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Maternal postpartum depression symptoms are negatively associated with emotion regulation of children born very preterm

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Postpartum depression (PPD) and posttraumatic stress disorder (PTSD) may develop after preterm birth, with prevalence rates of 17% and 24% for PPD and PTSD, respectively (1). Children of mothers with PPD or PTSD are more likely to have adverse developmental outcomes, particularly with regards to their emotion regulation (2). Emotion regulation allows control over the intensity, duration, and expression of emotions. This represents an important aspect of child development, as well as a cornerstone of future personal and professional life (2). Children born very preterm (i.e., birth < 32th gestational week) show an increased risk of unfavourable development for at least two reasons: the

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prematurity-related morbidity, and the increased probability of maternal psychological distress that subsequently interferes with mother-infant interactions and attachment (1). So far, the prospective relationships between maternal PPD and PTSD and emotion regulation of preschool children born very preterm are unknown.

This study examined associations between maternal PPD and PTSD symptoms at 3 months of corrected age and compromised emotion regulation abilities of 3-year old children born very preterm. Given previous research on full-term children and increased vulnerability of preterm infants, a significant positive correlation was expected. Secondly, factors associated with the development of emotion regulation of these children were identified.

This prospective study included 58 mother-infant (born very preterm) dyads (including eight twins) who had participated in a randomised controlled trial (RCT); see (1) for inclusion and exclusion criteria; Table 1 for description of the sample; Figure S1 for study flowchart. Questionnaire data from 3 months of corrected age, before randomization, was used and mothers were re-contacted when their child was approximately three years old. This research was approved by the ethics committee of the Canton Vaud, Switzerland (study number 14/12).

Maternal PTSD and PPD symptoms at three months of corrected age were assessed via validated self-report questionnaires (1). The Edinburgh Postnatal Depression Scale measured PPD symptoms (range 0-30, cut-off 10.5) and the Perinatal PTSD Questionnaire (PPQ) assessed PTSD symptoms (range 0-14, cut-off 6) (1). T, the flexibility index of the Behavior Rating Inventory of Executive Function – Preschool Version (BRIEF-P) composed of the shift and emotional control subscales was completed by mothers to assess child emotion regulation (3). For those three questionnaires, higher scores indicate higher impairments. Parental socioeconomic status, gestational age, and data about sepsis, bronchopulmonary dysplasia (BPD), and major cerebral lesions were retrieved from medical records, as they are important predictors of the neurodevelopment of children born very preterm (4).

Mann Whitney U tests examined differences between the intervention and control groups of the original RCT regarding maternal depression and PTSD, and the child flexibility index score. Spearman's correlations tested associations between maternal PPD and PTSD, and child emotion regulation. A backward linear regression including gestational age, socioeconomic status, and

absence of sepsis, BPD, and major cerebral lesions was conducted to identify factors associated with the development of child emotion regulation.

Of the 58 dyads, three were excluded because of invalid BRIEF-P scores. Maternal Edinburgh scale and PPQ scores of control and intervention groups did not differ significantly ($p = 0.154$ and $p = 0.323$, respectively). Also, no significant difference between flexibility index score of children of mothers of control and intervention groups was found ($p = 0.612$).

Maternal Edinburgh scale scores were positively correlated with child flexibility index score at three years ($p = 0.030$). No significant association between maternal PPQ scores and child flexibility index score were found ($p = 0.130$).

A backward linear regression showed that the maternal Edinburgh scale score ($\beta = 0.36$, $t = 2.75$, $p = 0.008$) significantly predicted child emotion regulation. Other significant predictors were presence of BPD ($\beta = 0.33$, $t = 2.37$, $p = 0.022$), and low socioeconomic status ($\beta = 0.30$, $t = 2.19$, $p = 0.022$). This model explained 24% of variance ($F(3, 47) = 4.87$, $p = 0.005$).

This was the first study to identify a negative prospective relationship between maternal PPD symptoms at three months of corrected age and emotion regulation of preschool children born very preterm. No such associations were observed with maternal PTSD symptoms. Maternal PPD symptoms, the presence of BPD and low socioeconomic status emerged as risk factors and explained an important part of the variance of child emotion regulation. These results partly confirm the longer-term impact of maternal mental health symptoms following preterm birth on a major aspect of child development, namely emotion regulation.

This study has limitations, including full reliance on self-report measures that are screening tools. It is possible that maternal perception of child emotion regulation was influenced by maternal mental health symptoms. Therefore, re-assessment of maternal mental health symptoms at three years would have been advisable. Investigating this topic with a larger prospective sample and the use of diagnostic interviews and behavioral assessments is recommended. Given the increased risk of mothers to develop PPD and PTSD following preterm birth, early identification and support for mothers with mental health issues may prevent the development of emotion regulation problems in their children.

Abbreviations list

BPD = bronchopulmonary dysplasia

BRIEF-P = Behavior Rating Inventory of Executive Function – Preschool Version

PPD = Postpartum depression

PPQ = Perinatal PTSD Questionnaire

PTSD = Posttraumatic stress disorder

RCT = Randomised controlled trial

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Conflict of interest and funding

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Table 1

Characteristics of the sample, including psychometric scores

Mothers (<i>N</i> = 50)		
Age, years (<i>M</i> , <i>SD</i>)	32.7	(5.6)
Nationality		
Swiss (<i>n</i> , %)	37	(74)
European (<i>n</i> , %)	8	(16)
Non-European (<i>n</i> , %)	4	(8)
Missing data (<i>n</i> , %)	3	(6)
Marital status		
Single (<i>n</i> , %)	13	(26)
Married/in a relationship (<i>n</i> , %)	34	(68)
Missing data (<i>n</i> , %)	3	(6)
Education		
Compulsory school (<i>n</i> , %)	10	(20)
Apprenticeship (<i>n</i> , %)	19	(38)
University grade or equivalent (<i>n</i> , %)	18	(36)
Missing data (<i>n</i> , %)	3	(6)
Multiparous pregnancy (<i>n</i> , %)	15	(30)
Randomization in Horsch, Tolsa (1)		
Control group (<i>n</i> , %)	24	(48)
Intervention group (<i>n</i> , %)	26	(52)
Maternal mental health outcomes		
Edinburgh scale score (<i>M</i> , <i>SD</i>)*	6.8	(4.5)
Edinburgh scale cut-off > 10.5 (<i>n</i> , %)*	6	(13)
PPQ score (<i>M</i> , <i>SD</i>)*	3.9	2.8
PPQ cut-off > 6 (<i>n</i> , %)*	13	(27)
Children (<i>n</i> = 58)		
Age, years (<i>M</i> , <i>SD</i>)	3.4	(0.7)
Gender (girls, %)	28	(48.3)
Gestational age, weeks and days (<i>M</i> , <i>SD</i>)	29.2	(2.2)

Weight at birth, g (<i>M, SD</i>)	1120	(319)
Missing data (<i>n, %</i>)	1	(1.7)
Flexibility index score (<i>M, SD</i>)**	47.6	(7.9)
Parental socioeconomic status (<i>M, SD</i>)**	5.4	(2)
Missing data (<i>n, %</i>)**	1	(1.8)
Presence of BPD (<i>n, %</i>)**	14	(26)
Missing data (<i>n, %</i>)**	2	(4)
Presence of major cerebral lesion (<i>n, %</i>)**	4	(7)
Missing data (<i>n, %</i>)**	2	(4)
Sepsis	4	(7)
Absence (<i>n, %</i>)**	42	(76)
Suspected or proven (<i>n, %</i>)**	10	(18)
Missing data (<i>n, %</i>)**	3	(6)

Edinburgh scale = Edinburgh Postnatal Depression Scale; PPQ = Perinatal PTSD Questionnaire;

Flexibility index of the Behavioral Rating Inventory of Executive Function – Preschool Version

assesses emotion regulation; Parental socioeconomic status was assessed by Largo score ranging

from 2 (= high socioeconomic status) to 12 (= low socioeconomic status); BPD = bronchopulmonary dysplasia.

* *n* = 48

** *n* = 55