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**Author(s):** Salomäki, Susanna; Junttila, Niina; Setänen, Sirkku; Rautava, Päivi; Huhtala, Mira; Leppänen, Marika; Lehtonen, Liisa; Korja, Riikka

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## Longitudinal associations between parental early psychological distress and children's emotional and behavioural problems during early childhood and self-reported social functioning in 11-year-old children born very preterm

Susanna Salomäki, Niina Junttila, Sirkku Setänen, Päivi Rautava, Mira Huhtala, Marika Leppänen, Liisa Lehtonen & Riikka Korjaon behalf of the PIPARI Study Group

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## Longitudinal associations between parental early psychological distress and children's emotional and behavioural problems during early childhood and self-reported social functioning in 11-year-old children born very preterm

Susanna Salomäki<sup>a</sup>, Niina Junttila<sup>b,c</sup>, Sirkku Setänen<sup>d,e,f</sup>, Päivi Rautava<sup>g,h</sup>, Mira Huhtala<sup>e,f</sup>, Marika Leppänen<sup>g,i</sup>, Liisa Lehtonen<sup>e,f</sup> and Riikka Korja<sup>a</sup> on behalf of the PIPARI Study Group

<sup>a</sup>Department of Psychology, University of Turku, Turku, Finland; <sup>b</sup>Department for Teacher Education, University of Turku, Turku, Finland; <sup>c</sup>Faculty of Education and Psychology, University of Jyväskylä, Jyväskylä, Finland; <sup>d</sup>Department of Pediatric Neurology, University of Turku, Turku, Finland; <sup>e</sup>Department of Paediatrics and Adolescent Medicine, Turku University Hospital, Turku, Finland; <sup>f</sup>Department of Pediatrics and Adolescent Medicine, University of Turku, Turku, Finland; <sup>g</sup>Department of Public Health, University of Turku, Turku, Finland; <sup>h</sup>Clinical Research Center, Turku University Hospital, Turku, Finland; <sup>i</sup>Department of Psychiatry, Turku University Hospital, Turku, Finland

### ABSTRACT

This study examined longitudinal associations between parental psychological distress (stress and depression) when the child was 2 to 4 years and a child's emotional and behavioural problems at ages 3 to 4, and social functioning (loneliness and social competence) at age 11 in very preterm born children. The participants were Finnish families of 172 very preterm infants (gestational age < 32 weeks and/or birth weight ≤ 1500 g). In girls, higher levels of maternal depression were associated with higher levels of social and emotional loneliness. Furthermore, higher levels of maternal stress and children's externalizing problems were associated with lower levels of experienced empathy. In boys, higher levels of paternal depression were associated with lower levels of social loneliness and impulsive behaviour. In conclusion, early parental psychological distress is associated with early socioemotional development and the later experienced social functioning in former very preterm infants. The sex of the child moderates these associations.

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**CONTACT** Susanna Salomäki ✉ [susanna.salomaki@utu.fi](mailto:susanna.salomaki@utu.fi) 📧 Department of Psychology, University of Turku, Turku 20014, Finland

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Preterm birth has been shown to challenge social functioning until adulthood (Ritchie et al., 2015; Taylor, 2020; van der Pal de Bruin et al., 2015). Children born very preterm have been reported to be less satisfied with their social networks and to be bullied more often (Ritchie et al., 2018). In addition, they have been reported to have more emotional and behavioural problems compared to term born peers in early adolescence (van der Pal de Bruin et al., 2015), which may impair social functioning (Reyes et al., 2019). Low social competence, as reduced prosocial and increased antisocial behaviours, has been shown to associate with high levels of loneliness (Junttila et al., 2012), social anxiety, and behavioural problems at school age (Bornstein et al., 2010). Prolonged loneliness, as anxiousness arising from the discrepancy between actual and desired social relations, can have detrimental effects on mental and physical well-being and health (Hawley & Cacioppo, 2010).

Following the framework of the International Classification of Functioning, Disability and Health (WHO, 2001), social functioning in this study was defined as low levels of social and emotional loneliness, indicating successful participation, and high levels of social competence reflecting engagement in social activities (Salomäki et al., 2020). Social competence, as a meta-level concept, encompasses effectiveness in social interaction (Rose-Krasnor, 1997). In this study, social competence was operationalized as a combination of prosocial and antisocial behaviours (Junttila et al., 2006).

Social functioning has been shown to develop as a result of the bidirectional effect between a child's characteristics and the social context (Ding et al., 2020). In children born very preterm, impaired social functioning has been suggested to originate from neurodevelopmental problems caused by preterm birth (Lind et al., 2020; Taylor, 2020), which increases vulnerability to early environmental stressors such as maternal psychological distress (Hosozawa et al., 2021) and families' socioeconomic status (Ritchie et al., 2015). In addition, the effects of parental psychological distress on child social functioning have been suggested to be influenced by direct genetic inheritance (Lean et al., 2020; Maughan et al., 2007). Furthermore, there is evidence indicating that neonatal stressors in the NICU can affect behavioural outcomes through epigenetic mechanisms (Provenzi et al., 2018). Parents of preterm infants have been shown to report more stress, anxiety, and depressive symptoms than parents of infants born at term, especially during the first years and in the case of medical and developmental problems (Mendelson et al., 2017;

Treyvaud, 2014). Parental psychological distress has been shown to be related to behavioural and dysregulation problems of infants born very preterm and term (Fredriksen et al., 2019; Huhtala et al., 2014; Leppänen et al., 2023). It seems that the development of social functioning might be different for boys and girls, as girls' socioemotional development might be sensitive to parental psychological distress (Junttila & Vauras, 2009; Nolvi et al., 2019). Term born boys have been reported to demonstrate less prosocial and more externalizing behaviours (Junttila et al., 2006) and higher levels of emotional loneliness (Junttila & Vauras, 2009) than girls. However, we have previously shown that sex differences in experienced social functioning were smaller in preterm than in term born young adolescents (Salomäki et al., 2020). On the other hand, girls' socioemotional development has been shown to be more sensitive to parental psychological distress (Junttila & Vauras, 2009; Nolvi et al., 2019). It is important to consider possible sex differences when studying the associations between different risk factors and social functioning.

Although parental psychological distress has been shown to be associated with emotional and behavioural problems in young children born very preterm (Huhtala et al., 2014; Lean et al., 2020; Treyvaud et al., 2010), there is a lack of studies that specifically investigate the impact of early parental psychological distress on perceived social functioning in young adolescents born very preterm. Furthermore, limited attention has been given to examining the role of sex in social functioning among young adolescents born very preterm. Our aim was to examine how maternal and paternal psychological distress (stress and depression) and children's emotional and behavioural problems (internalizing and externalizing) when the children are 2 to 4 years old are associated with experienced social functioning (loneliness and social competence) of 11-year-old girls and boys born very preterm. We hypothesized that a higher level of parental psychological distress and a child's emotional and behavioural problems during early childhood are associated with a lower level of experienced social functioning in early adolescence, especially in girls.

## Participants and methods

The present study is part of the follow-up study PIPARI (Development and Functioning of Very Low Birthweight Infants from Infancy to School Age), where 289 very preterm infants born in 2001–2006 at Turku University Hospital, Finland, were invited to participate. A total of 34 infants died

during the neonatal period. The exclusion criteria were major congenital anomalies or chromosome anomalies ( $n = 12$ ), parents' inability to speak or understand the official languages in Finland ( $n = 6$ ), and infants' residence outside the hospital's catchment area ( $n = 7$ ). A total of 9 parents declined to participate. During the follow-up period, 2 participants died, and 47 dropped out. The final number of participants at 11 years was 172.

Parental psychological distress was assessed when the child was 2 to 4 years with the Parenting Stress Index (PSI; Abidin, 1995) and with the Beck Depression Inventory (BDI; Beck et al., 1961; Salmela-Aro et al., 2001). The PSI total stress scale comprises 101 items, which are rated with a 5-point Likert scale. The scale is scored separately according to the PSI manual for mothers and fathers. Higher scores indicate a higher level of parental stress. The modified 13-item Finnish translation (Salmela-Aro et al., 2001) of the original 21-item BDI assesses the symptoms of depression on a 5-point Likert scale. The scores for the individual items are summed and rescaled to range between 0 and 39. The BDI total scores were calculated separately for mothers and fathers and used as continuous measures. Higher scores indicate a higher level of depression.

Children's emotional and behavioural problems were assessed with the Child Behavior Checklist (CBCL) for ages 1.5 to 5 years (Achenbach, 2001). The CBCL comprises 99 closed and 1 open-ended problem items on 2 subscales: internalizing problems and externalizing problems. For each item, parents choose 'not true' (0), 'somewhat or sometimes true' (1), or 'very often or often true' (2), the one that best describes their child's behaviour during the previous 2 months. The scores for internalizing problems range between 0–72 and for externalizing problems between 0–48. The subscale scores were used as continuous measures, where higher scores indicated a higher level of emotional and behavioural problems.

Social functioning was assessed with the Finnish version of the Peer Network and Dyadic Loneliness Scale (PNDLS; Hoza et al., 2000; Junttila & Vauras, 2009) and the Multisource Assessment of Children's Social Competence Scale (MASCs) self-rating (Junttila et al., 2006). The PNDLS has been validated to assess subjective feelings of social and emotional loneliness among school-aged children (Hoza et al., 2000; Junttila & Vauras, 2009). It comprises 10 paired statements: 5 concerning social loneliness, and 5 concerning emotional loneliness. First, respondents choose which one of the paired statements describe their situation, and then they evaluate whether the statement fits them 'quite well' or 'very

well'. Item scores vary between 1 (very low loneliness) and 4 (very high loneliness). The sum scores of the two types of loneliness vary between 5–20. The MASCS has been validated to measure perceived social competence in children at school (Junttila et al., 2006). It comprises 15 items on four subscales: co-operating skills, empathy, impulsivity, and disruptiveness. Each item is rated on a 4-point Likert scale. The subscales were calculated according to the Finnish manual of the MASCS (Kaukiainen et al., 2005) and used as continuous measures, where higher scores indicate a higher amount of the attribute.

Neurodevelopmental impairment (NDI) was defined any of the following: cerebral palsy, severe hearing impairment or severe visual impairment by 2 years, or severe cognitive impairment (intelligence quotient < 70) according to the Wechsler Intelligence Scale for Children (4<sup>th</sup> edition; Wechsler, 2011) at 11 years.

### *Procedure*

Data on the neonatal period were collected from medical records. Information on parental education was requested from the parents before they were discharged home. Parental questionnaires were sent out 4 weeks before the child reached the age of 2 years (corrected age) and 4 years. The CBCL was sent out 4 weeks before the child turned 3 and 4 years old. All questionnaires were returned at the follow-up visit or by mail. In the statistical analyses, we used assessments from Time 1 or Time 2, and if the same questionnaire was returned at both time points, we used the mean score of Time 1 and 2." Preliminary analyses did not indicate any statistically significant differences in the scores measured at consecutive time points. The numbers and percentages of returned parental questionnaires are presented in Supplemental Table S1. Descriptive statistics for the scores of the PSI, BDI and CBCL, as well as the differences between successive time points, are presented in Supplemental Table S2. Children independently completed the PNDL and MASCS during the follow-up visit at the age of 11 years. They were offered assistance if required.

### *Ethics*

The PIPARI study protocol was approved by the Ethics Committee of the Hospital District of Southwest Finland originally in December 2000,

permission number 11/2000, § 333 and then at several time points (March 2003, July 2007, and T08/036/16). All parents gave written informed consent for the entire follow-up period, and all children provided written informed consent for the follow-up visit at 11 years after receiving written and oral information.

### Statistical analyses

Descriptive statistics and dropout analyses were run using SPSS, version 26 (IBM SPSS Statistics for Windows, IBM Corporation, Armonk, NY). *P* values of less than 0.05, two-tailed, are considered statistically significant. Continuous variables are described by means, standard deviations, and minimum and maximum values. Categorical variables are described using frequencies and percentages. The independent samples *t*-test and the chi-square test ( $\chi^2$ ) are used to compare differences between groups (boys and girls in Table 1, participants and dropouts in Supplemental Table S3).

Linear regression and structural equation models were constructed using Mplus version 8 (Muthén & Muthén, 2019). First, we chose the controlling variables for the main model. We tested whether background variables (neurodevelopmental disability, parents' divorce before or at the

**Table 1.** Descriptive statistics for parental early psychological distress, children's early emotional and behavioural problems, and children's social functioning at 11 years, mean (SD) min – max.

	Boys	Girls
<sup>a</sup> Parenting Stress Index		
Mother	213 (40) 130–306	208 (46) 128–306
Father	206 (38) 127–297	192 (36) 126–275
<sup>a</sup> Beck Depression Inventory		
Mother	8.6 (5.9) 0–25	9.0 (7.4) 0–29
Father	6.1 (5.5) 0–26	5.9 (5.8) 0–26
<sup>b</sup> Child Behavior Checklist		
Internalizing problems	5.3 (4.9) 0–28	6.6 (5.6) 0–28
Externalizing problems	12.9 (7.2) 2–36	11.1 (6.0) 1–28
<sup>c</sup> Peer Network and Dyadic Loneliness Scale		
Social loneliness	7.8 (2.3) 5.0–14.0	8.1 (2.5) 5.0–15.0
Emotional loneliness	8.0 (2.6) 5.0–17.0	7.4 (2.4) 5.0–15.0
<sup>c</sup> Multisource Assessment of Children's Social Competence Scale		
Co-operating skills	10.0 (1.4) 6.4–12.9	10.3 (1.2) 7.0–12.9
Empathy	5.7 (0.80) 2.9–7.0	6.2 (0.90) 1.8–7.0
Impulsivity	4.3 (1.1) 2.2–6.8	4.0 (1.4) 2.2–8.9
Disruptiveness	3.9 (1.0) 2.7–6.0	3.5 (0.89) 2.7–7.1

<sup>a</sup>Parental psychological distress when a child is age 2 to 4 years; <sup>b</sup>Children's socio-emotional problems at 3 to 4 years; <sup>c</sup>Children's experienced social functioning at 11 years.



5-year age point, gestational age, birth weight z-score, and maternal education) predicted children's internalizing and externalizing problems at 3 to 4 years and/or their loneliness (social and emotional) and social competence (co-operating skills, empathy behaviour, impulsivity, and disruptiveness) at 11 years. Based on the statistically significant associations, the final controlling variables chosen for inclusion in the main model were the child's neurodevelopmental disability and gestational age. Second, we used multigroup structural equation modelling to test whether maternal and/or paternal stress or depressive symptoms were associated with girls' or boys' internalizing or externalizing problems at 3 to 4 years and/or their loneliness and/or social competence at 11 years. These models were fit to the covariance matrix using the maximum likelihood method with Mplus 7 (Muthén & Muthén, 2013). The fit of the models was evaluated using the chi-square test, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the standardized root mean square residual (SRMR). The fit indexes for the final model (=multigroup model) indicated a good fit:  $\chi^2$  (df) = 22.6 (24), CFI = 1.0, TLI = 1.0; RMSEA = 0.0 (95%CI 0.0–0.08), and SRMR = 0.03. The skewness and kurtosis values were within reasonable limits; that is, the statistics were between –2.0 and 2.0 for skewness and between –7.0 and 7.0 for kurtosis (Curran et al., 1996). To test the invariance between groups, we used the chi-square difference test and the difference in the CFI between unrestricted and loadings restricted models. If  $\Delta \chi^2 p > .050$  and  $\Delta CFI < .010$ , the more restrictive model could be accepted (Cheung & Rensvold, 2002). The goodness of fit estimates for the multigroup model indicated a good fit:  $\chi^2$  (df) = 22.6 (24),  $p = 0.05$ ; CFI = 1.0; TLI = 1.00; RMSEA = 0.00 (90%CI 0.00–0.08); and SRMR = 0.03.

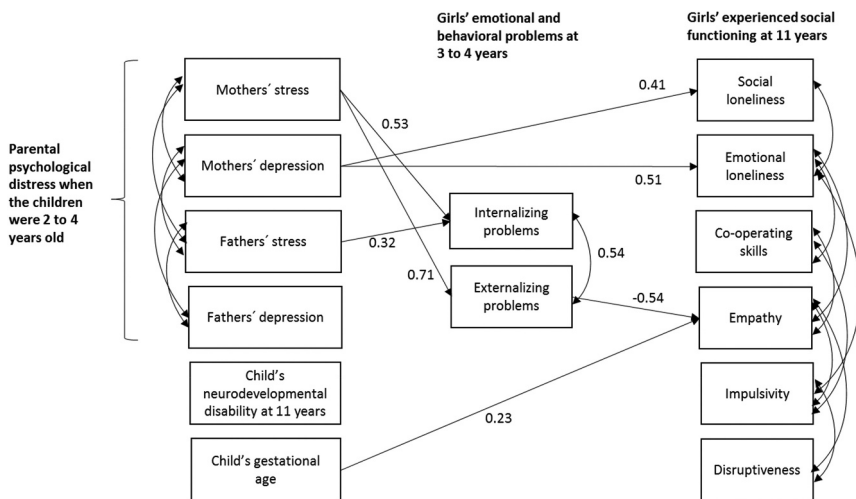
## Results

A total of 172 children born very preterm (45% girls, 55% boys) were included. Mean gestational age of the participants was 29 weeks (SD = 3) and 24 (14%) participants had neurodevelopmental disability at the age of 11. Participants had higher levels of maternal education compared to the dropouts ( $n = 49$ ), with 64% having more than 12 years of education compared to 39% ( $p = 0.006$ ). The background characteristics of the participants are presented in Supplemental Table S3. The descriptive statistics for parental stress

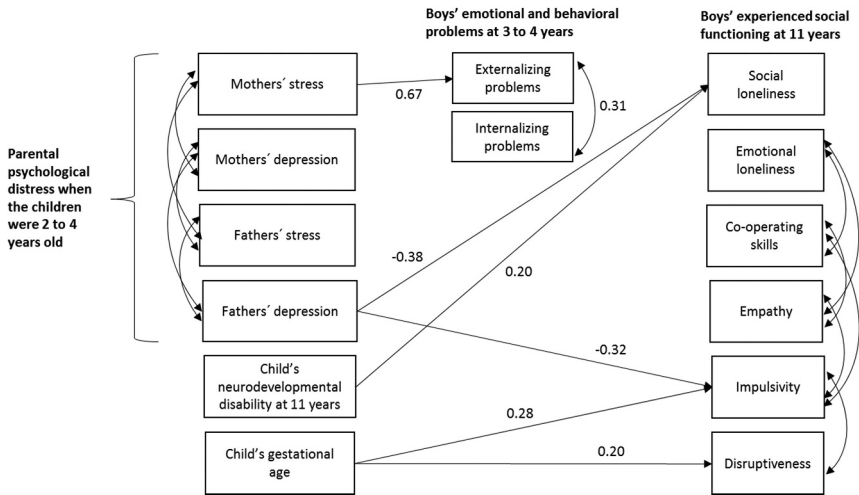
and depression, child's internalizing and externalizing problems, and child's loneliness and experienced social competence are presented in Table 1. The standardized regression coefficients and  $p$  values for background variables predicting outcome variables are presented in Supplemental Table S4.

### Early predictors of experienced social functioning in girls

The significant standardized path coefficients in the girls' model are presented in Figure 1. A higher level of maternal depression when the child was 2 to 4 years old was associated with a higher level of social (0.41) and emotional (0.51) loneliness at 11 years. A higher level of maternal stress when the child was 2 to 4 years old was associated with a higher level of internalizing (0.53) and externalizing problems (0.71) when the child was 3 to 4 years old, which was further associated with a lower level of experienced empathy behaviour ( $-0.54$ ) at 11 years. A higher level of paternal stress was associated with a higher level of internalizing problems (0.32) when the child was 3 to 4 years, but not with experienced social competence or loneliness at 11 years. Older gestational age was associated with a higher level of empathy behaviour (0.23) at 11 years.



**Figure 1.** Multigroup structural equation model for girls: standardized regression coefficients between parental early psychological distress and a child's early emotional and behavioural problems and experienced social functioning in early adolescence.



**Figure 2.** Multigroup structural equation model for boys: standardized regression coefficients between parental early psychological distress and a child's early emotional and behavioural problems and experienced social functioning in early adolescence.

### Early predictors of experienced social functioning in boys

The significant standardized path coefficients are presented in [Figure 2](#). In boys, a higher level of paternal depression when the child was 2 to 4 years old was associated with a lower level of social loneliness ( $-0.38$ ) and experienced impulsive behaviour ( $-0.32$ ) at 11 years. A higher level of maternal stress when the child was 2 to 4 years old was associated with a higher level of externalizing problems ( $0.67$ ) when the child was 3 to 4 years old. Higher gestational age was associated with higher levels of impulsive ( $0.28$ ) and disruptive ( $0.20$ ) behaviour at 11 years. Boys with NDI reported higher levels of social loneliness ( $0.20$ ) at 11 years compared to boys without NDI.

### Discussion

This study examined how parental psychological distress and child emotional and behavioural problems between 2 and 4 years are associated with self-experienced social functioning in 11-year-old children born very preterm. We investigated girls and boys separately to examine the role of biological sex in social functioning. We showed that higher levels of early maternal stress associated with higher levels of children's externalizing problems at 3 to 4 years, which was associated with lower levels of

empathy behaviour in girls born very preterm at 11 years. Furthermore, a higher level of maternal depression when the child was 2 to 4 years associated with a higher level of social and emotional loneliness in girls at 11 years, as hypothesized. Surprisingly, a higher level of early paternal depression associated with a lower level of social loneliness and a lower level of impulsive behaviour in boys at 11 years.

Our finding of longitudinal associations between early parental distress and children's social functioning is in line with previous literature in full-term and preterm populations (Hosozawa et al., 2021; Montagna & Nosarti, 2016). Together with previous literature we suggest that a child's exposure to maternal psychological distress during the early years creates a long-term risk for child's lower social functioning (Hosozawa et al., 2021; Huhtala et al., 2014). The novelty of our study was that this link remained up to early adolescence based on self-reported social functioning. Previous studies in preterm populations have focused mainly on children's socioemotional development before school age using parents' reports of children's functioning (Huhtala et al., 2014; Rabiner et al., 2016). Recognizing impaired social functioning in early adolescence is important because experiences of social functioning and friendship have been shown to be associated with perceived mental and physical health in adolescence (Schwartz-Mette et al., 2020), and with the quality of life in adulthood in very preterm populations (Baumann et al., 2016).

Girls born very preterm were more vulnerable to the longitudinal effects of their mothers' psychological distress during early childhood than boys. Previous literature regarding community samples has shown conflicting results regarding whether girls are more vulnerable compared to boys to parents' psychological distress. Mother's depression was associated with a child's socioemotional development, regardless of the sex of the child (Fredriksen et al., 2019). Mothers' loneliness predicted girls' social loneliness, and fathers' loneliness predicted boys' social loneliness in early adolescence (Salo et al., 2020). However, mothers' and fathers' loneliness have been shown to be associated with lower peer-evaluated co-operating skills in 10-year-old girls, but not in boys, and lower co-operating skills with social and emotional loneliness (Junttila & Vauras, 2009). It is possible that parental stress related to very preterm birth affects behavioural functioning in a sex-specific way. More studies are needed to uncover sex-specific pathways and potential mechanisms from maternal and paternal psychological distress to social functioning of girls

and boys born very preterm. In a community sample, prenatal exposure to maternal stress was shown to lead to more pronounced fear reactivity in girls compared to boys at 8 months of age (Nolvi et al., 2019).

Several mechanisms may explain the association between early maternal depression and social and emotional loneliness in girls at 11 years. Shared genetic factors may explain the link between mothers' distress and girls' socioemotional outcomes (Harold et al., 2017). Mothers' stress and depression may affect children's socioemotional well-being through altered parenting behaviour. Previous studies have shown that maternal depression increases the risk of problems in caregiving behaviour in term and very preterm populations (Korja et al., 2008; Neri et al., 2015). Sensitive and warm parenting has been shown to increase long-term resilience in very preterm populations (Faure et al., 2017). Sensitive parenting might be especially significant for very preterm infants who have biological differences in brain maturation (Montagna & Nosarti, 2016).

Contrary to our hypothesis, a higher level of early paternal depression associated with a lower level of social loneliness and impulsive behaviour at 11 years in boys. It has been suggested that paternal depression may have less influence on children's social functioning than maternal depression due to the possible buffering role of sensitive maternal parenting in the association between paternal depression and children's social functioning (Martin et al., 2010; van Eldik et al., 2019). Previous findings based on this same very preterm cohort have shown that maternal depression associated with a higher levels of social, behavioural, and functional problems of children at 5 years, but paternal depression did not (Huhtala et al., 2014). The timing of paternal depressive symptoms may also be meaningful. Scott et al. (2018) showed that the influence of paternal parenting on a child's socioemotional development increases as a child grows older.

### Strengths and limitations

Major strengths of this study were prospective study design from early childhood until early adolescence, and the data quality. We used validated measures and the rate of returned questionnaires was high. Self-reports by the children and parental reports of their children's socioemotional functioning allowed multigroup structural equation modelling. A possible limitation was the lack of control group to determine whether the studied associations were specific to the very preterm population. We studied parental stress

without distinguishing child-centred stress from other stressors. This might have affected the results, because especially child-centred stress is elevated among the parents of children born very preterm. The questionnaires assessing parental psychological distress and children's emotional and behavioural problems were collected when the child was 2 years old and when the child was 4 years old. However, due to missing values the results were aggregated to calculate mean scores in order to simplify the statistical models. This may have interfered in detecting specific age-related associations. Because parental psychological distress and the child's emotional and behavioural problems were not assessed at 11 years, we were unable to determine the effects of early risk factors compared to the effects of stable or concurrent risk factors associated with social functioning in early adolescence.

## Conclusions

Early parental psychological distress was associated with longitudinal social functioning problems in 11-year-old children born very preterm. Sex-modulated associations were found between early parental psychological distress and social functioning. It is important to recognize parents of very preterm infants who experience psychological distress to offer psychosocial support.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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## Data availability statement

By law, we are not permitted to disclose data to third parties. Requests to access the data set may be sent to Findata at the Institute of Health and Welfare in Finland.

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