continued on next page)

Table 1 (continued)

Parenting stress									
Reference	Year	Population	Location	Measure	Birth weight M (SD), g	Gestational age M (SD), wk	age, months	Main results	QA score
Neri et al. <sup>a</sup>	2017	68 mother-infant dyads born with <VLBW/66 control dyads born FT	Italy	PSI-SF	ELBW: 823.00 (96.6). VLBW: 1260.39 (162.7)	ELBW: 27.52 (2.06) VLBW: 29.70 (1.33)	9	behavior were significant predictors, with a positive relationship to Parent stress. Group comparisons show no difference in stress between the three birth weight groups	7
Pisoni et al.	2019	20 mothers of VPT infants/20 mothers of FT infants	Italy	PSI-SF	1282.55 (271.04)	30.3 (2.75)	H, 3	Group comparisons showed higher depression in the NICU for preterm vs full-term mothers. Three months later, no group differences were found in depression or stress.	4
Schmöker et al.	2020	493 mothers and 329 fathers of VPT	Sweden	SPSQ	2306 (638)	29.5 (2)	3, 6, 12	Regression analysis showed that mothers of infants with lower gestational age reported higher overall stress and felt more restricted in their parental role than mothers of infants with higher gestational age. No difference between mothers and fathers. Trajectory: maternal stress reduced, while paternal stress increased over time.	7
Sierra-García	2018	130 parents of children born VPT	Spain	PSI-SF	1140.50 (281.14)	29.34 (2.28)	22	Prevalence: More than half of mothers obtained scores above cut-off on Dysfunctional Interaction (66.7 %) and Difficult Child (60.4 %). 56.3 % of mothers reported a high level of Total stress.	4
Suttora et al.	2021	32 mother-infant dyads born <VPT/33 mother-infant dyads born FT	Italy	PPQ; PSI	1292 (326)	30.94 (2.19)	6	Group comparisons show no difference in post-traumatic stress symptoms or parenting stress between mothers of VPT and full-term.	3
Treyvaud et al. <sup>b</sup>	2014	148 parents of <VPT children/69 parents of FT	Australia	HADS; PSI	969 (221)	27.5 (1.93)	7 y	Group comparison showed higher total stress in both parent- and child-related domain even when controlling for social risk and child disability	8

Note: BDI: Beck Depression Inventory; BW: Birth Weight; CA: Corrected Age; D: at discharge; ELBW: Extremely low birth weight; EPT: Extremely preterm; GA: Gestational Age; H: Hospitalization; HADS: Hospital Anxiety Depression Scale; PDH: Parenting Daily Hassles Scale; (m)PPQ: Perinatal Post-Traumatic Stress Disorder Questionnaire (modified); PSI (SF): Parenting Stress Inventory (Short form); PSS: Parental Stressor Scale; QA: Quality Assessment; SPSQ: Swedish Parenting Stress Questionnaire; STAI: State Trait Anxiety Inventory; SWLS: Satisfaction With Life Scale; VLBW: Very Low Birth Weight; VPT: Very Preterm; LPT: Late preterm; FT: Full-term; Y: years.

<sup>a</sup> Five studies presenting evidence from the same longitudinal cohort. <sup>b</sup> two studies presenting evidence from the same cohort. <sup>c</sup> Two studies presenting evidence from the same cohort.

groups (Neri et al., 2017; Suttora et al., 2014). Similarly, in a population of VPT parents two and four years after birth, Korja et al. (2014) ( $n = 211$ ) and Schuetz Haemmerli et al. (2020) ( $n = 85$ ) did not observe higher parental stress compared with parents of FT. Another American study, Gerstein and Poehlmann-Tynan (2015) even observed that at 24 months, lower neonatal risk was associated with higher stress.

Environmental factors are likely to influence parental stress. Length of hospital stay, immigration status, socio-economic status (Gerstein et al., 2019; Vriend et al., 2021), as well as factors related to the mother, such as maternal education (De Stasio et al., 2018; Gerstein et al., 2019; Howe et al., 2014; Kenyhercz and Nagy, 2020; Vriend et al., 2021), mental health (Gray et al., 2018; Schuetz Haemmerli et al., 2020) and younger maternal age (Gerstein et al., 2019) can increase stress. However, factors related to the child, such as internalizing and externalizing behaviors at 2 years old (Gray et al., 2018; Korja et al., 2014), feeding issues between birth and 2 years of age (Howe et al., 2014), receiving early intervention services (Dempsey and Keller-Margulis, 2020), having twins (Schmöker et al., 2020) and having a girl (Linden et al., 2015) also contribute to parenting stress.

**3.2.1.2. Paternal stress.** Five studies investigating stress levels following very preterm birth have included fathers. None of the studies have compared stress levels of fathers of full term and preterm children, but

rather compared stress levels in mothers and fathers of very preterm children. The largest study including 329 fathers of VPT (Schmöker et al., 2020) shows no difference in stress between mothers and fathers, but contrary to maternal stress which decreased in the first year, paternal stress increased between 6 and 12 months. Two other studies reported higher paternal stress than maternal stress specifically in the attachment and acceptability domain evaluated by the PSI two years after VPT birth (Howe et al., 2014; Schuetz Haemmerli et al., 2020). This pattern might be shifting as children get older: indeed, Huhtala et al. (2014) observed that VPT mothers have higher stress than VPT fathers in the parent domain at four to five years (factors concerned with the parental function and maternal health).

### 3.2.2. Mental health of parents of preterm children

Table 2 summarizes the studies concerned with depression, anxiety and PTSS outcomes following preterm birth.

**3.2.2.1. Depression.** Summarized results are shown in Table 2. At discharge (Gerstein et al., 2019), four to six months (Cambonie et al., 2017; Haeusslein et al., 2021) and at 12 months (Vriend et al., 2021) ~20 % of VPT and EPT mothers, respectively, had severe depressive symptoms compared with the 12.1 % of prevalence observed in a larger UK cohort study on mothers of full-term infants (Carson et al., 2015).

**Table 2**  
Characteristics of studies in the systematic review.

Depression and anxiety									
Reference	Year	Population	Location	Measure	BW	GA	Age: months	Main results	QA score
Agostini et al. <sup>a</sup>	2014	(69 mother-infant dyads <VLBW/80 FT)	Italy	EPDS	ELBW: 820.24 (98.32)	ELBW: 27.42 (2.16) VLBW: 29.64 (1.24)	3 CA	Group comparisons show higher depression in mothers of extremely low birth weight infants	8
Genova et al. <sup>a</sup>	2022	(94 couples with infants <VLBW/83 FT)	Italy	EPDS	ELBW: 818.9 (122.6) VLBW: 1305.66 (145.3)	27.3 (1.9). 30.20 (2.1)	3, 9, 12	Group comparisons show higher depression in mothers at 3 months and no difference at 12 months. For fathers there was no difference.	4
Neri et al. <sup>a</sup>	2015	(77 infants <VLBW/120 FT)	Italy	EPDS; Penn State Worry Questionnaire (PSWQ)	ELBW: 823.00 ± 96.6. VLBW: 1260.39 ± 162.7	ELBW: 27.52 ± 2.06 VLBW: 29.70 ± 1.33	3	Group comparison showed higher prevalence of depressed women in the ELBW group compared to those of the full-term group (25.0 % vs 4.2 %, respectively). 15.6 % of VLBW infants' mothers were depressed, but this difference was not significant.	5
Neri et al. <sup>a</sup>	2020	(38 couples with ELBW infants, 56 with VLBW, and 83 of FT infants)	Italy	EPDS	ELBW: 818.89 ± 122.63 VLBW: 1305.50 ± 145.22	27.29 ± 1.99 30.21 ± 2.11	3, 9, 12	A significantly positive partner effect was observed regarding the influence of 3-month maternal depressive symptoms on paternal depressive symptoms at 9 months, but only in the case of the VLBW group.	6
Treyvaud et al. <sup>b</sup>	2014	148 parents of <VPT children/69 parents of FT	Australia	HADS; PSI	969 (221)	27.5 (1.93)	24, 7 y	Group comparisons showed higher parental anxiety and depression in the preterm vs. the full-term group even when controlling for social risk and child developmental disability	8
Yaari et al. <sup>b</sup>	2019	159 mothers of children born <VPT/71 mothers of children born FT	Australia	GHQ; HADS	969 (221)	27.5 (1.93)	24, 7y, 13y	Group comparison found that mothers of children born very preterm displayed elevated psychological distress compared with mothers of full-term children, and this difference was consistent over time.	6
Akkus et al.	2021	Mothers of 18 VPT/11 PT/11 FT children	Turkey	BDI; STAI-T	1260 [800–2800]	28.4 (1.9)	18, 24 CA	Group comparisons show no difference in maternal depression or anxiety symptoms	6
Bozette & Holditch-Davis	2015	38 mother-child dyads born <VLBW	USA	CES-D	1131 (342)	28.3 (2.2)	36 CA	Depressed vs. nondepressed: Mothers did not differ on age, race, worries, or perception of the child's vulnerability, but differ on marriage status.	6
Carson et al.	2015	Parents of 12,100 children born in the UK (119 < VPT/121 MPT/ 646 LPT/2381 early term/8404 FT)	UK	RMI-m			9	Comparisons show that mothers of VPT have 1.66 higher chance of depression and fathers 1.97 following preterm birth. Mothers and fathers' depression levels were associated with each other (OR = 2.22).	7
Garfield et al.	2021	Parents of 41 EPT/154 VPT/236 PT infants	USA	EPDS	1872 (788)		14d, 1	Regression results show that gestational age did not predict depression scores. Trajectory: symptoms decrease from the early NICU period until 30 days post discharge for mothers and fathers, but fathers show less improvement over time.	7
Gerstein et al.	2019	74 mother-child dyads born <VPT	USA	EPDS; BDI		26	D, 24 - 5y	Prevalence: 21 % of mothers had post-partum depression at NICU discharge. At five years 4 % had moderate to severe depression and 10 % had mild depression.	7
Gray et al. <sup>c</sup>	2013	101 mothers of VPT/98 mothers of FT	Australia	PSI-SF; EPDS	1109 (343)	27.7 (2.0)	12	Group comparisons show no difference in depression scores in mothers.	7
Hawes et al.	2016	734 mothers of preterm children (EPT/MPT/LPT)	USA	EPDS			1	No correlation between infant factors and depression scores	4
Huhtala et al.	2014	201 families of VPT children	Finland	BDI; PSI;	1076 (283)	28.8 (2.8)	4y; 5y	Group comparisons found that mothers had higher depression than fathers	6
Kenyhercz & Nagy	2020	Mothers of children born with ELBW (N = 38)/ VLBW (N = 30)/LBW (N = 44)	Hungary	BDI; SWLS; BAI	ELBW: 772.63; 169.23 VLBW: 1386.03; 124.04	26.95; 2.52 32.07; 2.53	24–28	Correlation results show that lower birth weight is associated with higher stress, anxiety and depression and lower quality of life	4
Linden et al.	2015	Parents of 106 children born VPT/parents of 50 FT born children	Canada	PSI; BDI; STAI	1322 (434)	29.6 (2.4)	7y	Group comparisons found higher depression and anxiety in parents of preterm compared to full-term.	5

(continued on next page)

Table 2 (continued)

Depression and anxiety									
Reference	Year	Population	Location	Measure	BW	GA	Age: months	Main results	QA score
McMahon et al.	2020	100 fathers of 125 VPT infants	Australia	CES-D; HADS-A			3, 6, 12 CA	Prevalence: shortly after birth, 44 % and 53 % of fathers report elevated depressive and anxiety symptoms respectively. At 6 months, 12 % and 16 % of fathers fall in these same categories. Trajectory: Depressive and anxiety symptoms showed the largest decline between shortly after birth and term-equivalent age before remaining relatively stable.	8
Montirosso et al.	2017	Mothers of 110 infants born VPT	Italy	BDI	1121.85 (226.21)	29.04 (2.17)	D, 6	Regression analysis show that the risk index based on gestational age, birth weight and length of stay in the NICU did not predict maternal depression at hospital discharge or 6 months.	6
Pisoni et al.	2019	20 mothers of VPT infants/20 mothers of FT infants	Italy	EPDS	1282.55 (271.04)	30.3 (2.75)	H, 3	Group comparisons showed higher depression in the NICU for preterm vs full-term mothers. Three months later, no group differences were found in depression or stress.	4
Quist et al.	2019	Mothers of 8200 infants (VPT = 800/MPT = 1500/FT = 5900)	USA	CES-D	1719.2 (2131.7)	28.8 (3.1)	9	Regression analysis: there was no main effect of gestational age category on the odds of maternal depressive symptoms. Risk factor: infant fussiness and gestational age interact and increase the odds of maternal depressive symptoms.	8
Salvatori et al.	2015	27 mothers of VPT/20 mothers of FT	Italy	BDI-II	1091.3 (280.96)	29.16 (1.99)	18, 24	Group comparison regarding maternal depression levels showed no significant difference	7
Vriend et al.	2021	693 mothers and 340 fathers of VPT infants	Netherlands	HADS;	1284.8 (384.6)	29.3 (2.1)	1, 12	Prevalence: at 12 months, the prevalence of elevated anxiety and depression were 14 % and 9 % for mothers and 5 % and 4 % for fathers. At 12 months, in 20 % of the couples, one or both parents reported elevated symptoms and within couples, anxiety and depression were positively associated. Risk factors were length of hospital stay, migration background, educational level and employment status.	7
<b>Depression, Anxiety &amp; PTSS</b>									
Cambonie et al.	2017	163 mother-infant dyads born VPT	France	CES-D; STAI; mPPQ	1194 (329)	29.1 (1.8)	D, 6	Prevalence: 17 % of mothers had probable depression, 22.1 % had high state anxiety and 27.5 % had high trait anxiety at 6 months. Trajectory: Anxiety and depression decrease from hospital discharge to 6 months 45.7 % of the mothers had a score of 19 or above on the PPQ	6
Greene et al.	2019	69 mothers of children born VPT	USA	CES-D; STAI; mPPQ	957 (243)		D, 4, 8	Regression analysis shows that birth weight predicts PTSS and anxiety at birth, and anxiety in the first year. Regression analysis shows that birth weight predicts PTSS at birth.	8
Haeusslein et al.	2021	129 mothers of children born VPT	USA	EPDS; STAI; mPPQ	NA	NA	4.8	Prevalence: about 1 in 3 (44 of 129) mothers reported clinically significant symptoms of anxiety, depression or PTSD, with 24 % reporting depression, 19 % reporting anxiety symptoms. 20 % reporting PTSD symptoms.	7
Hall et al.	2017	62 mothers of VPT; 64 mothers of MPT; 71 mothers of FT infants	Netherlands	EPDS; STAI; PPQ			1, 6	Latent class analysis shows higher proportion of mothers with psychological distress symptoms (depression, anxiety, PTS) in mothers of preterm.	2
Misund et al.	2013	29 mothers of VPT children	Norway	GHQ; STAI; IES-r; ICD-10 <sup>†</sup>	1200 (400)	28.5 (2.6)	0, 2.7, 6, 18 CA	Trajectory: Anxiety increased from T1 (21.5 %) to T1 (23.8 %) and to T3 (22.8 %). Post-traumatic symptoms decrease from T1 (19.7 %) to T3 (10.2 %), but prevalence of PTSD increase from T0 (14%), T1 (30%) and T3 (23%).	8

(continued on next page)

Table 2 (continued)

Depression and anxiety									
Reference	Year	Population	Location	Measure	BW	GA	Age: months	Main results	QA score
								Depression decreased from T0 (24%) to T3 (8%). Trajectory: Post-traumatic symptoms decrease from T1 (19.7 %) to T3 (10.2 %), prevalence of PTSD increases from T0 (14%), T1 (30%) and T3 (23%).	
<b>Post-traumatic stress</b>									
Barthel et al.	2020	145 families of VLBW infants; 136 families of FT infants	Germany	IES-r; DSM-IV <sup>d</sup>	1061, (297.13)	28.22 (2.56)	1, 6, 12, 24 m pp. 5y, 8y	No parent reached levels of PTSS indicating PTSD diagnosis at 5 years. Group comparison showed higher mean PTSS scores at 1 month and 5 years in parents of very premature compared to parents of full-term. Regression results showed that preterm birth predicted PTSS at 5 years in mothers, but not in fathers.	8
Pace et al.	2020	105 families of VPT infants	Australia	PCL-S	1038 (261)	27.8 (1.5)	TEA, 12, 24	Prevalence: at term equivalent age and 12 and 24 months, elevated PTSSs were reported by 36 %, 22 %, and 18 % of mothers and 35 %, 25 %, and 19 % of fathers, respectively.	5
Rodriguez et al.	2020	146 mothers of VLBW infants	Argentina	DTS			6, – 5y	Group comparison showed a higher proportion of mothers of EPT than VPT with chronic PTSD. Prevalence: 44 % had symptomatic stress 6 months after their baby's birth. 18.7 % had chronic post-traumatic stress symptoms between 3 and 5 years after birth.	5
Schechter et al.	2020	91 parents of preterm (21 % EPT; 33 % VPT; 38 % MPT; 9 % FT)	USA	PCL-C			0–12	Prevalence: 24 % of extremely preterm, 4 % of very preterm, 15 % of moderate to late preterm, and 29 % of full term. No group difference	4
Suttora et al.	2021	32 mother-infant dyads born <VPT/33 mother-infant dyads born FT	Italy	PPQ;	1292 (326)	30.94 (2.19)	6	Group comparisons found no difference in post-traumatic symptoms between mothers of very preterm and full term	3
Turpin et al.	2019	33 mothers of VPT; 21 mothers of FT	Switzerland	PPQ;	1452.88 (382.85)	30.53 (2.11)	18	Group comparisons found higher level of PTSS in mothers of very preterm vs full term. A significant difference in socio-economic status was noted between the groups.	5

Note: BAI: Beck Anxiety Inventory; BDI: Beck Depression Inventory; BW: Birth Weight; CA: Corrected Age; CES-D: Center for Epidemiologic Studies Depression Scale; ELBW: Extremely low birth weight; EPT: Extremely preterm; LPT: Late preterm; FT: Full-term; D: at discharge; DTS: Davidson Trauma Scale; EPDS: Edinburgh Postnatal Depression Scale; GA: Gestational Age; GAD-7: Generalized Anxiety Disorder Seven Item Scale; GHQ: General Health Questionnaire; HADS: Hospital Anxiety Depression Scale; ICD-10: International Classification of Diseases, 10th revision; IES(r): Impact of Event Scale (revised); PCL-C: PTSD Checklist - Civilian; PCL-S: PTSD checklist - Specific; (m)PPQ: Perinatal Post-Traumatic Stress Disorder Questionnaire (modified); PTSS: Post-Traumatic Stress Symptoms; PTSD: Post-traumatic Stress Disorder; QA: Quality Assessment; RMI-m: Rutter Malaise Inventory – modified; STAI: State Trait Anxiety Inventory; SWLS: Satisfaction With Life Scale; TEA: Term Equivalent Age; VLBW: Very Low Birth Weight; VPT: Very Preterm.

<sup>a</sup> Five studies presenting evidence from the same longitudinal cohort.

<sup>b</sup> Two studies presenting evidence from the same cohort.

<sup>c</sup> Two studies presenting evidence from the same cohort.

<sup>d</sup> Clinical interview using DSM-IV classification.

<sup>e</sup> Clinical interview based on ICD-10 criteria.

Furthermore, the percentage at six months was likely underestimated because mothers who stayed in the cohort until 6 months had significantly lower depression and anxiety scores than those who dropped out (Cambonie et al., 2017). Additionally, latent class analysis results show that mothers of VPT ( $n = 62$ ) were overrepresented in the high and extreme psychological distress groups six months post-partum (Hall et al., 2017). Next, considering comparative results, four studies have shown that depression is higher in ELBW and VLBW mothers in the first two years (Agostini et al., 2014; Carson et al., 2015; Hall et al., 2017; Kenyhercz and Nagy, 2020). The largest of these studies was the UK millennium cohort study, including 242 parents of VPT and moderately preterm infants, which reported that parents of VPT are twice as likely to experience PPD compared with parents of FT nine months after birth (21.7 % vs 11.7 %) (Carson et al., 2015). These results were replicated by Kenyhercz and Nagy (2020) who showed that among 68 mothers of

ELBW and VLBW, lower birth weight was associated with higher depression and anxiety at two years. Conversely, four Italian studies found that maternal depression was not different between ELBW, VLBW and the FT group (Genova et al., 2022; Montiroso et al., 2018; Pisoni et al., 2019; Salvatori et al., 2015). Including 162 families, Montiroso et al. (2018) observed that infant-centered care and pain-management procedures predicted lower depression in VPT mothers, but that infant-related variables (i.e. birth weight and gestational age) were not associated with higher depression in the NICU or six months after. It should be mentioned that this study excluded single parents and those with previous mental disorders from their sample. Another study by Genova et al. (2022) including 94 families, showed higher depression in mothers of ELBW compared with VLBW at three months, but this difference disappeared at 12 months. Likewise, two smaller Italian studies by Pisoni et al. (2019) and Salvatori et al. (2015) ( $n = 20$  and  $n = 27$

respectively) showed no group differences in depression symptoms at 3, 18 and 24 months when comparing mothers of VPT to mothers of FT. However, a specificity of these latter four studies is the exclusion of parents with a history of mental illness (Genova et al., 2022; Montiroso et al., 2018; Pisoni et al., 2019; Salvatori et al., 2015), as well as eating disorders and child neurological disorders (Salvatori et al., 2015) from their samples. Furthermore, four American studies (Garfield et al., 2021; Greene et al., 2019; Hawes et al., 2016; Quist et al., 2019) did not find an association between low gestational age (GA) or birth weight and higher depression. Of these, Garfield et al. (2021) who compared three groups of preterm gestational age (GA): 236 mothers of moderate- to late premature (M/LPT), 154 of VPT and 41 of EPT, noted that GA did not predict depression at 30 days post-discharge. Four and eight months after birth, Greene et al. (2019) did not find that a lower birth weight predicted higher depression among 69 mothers of ELBW infants. Lastly, Quist et al. (2019) ( $n = 800$  VPT, 1500 M/LPT, 5900 FT) similarly showed that nine months after birth, GA did not predict depressive symptoms but that there was an interaction between infant fussiness and GA that could play a part in predicting these.

Only three studies have examined depression in parents beyond two years following EPT and VPT birth. In one of these, a group of Australian researchers found a higher level of psychological distress at 7 and 13 years after VPT birth while controlling for social risk and child neuro-cognitive disabilities (Treyvaud, 2014; Yaari et al., 2019). Differences might be subtle however, as Gerstein et al. (2019) found that prevalence of depression was in the normal range in a sample of 62 mothers of EPT at the five-year checkup visit. Many factors could contribute to explaining depressive symptomatology after preterm birth. Environmental factors such as social risk (Treyvaud, 2014; Yaari et al., 2019), educational level (Garfield et al., 2021; Linden et al., 2015; Vriend et al., 2021), maternal age (Greene et al., 2019), employment status, immigration background, length of hospital stay (Hall et al., 2017; Vriend et al., 2021), and interpersonal factors such as: marital status (Bozzette and Holditch-Davis, 2015; Hawes et al., 2016), social support (Haeusslein et al., 2021), and child developmental disabilities (Treyvaud et al., 2014) were observed to increase risk of maternal mental health problems.

**3.2.2.2. Anxiety.** Most studies report descriptive results and show that in the period up to one year after birth, anxiety levels decrease (Misund et al., 2013), but remain elevated in 19–27 % of parents of very premature children (Cambonie et al., 2017; Haeusslein et al., 2021; Hall et al., 2017; Vriend et al., 2021). Three months after birth, Neri et al. (2015) saw that mothers of ELBW infants reported higher anxiety than mothers of FT. At eight months, Greene et al. (2019) found a significant association between lower birth weight and higher anxiety in 69 mothers of VPT infants that could not be explained by socio-economic factors. Similar findings were reported by Kenyhercz and Nagy (2020) in 68 mothers of ELBW and VLBW children at two years. What is more, still in a population of ELBW, another study reported by two groups of authors found that parents were 2.5 times more likely of having clinical anxiety as parents of FT at 7 and 13 years (Treyvaud et al., 2014; Yaari et al., 2019) ( $n = 159$ ). Conversely, Akkus et al. (2021) at two years ( $n = 18$ ) and Linden et al. (2015,  $n = 100$ ) at seven years after birth observed no difference in anxiety for mothers of VPT vs FT. It is worth noting that the two latter studies showed higher maternal unemployment and lower education levels in the VPT versus the FT group. Nevertheless, social and demographic factors seem to be important risk factors for anxiety (Greene et al., 2019; Haeusslein et al., 2021; Kenyhercz and Nagy, 2020; Misund et al., 2013; Treyvaud, 2014; Vriend et al., 2021).

**3.2.2.3. Post-traumatic stress.** With respect to post-traumatic stress (Table 2), a distinction should be made between Post-Traumatic Stress Symptoms (PTSS) and Post-Traumatic Stress Disorder (PTSD), which is a clinical diagnosis. First, descriptive results show that about ~45 % of

mothers of VPT had elevated PTSS at 6 months (Cambonie et al., 2017; Rodríguez et al., 2020). However, a Swiss study reported by Schecter et al. (2020) found a six-month prevalence for 24 % in EPT and 4 % in VPT mothers. Furthermore, an Australia-based group found that PTSS remained high from term equivalent age, to 12 and 24 months, with 36 %, 22 % and 19 % respectively in mothers of EPT (Pace et al., 2020). Additionally, PTSD can occur in 23 % of VLBW mothers at 20 months as well as 57 % of mothers of ELBW and 35 % of VLBW at three to five years (Misund et al., 2013,  $n = 29$ ; Rodríguez et al., 2020,  $n = 146$ ). A few studies that report comparative results observed a difference in level of PTSS symptoms at birth, 6 and 18 months respectively (Greene et al., 2019; Hall et al., 2017; Turpin et al., 2019) and five years (Barthel et al., 2020). Regarding these, it should be mentioned that Greene et al. (2019) only found that a lower birth weight predicted higher PTSS at birth, but not at 4 or 8 months ( $n = 69$ ). Turpin et al. (2019) on the other hand, found that PTSS was higher in VPT ( $n = 33$ ) than in FT mothers when children were aged 18 months. Hall et al. (2017) demonstrated that when grouped according to psychological distress and parent-infant interactions, the groups differed on gestational age, with mothers of VPT infants being overrepresented in high distress “classes”. Importantly, these classes were also represented by mothers of infants with a lower health status or AGPAR score and more time in the incubator and at the hospital. Finally, beyond two years, Barthel et al. (2020) compared mothers of VPT and FT five years postpartum and found higher PTSS scores in VPT mothers, while controlling for socio-economic status and social support ( $n = 77$ ). Nevertheless, two studies did not find that gestational age was related to PTSS (Haeusslein et al., 2021; Suttora et al., 2014) ( $n = 129$  and  $n = 32$  respectively) which was evaluated at 5 and 12 months. Haeusslein et al. (2021), included an ethnically diverse cohort from six NICUs and showed in a regression model that whereas gestational age and socio-demographic data did not predict PTSS, social support, stress in NICU and use of medical equipment at home were significant independent predictors at 5 months. It should be noted that an inclusion criterion in the latter study was having a smartphone or tablet.

Looking at possible risk factors for developing PTSS, we found factors related to the birth such as preeclampsia (Misund et al., 2013), length of incubation time (Hall et al., 2017), factors related to child health such as IVH (intraventricular hemorrhage) grade 1 or 2 (Misund et al., 2013), use of medical equipment at home (Hall et al., 2017; Haeusslein et al., 2021), factors related to maternal mental health: traumatic past events, (Greene et al., 2019), previous psychological treatment, (Misund et al., 2013), postnatal PTSS (Barthel et al., 2020), stress in NICU (Haeusslein et al., 2021), as well as socio-economic factors.

**3.2.2.4. Fathers' experiences following very preterm birth.** Ten recent studies have targeted depressive symptoms and mental health in fathers of very preterm infants. Descriptive results showed that various studies have reported between 4 and 16 % of fathers experienced elevated depression symptoms during the first 12 months (Carson et al., 2015; McMahon et al., 2020; Vriend et al., 2021). With regards to PTSS, Pace et al. (2020) reported 35 %, 25 % and 19 % at term equivalent age, 12 and 24 months. Anxiety levels observed were similar to the prevalence of depression with 10 % at 1 month and 5 % at 12 months (Vriend et al., 2021). Recently, Schecter et al. (2020) showed that prevalence of a moderate to high level of PTSD symptoms across gestational ages at a one-year follow-up visit did not differ between mother and fathers, although one study reported less depression and stress related to the parental function at five years (Huhtala et al., 2014) than mothers. Furthermore, a study showed that fathers of VPT were found to experience more PTSS symptoms than fathers of FT five years post-partum (Barthel et al., 2020). Similar to what was found for mothers, lifetime history with PTSD (i.e. clinical diagnosis) and PTSS evaluated at birth predicted symptoms at five years (Barthel et al., 2020,  $n = 77$ ). Notably, an association was found between the mother and father's depression

and anxiety levels (Carson et al., 2015; Neri et al., 2020; Vriend et al., 2021) which led to a prevalence of about 20 % of families with at least one of the parents struggling with symptoms of mental health problems 12 months after birth. Looking at depression symptoms, a larger comparative study by Carson et al. (2015) with 242 families of VPT infants found that fathers had higher depression at 9 months than fathers of full-term. It is worth noting that the populations were mainly composed of minority groups/non-Hispanic Black participants, with a lower socio-economic status or lower education level. On the contrary, Garfield et al. (2021) examined whether the level of depression was related to gestational age in a sample of 201 fathers of VPT infants, but did not find such an association at one month after discharge, and Genova et al. (2022) who included 94 fathers of ELBW ( $n = 38$ ) and VLBW ( $n = 56$ ) found no difference in depression compared with fathers of FT at 3, 9 and 12 months after hospital discharge.

## 4. Discussion

### 4.1. Summary of results

Parents of ELBW and VLBW children reported higher parenting stress, more anxiety, PTSS, and depression in the first two years following birth. Fewer studies have examined anxiety, PTSS, depression and stress beyond two years, but paternal and maternal PTSS were shown to persist up to five years and maternal parenting stress could be higher up to seven years. Maternal depression and anxiety symptoms could persist up to 13 years.

When looking at stress in detail, the domains related to difficult parent-child interactions and difficult child behavior were prominently featured. This is in line with earlier findings that parenting stress following preterm birth is mainly caused by the children's difficulties and the parent-infant interactions (Treyvaud et al., 2014). Parental distress and a feeling of restriction in the parental role were also apparent among mothers (Coletti et al., 2015; De Stasio et al., 2018; Dempsey and Keller-Margulis, 2020; Gray et al., 2018; Howe et al., 2014; Sierra-García et al., 2018; Treyvaud et al., 2014). Parental distress in this context refers to personal characteristics of the parent generating stress, and relates to depression and well-being. Two studies reported higher stress in fathers than in mothers specifically in the attachment and acceptability domain of the PSI (these domains refer to the emotional proximity with the child and whether the child conforms with the parents' expectations or not) (Howe et al., 2014; Schuetz Haemmerli et al., 2020) reflecting the fact that some fathers have difficulties feeling close to their child and that his/her characteristics are not what the parent expected. Six studies looked at stress beyond two years, and it seems that differences in parenting stress become less pronounced. One hypothesis for this shift could be that between two and three years old, children born premature tend to close the gap between their corrected age and chronological age in terms of growth, motor, language and cognitive development (D'Agostino, 2010). While it is possible that parenting stress may remain higher seven years following birth for ELBW mothers, we identified risk factors relative to the context (i.e. length of hospitalization), the mother (i.e. age, mental health), and the child (i.e. internalizing and externalizing behaviors, feeding issues) that could participate in generating stress.

Looking at maternal depression in the first two years post-partum, there is some evidence that depression is higher in mothers of ELBW and VLBW (Agostini et al., 2014; Carson et al., 2015; Hall et al., 2017; Kenyhercz and Nagy, 2020). However, previous history with mental illness is also important. This was highlighted by Silverman et al. (2017) who reported evidence from all births recorded in Sweden between 1997 and 2008, resulting in an astonishing sample of 707,701 mothers. They observed that when the mother had history with depression, her odds were twenty-fold that of a mother without such history of being diagnosed with post-partum depression (PPD) in the year that followed the birth. Moderate preterm delivery also had an effect, although more

moderate with a 1.36 times higher risk of PPD. What is more, Montirosso et al. (2018) found that infant-centered care and pain-management procedures could reduce depression in VPT mothers, and this brings into question how modern developmental care can improve parent's experiences during hospitalization. This could also explain some of the discrepancy observed in the results that come from different hospitals providing different care and between studies that do or do not include mothers with a previous history of mental illness. However, other factors influence the risk of depression as well, including socio-economic factors and child developmental disabilities (Bozette and Holditch-Davis, 2015; Garfield et al., 2021; Hall et al., 2017; Linden et al., 2015; Treyvaud et al., 2014; Vriend et al., 2021; Yaari et al., 2019). Interestingly, Treyvaud et al. (2014) found that mental health issues at two years, did not predict moderate to severe anxiety or depression when the child was aged seven in parents of VLBW children, as opposed to parents of FT. This indicates that depression can develop in the short and long-term following preterm birth, and it is important to continue following up parents beyond two years.

In the first year postpartum, high levels of anxiety have been observed in 19–28 % of mothers of VPT children (Cambonie et al., 2017; Haeusslein et al., 2021; Hall et al., 2017; Vriend et al., 2021). Anxiety following preterm birth can be a reaction to the traumatic experience surrounding the birth (Josse, 2019) and is also closely related to PTSS. Beyond two years, anxiety seems therefore to stabilize at a normal level, although one study showed higher symptoms 13 years after birth (Akkus et al., 2021; Linden et al., 2015; Treyvaud et al., 2014), but research suggests that symptoms of anxiety can be correlated with socio-demographic risk factors (Greene et al., 2019; Haeusslein et al., 2021; Kenyhercz and Nagy, 2020; Misund et al., 2013; Treyvaud et al., 2014; Vriend et al., 2021).

In mothers of VPT infants, PTSS are prevalent in the first two years following birth and up to five years after it (Barthel et al., 2020; Cambonie et al., 2017; Greene et al., 2019; Hall et al., 2017; Misund et al., 2013; Rodríguez et al., 2020; Turpin et al., 2019). Treyvaud's (2014) review already noted that previous psychiatric disorders are common in parents of VPT. Indeed research has shown that traumatic experiences in the past are a risk factor for premature birth (Torchin and Ancel, 2016), and that past trauma can predict post-partum PTSS (Greene et al., 2019). There is therefore reason to believe that there might be a bidirectional association between PTSS, depression and premature birth (Torchin and Ancel, 2016). Consequently, future research should try to include both history with and symptoms of PTSS and depression in order to understand parental psychological distress following VPT birth.

Our review showed that only ten studies included fathers. Although in term of prevalence, the occurrence of depression could be lower in fathers than in mothers of VPT children (Carson et al., 2015; Huhtala et al., 2014; McMahon et al., 2020), it is possible that men report depression differently than mothers in self-report scales (Neri et al., 2020). We might therefore be inclined to conclude that father's experiences are similar to that of mothers in this situation (Pace et al., 2020; Vriend et al., 2021). An important consideration is the correlation between the partners' mental health scores; when one parent experiences depression or anxiety, his/her partner is also more likely to have higher depressive or anxiety symptomatology (Carson et al., 2015; Neri et al., 2020; Vriend et al., 2021). This highlights the need to consider parents as a family unit, not only as independent individuals (fathers and mothers), and might prove useful in mental health prevention and support programs.

In recent years, important changes have been implemented in relation to family-centered care in neonatal units: for example, the WHO guidelines for "zero separation" call for immediate skin-to-skin contact, without any initial time in an incubator (World Health Organisation, 2023). Moreover, parental 24 h/7 access to neonatal units is becoming more and more widespread in hospitals around Europe (Sizun and Ratynski, 2021) and it is quite possible that these changes in practice have and will improve the experience of parents in the next coming

years. Research should therefore continue to evaluate parental stress and mental health symptoms in order to detect difficulties earlier, but also to share knowledge on the effectiveness of these strategies.

#### 4.2. Strengths and limitations

The current review gave a global overview of the literature concerning mothers and fathers' mental health and stress after VPT and EPT birth. We did not reduce the scope of the review with regards to time passed after birth or type of validated measures used to evaluate the constructs, which allowed us to include a large amount of evidence found worldwide. However, some limitations can be noted with this approach. Firstly, a limitation becomes apparent when comparing results of studies using different measures, which have different sensitivities and measure different aspects of symptoms. Secondly, we chose to limit our scope to research on a specific population of parents of very preterm children or children with a very low birth weight (<33 GA or <1500 g). This was done to account for some of the various differences in the care received and experiences surrounding birth for parents of moderately or late preterm children, which is more similar to a full-term birth. However, in doing so, we might have missed results that were relevant to moderate and late prematurity. Furthermore, this review was mainly composed of results obtained from data collected before the COVID pandemic, which might have had significant impact on parents' mental health and stress levels. Time will tell how these restrictions might have produced long-term effects for these parents and children.

#### 5. Conclusion

In recent years, there has been more focus on fathers' outcomes after EPT and VPT birth and it has been observed that parents of EPT and VPT experience high parenting stress and mental health symptoms in the two years following birth. Research has also showed an association between parents' symptoms of depression and anxiety, and that it is not necessarily early symptoms of depression or PTS that predict later symptoms. Fathers seem to report more difficulty feeling close to their VPT children, and should also be supported in their interactions. For both parents, less evidence is available beyond the period of toddlerhood and on the long term; however, studies suggested that long-term symptoms might persist. Future research should consider the parents as a unit, evaluate long-term outcomes after two years, and control for history of previous traumatic experiences and mental health disorders.

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#### CRedit authorship contribution statement

**Ramona Sandnes:** Conceptualization, Data curation, Methodology, Validation, Writing – original draft, Writing – review & editing. **Marine Le Floch:** Data curation, Methodology, Validation, Writing – review & editing. **Elise Riquin:** Conceptualization, Data curation, Methodology, Validation, Writing – review & editing. **Isabelle Nocus:** Methodology, Supervision, Writing – review & editing. **Jean Baptiste Müller:** Conceptualization, Data curation, Methodology, Supervision, Validation, Writing – review & editing. **Fabien Bacro:** Methodology, Supervision, Validation, Writing – review & editing.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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