



Research paper

Mothers' and their children's emotional and behavioral symptom trajectories and subsequent maternal adjustment: Twenty-seven years of motherhood

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ABSTRACT

Background: This study aims to describe maternal depressive symptoms (MDS) trajectories in a longitudinal study extending from pregnancy to 27 years after the birth of the firstborn child. We also explored the associations of both MDS trajectories and child internalizing and externalizing problem trajectories with maternal adjustment (adaptive functioning, emotional and behavioral problems).

Methods: The population-based study was conducted in Tampere, Finland, and the sample comprised 356 first-time mothers. MDS were screened with the Edinburgh Postnatal Depression Scale during pregnancy, first week after delivery, 2 and 6 months postnatally, and when the child was 4–5, 8–9, 16–17, and 26–27 years of age. The internalizing and externalizing problems of the children were assessed with the Child Behavior Checklist when the child was 4–5, 8–9, and 16–17 years of age. Maternal adaptive functioning and internalizing and externalizing problems were assessed with the Adult Self Report at 26–27 years after the birth of the first child. Complete follow-up data were available for 168 mothers.

Results: We describe a three-group trajectory model of MDS (High Stable, Low Stable, Very Low). Elevated depressive symptom patterns were associated with less optimal maternal outcomes regarding both adaptive and problem dimensions. The child's internalizing and externalizing problem trajectories were associated with maternal internalizing and externalizing problems but not with maternal adaptive functioning.

Limitations: Maternal and child measures were based on maternal reports only.

Conclusions: The interconnectedness of the well-being of the mother and child should be noted in health and mental health services for adults and children.

1. Introduction

Depression is one of the most common and straining health concerns among women of child-bearing age in Western countries (Ferrari et al., 2013; Steel et al., 2014). Recent systematic reviews report the global prevalence of postpartum depression in women to be 14 % (Liu et al., 2022) or even 17 % (Wang et al., 2021), with varied prevalence rates in

various geographic areas and highest rates in developing countries. Yin et al. (2021) report in their systematic review the pooled prevalence of any prenatal depression to be 20.7 %. Later in life the prevalence rates of depressive disorders are reportedly lower, but peak in older adulthood, being 7.5 % in women aged 55 to 74 years (WHO, 2017).

Increasing numbers of studies have reported on the longitudinal trajectories of maternal depressive symptoms (Vanwetswinkel et al.,

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2022). The evidence concerning heterogeneity in the trajectories is strong (Nandi et al., 2009; Vanwetswinkel et al., 2022). At least one third of the symptomatic cases follow the moderate to severe course (Ferrari et al., 2013). Concerning perinatal depression, low, medium, high, and episodic trajectories have been distinguished in several studies (Santos et al., 2017; Vanwetswinkel et al., 2022). In a recent systematic review including 33 studies from high-, middle-, and low-income countries, two to six trajectories solutions were identified, and a solution with three trajectories was most often observed (Vanwetswinkel et al., 2022). The relative proportions of the trajectory subgroups varied according to the number of the trajectories. Low-symptom subgroups were the largest (6.5–92 %) whereas high-symptom subgroups were the smallest (1.1–14.6 %) according to the systematic review (Vanwetswinkel et al., 2022). The follow-up times varied considerably from 4 weeks to 27 years (Vanwetswinkel et al., 2022).

Psychosocial adjustment comprises both adaptive (positive) and problem (negative) dimensions. *Adaptive functioning* refers to an individual's ability to cope with the demands of various environments by actively modifying communication, social interaction, daily tasks, and motor functioning (Bornstein et al., 2013). Mental health problems are generally classified as *internalizing* or *externalizing* problem types (Achenbach et al., 2016). Internalizing problems are mainly within the self, such as depressive and anxiety symptoms, whereas externalizing problems refer to abnormal behavior towards other people and problems with social norms, such as aggressive, oppositional, or rule-breaking behavior (Achenbach and Rescorla, 2003).

There is considerable evidence regarding the adverse effects of maternal psychopathology on the mental health of the offspring (Goodman et al., 2011; Sanger et al., 2015). Longitudinal studies show that maternal perinatal depression or depressive symptoms are associated with many suboptimal child outcomes such as poorer social-emotional, cognitive, language, and motor development, lower levels of adaptive behavior and social competence, and higher levels of internalizing and externalizing problems (Rogers et al., 2020; Morales et al., 2023). The diversity of suboptimal child outcomes reflects the diversity of depressive symptoms and disorders (Nandi et al., 2009), and of the overlapping intergenerational transmission mechanisms of depression. These include genetic and epigenetic influences, the postnatal exposure to negative maternal affect, cognitions and behaviors, and the accumulation of stressful experiences associated with parental depression in everyday life (Goodman and Gotlib, 1999). Particularly the chronicity and severity of maternal depression are associated with poorer child outcomes (Morales et al., 2023).

The reverse causal pathway has not so often been considered. According to *transactional theory*, however, there is a dynamic interplay with reciprocal effects between parental and child characteristics over time (Sameroff and MacKenzie, 2003). Gross et al. (2009), for example, showed in their study of 289 mother-son dyads in the USA, that early child noncompliance predicted high or chronic trajectories of maternal depression. The follow-up started when the children were 1.5 years old and lasted over ten years. Maternal depressive symptom trajectories, in turn, were associated with adolescent's behavioral problems (Gross et al., 2009). In another study conducted in the USA, Nicholson et al. (2011) showed that adolescent mothers' depressive symptoms and their firstborn child's internalizing and externalizing behaviors were bidirectionally coupled. However, mother's depressive symptoms showed greater effect on child's behavior than vice versa. The children were aged three to ten years in the follow-up. Similarly, in a study of 180 mother-adolescent dyads, conducted in the USA, Allen et al. (2010) reported reciprocal relationships between maternal depressive symptoms and 13- to 16-year-old adolescent's externalizing problems.

A study of Sellers et al. (2016) in the UK reported that particularly daughters' depressive symptoms predicted reoccurrence of maternal depressive symptoms across 29 months. The sample included 299 mothers with a recurrent depressive disorder. The children were aged 9 to 17 years at the baseline. Raposa et al. (2011) found that maternal

depressive symptoms and children's behavioral problems increased or decreased in a reciprocal manner during the follow-up of 5 years. The sample included 679 Australian mothers and their 15-year-old adolescent children. In another Australian study with a sample of 3650 mothers, Kingsbury et al. (2017) reported that internalizing problems and combined social/attention/thought disorders in the children at 5 years, and behavior problems at 14 years were associated with maternal mental health impairment at 21 years.

On the other hand, the findings are ambiguous. Kouros and Garber (2010), for example, reported that children's externalizing problems were not related to a change in maternal depressive symptoms. Furthermore, among mothers with high initial levels of depression, children's depressive symptoms unexpectedly predicted declines in mothers' depressive symptoms. This study was conducted in the UK and assessed yearly 240 mothers and their children, from 6th to 12th grade.

The results of earlier studies thus show intertwined dynamics between mothers' and children's symptoms. There are discrepancies, however, which may relate to different samples, methodologies, and cultural contexts. Studies beginning during pregnancy and extending over childhood and adolescence are rare.

The first aim of this study was to explore, in a longitudinal setting, the depressive symptom trajectories among mothers in the general population from their first pregnancy to the point when their firstborn children were young adults (27 years of follow-up). The second aim was to explore maternal depressive symptom (MDS) trajectories and child problem trajectories in childhood and adolescence as determinants of the mother's psychosocial adjustment 27 years after the first delivery. Maternal outcome measures included adaptive functioning and internalizing and externalizing problems. The hypotheses concerning the second aim were that both maternal elevated depressive symptom trajectories and elevated child problem trajectories would independently predict the lower adaptive functioning and higher problem scores of the mothers.

2. Methods

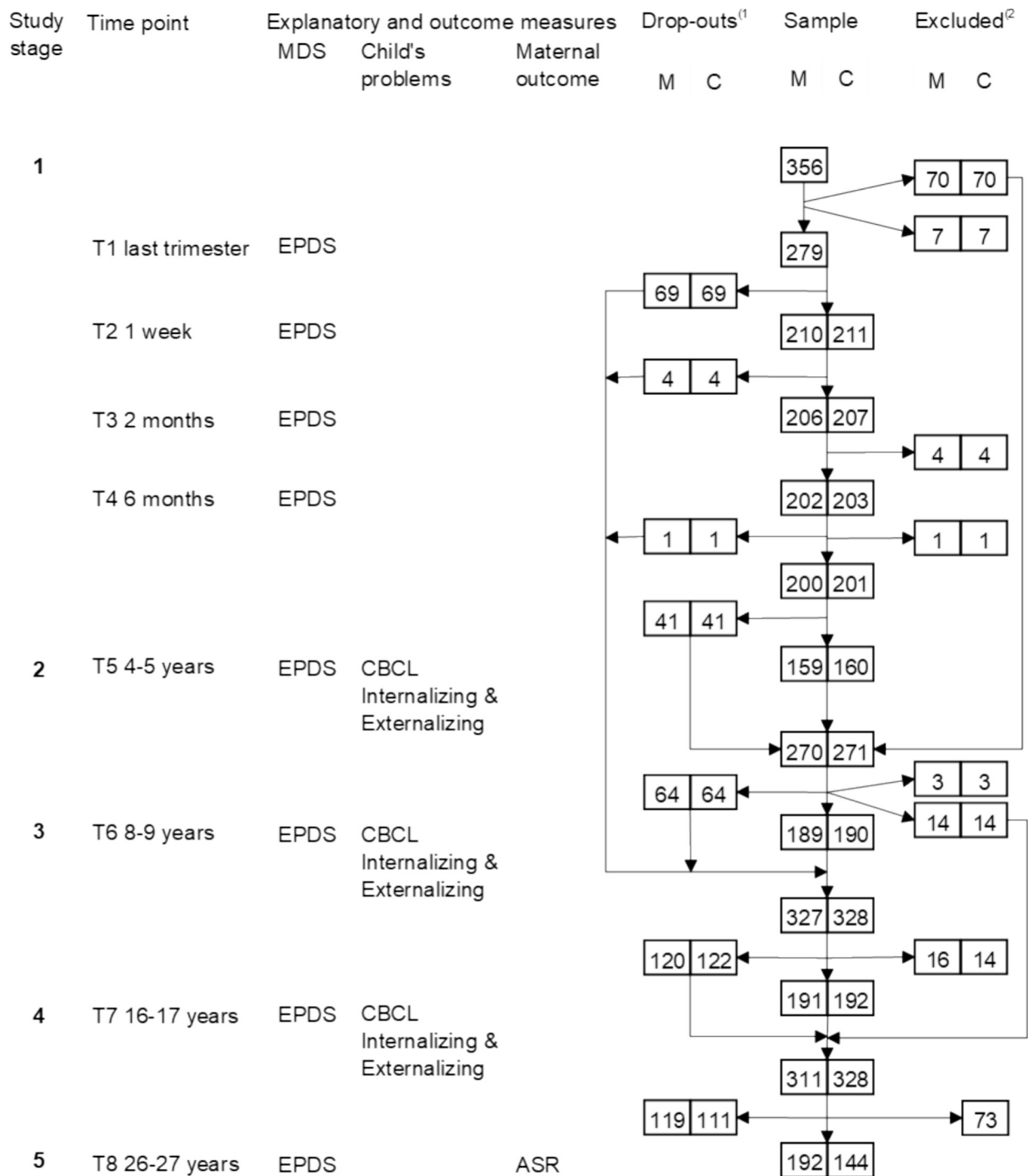
2.1. Study design and sample

The original sample of mothers in the general population ($n = 356$) was collected from all maternity clinics in the city of Tampere, Finland, during a six-month period in 1989, when the participants were expecting their first child. Tampere is an inland city in Finland, with a population of around 170,000 in 1989 (Statistics Finland, 1989). In Finland, almost all expecting mothers attend maternity clinics. In 1989, only four expectant mothers in Tampere did not (Tamminen, 1990).

During a regular visit to the maternity clinic, public health nurses at the clinics gave all first-time mothers a bulletin presenting the study (Tamminen, 1990). The mothers were asked to respond approximately ten weeks before delivery. Mothers who needed attendance in specialized health care were not included. According to the records kept by public health nurses, <10 % of mothers refused to participate in the study. All the respondent mothers were Finnish, corresponding to the general population in Tampere in 1989. Due to the small number of refusals and variations in the reasons for refusal, the original sample was considered to represent first-time mothers in Tampere (Tamminen, 1990). Later stages from postnatal stage to the firstborn child's adolescence, have been described in detail elsewhere (Luoma et al., 2001; Korhonen et al., 2012; Luoma et al., 2015, 2019). The flow chart of the entire longitudinal sample and the design of the study are shown in Fig. 1.

= Fig. 1 =.

The depressive symptoms of the mothers were screened using questionnaires during the third trimester of pregnancy (T1); the first week (T2), two months (T3), and six months (T4) after delivery; and when the child was 4–5 years (T5), 8–9 years (T6), 16–17 years (T7), and 26–27 years (T8). The mothers reported their firstborn child's emotional



¹⁾ Did not get questionnaires because of nursing personnel error (T1), mothers' unknown address (T7, T8), or did not participate (T1-T8).

²⁾ Excluded because of time limitations (T1), serious illness or death of mother or child (T1-T5, T6, T7-T8), refusal of mother (T1-T5, T6, T7-T8) or child (T7-T8) to participate, no maternal CBCL available (T8).

Fig. 1. Flow chart of the longitudinal study with explanatory and outcome variables. M = mother, C = child, EPDS = Edinburgh Postnatal Depression Scale, CBCL = Child Behavior Checklist, ASR = Adult Self Report, MDS = maternal depressive symptom measures, Child problems = child problem measures.

and behavioral problems at T5, T6, and T7. Mothers also completed questionnaires on their own socioemotional adjustment at T8.

At T8, there were 311 potentially eligible respondent mothers. The addresses of 3 mothers were not found, 4 mothers had died, the child of 2 mothers had died, 4 mothers lived abroad, and 2 mothers had at a previous stage cancelled their consent to further participate. Thus, we sent a postal survey with two reminders to 296 mothers, of whom 192 (65 %) responded.

The sample size concerning the trajectory analyses of MDS (the first aim) was 332. Complete data concerning the key explanatory and maternal outcome variables at T8 (the second aim) were available for 168 mothers (47 % of the original sample, 57 % of the eligible respondents, and 88 % of the participating mothers at T8).

At T8, the mean age of the respondent mothers was 53.7 years (SD 3.8). The minimum and maximum numbers of their biological children was 1–6 (mean 2.4; SD 1.0; median 2). Data on sociodemographic characteristics are presented in Table 1.

In the attrition analysis, the sample of 168 respondent mothers was compared with the drop-out subjects concerning the sociodemographic characteristics at T1, T6, and T7 (i.e., the time points when the concurrent sociodemographic data were available); trajectory memberships; and the child’s gender. The respondents did not differ statistically significantly from drop-out participants concerning maternal age, marital status, education, or employment at T1, T6, or T7, nor in maternal depressive symptom trajectories or child Internalizing or Externalizing Problem trajectories. There were more mothers of daughters among the respondents compared with the drop-out subjects

Table 1
Socio-demographic characteristics of the mothers at 27 years after the birth of the firstborn child in the whole sample (n = 168) and by the maternal depressive symptom (MDS) trajectories. All differences between the MDS trajectory groups are statistically non-significant (p > 0.05).

Characteristic	All (n = 168)	MDS trajectory		
		Very Low (n = 33)	Low Stable (n = 74)	High Stable (n = 61)
	M (SD) ^a	M (SD)	M (SD)	M (SD)
Maternal age ^b	53.7 (3.8)	53.3 (3.0)	53.3 (3.5)	54.4 (4.3)
Maternal marital status	%	%	%	%
Married, cohabiting, engaged	72	76	73	69
Single	28	24	27	31
Maternal education				
Elementary, vocational	76	76	72	80
University	21	21	24	18
Information missing	3	3	4	2
Maternal employment				
Working	92	97	95	87
Not working	8	3	5	13
Socioeconomic status				
Upper (entrepreneurs, white collar workers)	76	85	77	71
Lower (blue collar workers, students, pensionnaires)	17	12	15	21
Information missing	7	3	8	8
Gender of the firstborn child				
Girl	54	48	49	62
Boy	46	52	51	38
Number of biological children				
1	14	6	15	18
2	49	58	45	49
3 or more	37	36	41	33

^a Mean and standard deviation.

^b Information missing for 3 mothers in the Low Stable group and for 1 mother in the High Stable group.

(p = 0.023).

2.2. Measures

The mothers reported on their depressive symptoms using the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) at the various time points. The EPDS is a self-report form originally designed to screen postnatal depression, but it can be used among non-postnatal women as well (Cox et al., 1996). The questionnaire consists of ten questions, each of which has four response options scored on a scale from 0 to 3. The maximum score is 30, higher scores indicating more severe symptoms. The EPDS sum scores were considered as continuous variables in the analyses, but the cut-off points 9/10 between normal and subclinical level of symptoms and 12/13 between subclinical and clinical depressive symptoms (Cox et al., 1996) are presented in the illustrations. The validity of the EPDS has been studied extensively (Eberhard-Gran et al., 2001; Gibson et al., 2009). Originally, Cox et al. (1987) reported a sensitivity of 86 % and specificity of 78 % when the EPDS was validated against Research Diagnostic Criteria (RDC) for depression (Spitzer et al., 1978). Concerning prenatal depression, sensitivity and specificity estimates have varied between 64 and 100 % and 73–100 %, respectively (Kozinszky and Dudas, 2015). Concerning postmenopausal women, a sensitivity of 88 % and specificity of 85 % have been reported (Becht et al., 2001). The Cronbach Alphas of the EPDS in this sample were at the various time points between 0.82 (T2) and 0.88 (T8), showing good internal consistency.

The mothers reported their child’s psychosocial functioning and emotional and behavioral problems using the age-appropriate version of the Child Behavior Checklist (CBCL; Achenbach, 1991; Achenbach and Rescorla, 2001) at T5, T6, and T7. The CBCL includes 118 items on the child’s internalizing and externalizing problems for the parent to record. Each item is scored on a three-step scale from 0 (item not true) to 2 (item very true or often true). The Internalizing Problems score is a sum score including the items concerning withdrawal, somatic complaints, and anxiety/depression, while the Externalizing Problems sum score includes the item scores of social problems, rule-breaking, and aggressive behavior (Achenbach and Rescorla, 2001). The CBCL Internalizing and Externalizing Problems raw scores were converted to normalized T scores. The CBCL is an established instrument for parental reports on their children’s psychosocial adjustment, with abundant international data on its psychometric properties and validity (Achenbach and Rescorla, 2001).

To assess the mothers’ outcome at 27 years after delivery, the Adult Self Report (ASR; Achenbach and Rescorla, 2003) was used. The ASR is a questionnaire intended to assess the adaptive functioning as well as the internalizing and externalizing problems of adults. The Mean Adaptive Functioning scale contains subscales concerning family and friends, and subscales concerning a spouse or partner, job, and education, if they have been relevant to the respondent’s life during the last six months. The respondents report their internalizing and externalizing problems by answering 123 problem items. The Internalizing Problems scale includes items on anxious/depressed symptoms, withdrawal, and somatic complaints. The Externalizing Problems scale includes items on aggressive and rule-breaking behavior and intrusive problems (Achenbach and Rescorla, 2003). As in the CBCL, the raw scores were converted to normalized T scores. Higher Mean Adaptive Functioning scores indicate better adaptive functioning, whereas higher Internalizing and Externalizing Problems scores indicate more severe problems. The validity of the ASR has been addressed in studies conducted in various countries, including Finland (Achenbach and Rescorla, 2003; Aronen and Arajärvi, 2000; Aronen and Soininen, 2000).

2.3. Statistical methods

Group-based trajectory modeling (Nagin, 1999; Nagin and Odgers, 2010), based on censored normal distribution, was used to identify

trajectory groups describing the development of maternal depressive symptoms over time. The skew EPDS sum score distributions were normalized by square root transformation. The data collection points were treated as evenly spaced. Second-, third-, and fourth-degree equations of time were used in the models, and for each of them all 1–5-group models were examined. Each analysis was repeated five times to find the overall maximum likelihood instead of a local one (Leisch, 2004). The selection of the final model was based on Bayesian Information Criterion (BIC) and model interpretativeness (Nagin and Odgers, 2010). As group-based trajectory modeling accommodates incomplete data (Nagin, 1999; Leisch, 2004), the data used in the analyses consisted of the EPDS data of mothers for whom the sum score was available at least once in T1 and T3–T8. T2 was omitted because the psychometric properties of the EPDS might have been affected by postpartum blues after delivery (Lee et al., 2003).

The trajectory groups of children's Internalizing and Externalizing Problems from the age of 5 to the age of 16 years were defined according to the same principles as the EPDS trajectory groups. We have reported them in detail elsewhere (Korhonen et al., 2014). They were based on the problem reports of 261 children (49 % male), for whom at least one of the CBCL reports at T5–T7 was available.

The four-trajectory model of the children's Internalizing Problems included the Low Stable ($n = 73$, 28 %), Moderate Decreasing ($n = 53$, 20 %), Moderate Increasing ($n = 107$, 41 %), and High Stable ($n = 28$, 11 %) trajectories. Only the highest trajectory was above the subclinical/clinical level (T score ≥ 60) of Internalizing Problems throughout the study.

Concerning the four-trajectory model of children's Externalizing Problems, the two lowest trajectories remained at a low or moderate level throughout the study (Low Stable $n = 53$, 20 % and Moderate Decreasing $n = 151$, 58 %), while the High Decreasing trajectory ($n = 45$, 17 %) and the Moderate to High trajectory ($n = 12$, 5 %) exceeded the normal/subclinical level at least at some point during the longitudinal study.

Frequencies as well as means (M) and standard deviations (SD) are presented as descriptive statistics. The associations between continuous variables were explored with Pearson's correlation coefficient, and those between one categorized and one continuous variable with t -tests or one-way analyses of variance (one-way ANOVAs) accompanied by Bonferroni-corrected post hoc comparisons.

The simultaneous effect of the maternal depressive symptom trajectory group and the child problem trajectory groups on maternal outcome were investigated by six two-way ANOVAs, one per each outcome variable and per child problem trajectory. Both the main and interaction effects were included in the models.

Despite the number of cases delimited to that of mothers who participated at T8, imputation was not used. Extrapolation-based imputation was not possible as T8 is the first time when the mothers completed the ASR questionnaire which was used as the outcome measure. Imputing the missing data with sample means, on the other hand, would have biased the results towards the mean values. That would not have been appropriate as outcome values in the problem-indicating end of the range were the most interesting ones.

P -values below 0.05 were considered statistically significant. The trajectory models were fitted using the Flexmix package, stepFlexmix option in the statistical program R, version 3.4.1. The rest of the statistical analyses were conducted with SPSS, versions 23 and 25.

3. Ethical considerations

This study was performed in line with the principles of the Declaration of Helsinki. Approval for the first four data collection points (T1–T4) of the longitudinal study was granted by the Ethics Committee of the City of Tampere. Study stages T5–T7 were approved by the Ethics Committee of Pirkanmaa Hospital District, and the latest study stage (T8) was approved by the Regional Ethics Committee of the Expert

Responsibility Area of Tampere University Hospital (ref number R15115). Informed consent was obtained from the participating mothers at study stages T1–T8 and from the firstborn children at stages T7 and T8.

4. Results

4.1. Maternal depressive symptom trajectories (Aim 1)

According to the BIC values of the trajectory analyses, the best model would have been the four-group model based on the second-degree polynomial of time. The number of cases in one of the groups was, however, very small ($n = 8/332$, for Aim 2 $n = 3/168$), as in all four- and five-group models. Therefore, the three-group trajectory model of maternal depressive symptoms, based on the second-degree polynomial and having only a slightly larger BIC, was selected. The development of EPDS medians in these trajectory groups is presented in Fig. 2. In this model, the largest group of mothers (42 %) was assigned to the Low Stable trajectory group. The trajectory shows the highest median score (6) during pregnancy, a decline postnatally, and a small increase when the child was 5 years of age. After that, the trajectory shows stability and a small decline, with the median descending from 5 to 3. The Very Low trajectory (19 % of mothers) shows a very stable pattern, the median sum score staying below 2 and even being near zero at six months after delivery. The High Stable trajectory (39 % of the mothers) shows a stable median score level of 8–9.

= Fig. 2 =.

4.2. Maternal outcome at T8

The sociodemographic characteristics of the whole sample of respondent mothers and in MDS trajectory groups at T8 are presented in Table 1.

= Table 1 =.

At T8, the mean T score for maternal Mean Adaptive Functioning was 47.4 (SD 8.2), that for Internalizing Problems 47.7 (SD 11.2), and for Externalizing Problems 46.6 (SD 9.6). These maternal outcome variables were not statistically significantly associated with any of the maternal and child background variables presented in Table 1. The correlation coefficients between maternal age and the outcome variables were very small ($r = -0.09$ for Mean Adaptive Functioning, $r = 0.07$ for Internalizing Problems, and $r = -0.16$ for Externalizing Problems).

4.3. Maternal depressive symptom trajectory and child problem trajectories as predictors of maternal outcome (Aim 2)

The MDS trajectory grouping was statistically significantly associated with each of the three maternal outcome variables at T8. The Mean Adaptive Functioning was lowest in the highest MDS trajectory groups, while Internalizing and Externalizing Problems were highest in these groups (Fig. 3a).

In addition, both the Internalizing and Externalizing Problem trajectories of the children (Figs. 3b–c) were statistically significantly associated with the Internalizing and Externalizing Problems of the mothers at T8, higher child problem trajectories being associated with the highest maternal problem scores. Children's trajectory group memberships, however, were not statistically significantly associated with maternal Mean Adaptive Functioning scores at T8.

= Fig. 3 =.

In two-way ANOVAs with maternal Mean Adaptive Functioning as the outcome variable (Figs. 4a–b), the MDS trajectory had a statistically significant main effect whether combined with the child Internalizing or Externalizing Problem trajectory as the other explanatory variable. Child problem trajectories showed no significant main effects in either of the models.

Regarding maternal Internalizing Problems as the outcome variable

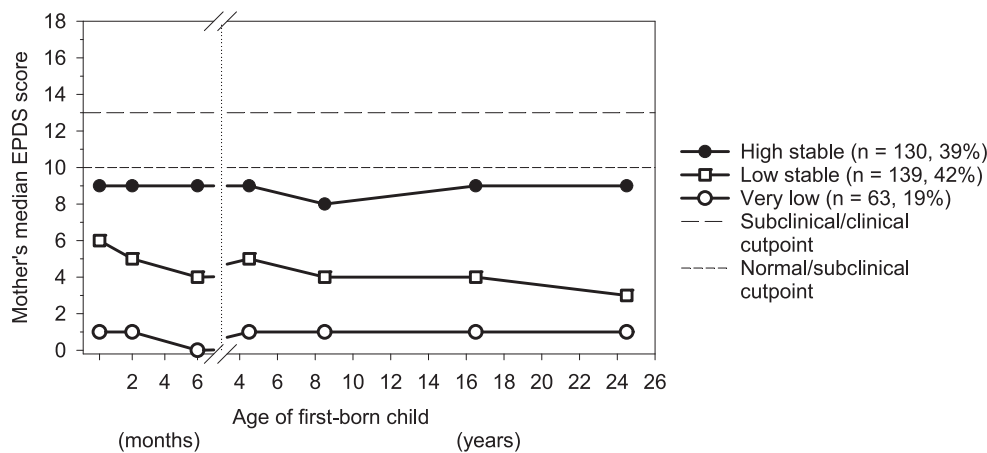


Fig. 2. Trajectories of maternal depressive symptoms (MDS). MDS at the various time points were screened with the Edinburgh Postnatal Depression Scale (EPDS).

(Figs. 4c-d), both the MDS trajectory and both child problem trajectories showed statistically significant main effects.

Considering *maternal Externalizing Problems as the outcome variable* (Figs. 4e-f), the MDS trajectory did not show a statistically significant main effect in either ANOVA, but both child problem trajectories showed statistically significant main effects.

= Fig. 4 =.

In all models, there was insufficient evidence to reject the null hypothesis concerning the significance of interaction effects.

5. Discussion

In this study, our first aim was to present a model of maternal depressive symptom trajectories from pregnancy to 27 years after the first delivery. The starting point of the depressive symptom trajectories was anchored to the first pregnancy. Thus, there was variation in the age of the women, and the model shows the development of the symptoms in relation to the duration of motherhood. Becoming a mother is a unique biopsychosocial transition phase in a woman's life and involves significant changes both in physiological and psychological dimensions with long-reaching effects on many aspects of health as well as cognitive and adaptive functioning (Duarte-Guterman et al., 2019; Orchard et al., 2023). The findings indicated that the pattern of MDS was rather stable for each of the three trajectories of the selected model. Studies concerning the developmental pattern of depressive symptoms over time in the general population have most often presented three or four trajectories, the majority showing low levels of symptoms, with only a minority – usually below 10 % – having a persistently high level of symptoms (Musliner et al., 2016). In this study, over a third of the mothers were assigned to the highest trajectory that presented a stable subthreshold pattern of depressive symptoms over time. The female gender carries a greater risk for depressive symptoms (e.g., Steel et al., 2014) and the participants in this study comprised a special group of women – first-time mothers. Only one of the earlier studies investigating maternal depressive symptom trajectories (Najman et al., 2016) extended over a period of 27 years. It reported on a model with three trajectory groups: low/no depression (48.4 %), mid-depression (41.7 %), and high/escalation trajectory (9.9 %) groups. Differences in the sizes of the trajectory groups might be due to different self-report instruments and diagnostic methods. It should be noted that belonging to the highest trajectory group is not the same as a clinical diagnosis of depression. It has been reported that most subjects suffering from subthreshold depressive symptoms never develop MDD (Jeuring et al., 2016). For example, in a register-based study conducted in Finland, prenatal major depression according to the International Classification of Diseases (ICD) 10 (WHO, 1993) was diagnosed in specialized health care only in 0.8 % of pregnant mothers (Räsänen et al., 2014). High

levels of MDS, assessed with self-report questionnaires, have been shown to occur in much higher percentages of mothers pre- and postpartum (e.g., Affonso et al., 2000; Luoma et al., 2001; Yin et al., 2021). In recent years, it has been reported that the prevalence of prenatal depression has even increased (Yin et al., 2021; Mateus et al., 2022). It should be noted that high scores in the EPDS do not provide a diagnosis or differential diagnosis and may be due to disorders other than depression, such as anxiety or PTSD, or other distress (Cox, 2019; Matthey et al., 2013).

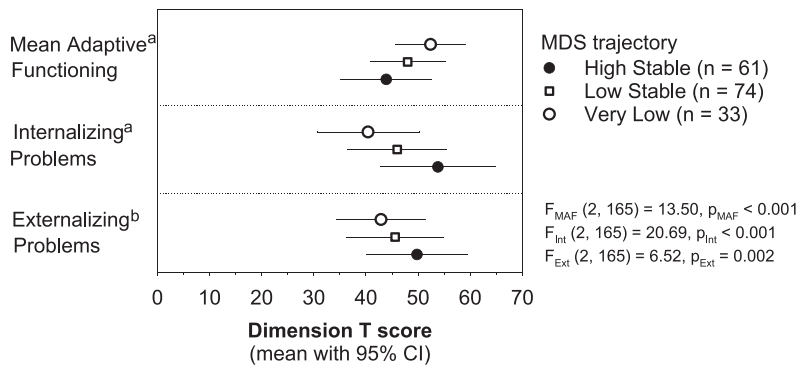
The findings regarding the first aim showed that the moderately large percentage of the mothers who showed high subthreshold symptoms during pregnancy continued to score high during the follow-up. Prenatal stage is particularly sensitive time for changes in women's lives. Besides depression itself, known risk factors for continuously or intermittently high depressive symptom trajectories include other mental and physical health problems, poor health habits, loneliness, inadequate social support, and partner problems (e.g., Luoma et al., 2015; Musliner et al., 2016; Mughal et al., 2023). Preventive interventions aimed at these risk factors and at the cumulation of risks can have far-reaching beneficial effects both on mothers' and their children's well-being.

Our hypotheses concerning the second aim were that elevated MDS trajectories would predict the lower adaptive functioning and higher problem scores of the mothers. The results of this study are consistent with the study of Najman et al. (2016), which showed that belonging to the highest MDS trajectory group was associated with the greatest maternal impairment. Our findings highlight that even subthreshold depressive symptom levels were associated with poorer adjustment, as measured with both positive and negative mental health dimensions. The mothers with elevated depressive symptom patterns reported lower adaptive functioning and higher symptom levels, not only of internalizing but, interestingly, also of externalizing quality. Respondents with a high score in a depressive symptom screen may also include individuals with affective symptoms such as irritability, distractibility, psychomotor agitation, or aggression (Natale et al., 2022).

The findings regarding the second aim emphasize that subthreshold depressive symptoms should not be overlooked. They can affect many dimensions of maternal well-being. A large percentage of mothers reported mild depressive symptoms both in our study and in recent other studies. This challenges women's health care both perinatally and at subsequent stages. Research, however, has increasingly provided data on how depressive symptoms can be alleviated through a wide range of interventions (e.g., Noetel et al., 2024).

It was also expected that mothers who had perceived elevated problem patterns in their children would report higher levels of problems in themselves. This hypothesis was supported. As in the study of Kingsbury et al. (2017), the mothers and their children showed mutual

Maternal adjustment dimension

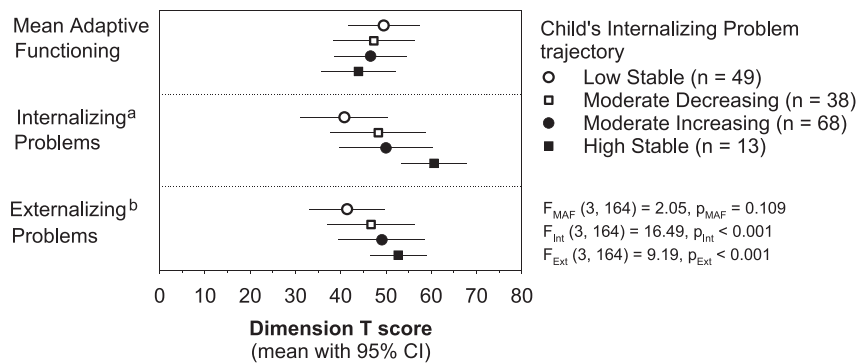


Post hoc comparisons with Bonferroni correction: statistically significant ($p < 0.05$) differences between:

^a all pairs

^b Very Low and High Stable, and Low Stable and High Stable.

Maternal adjustment dimension

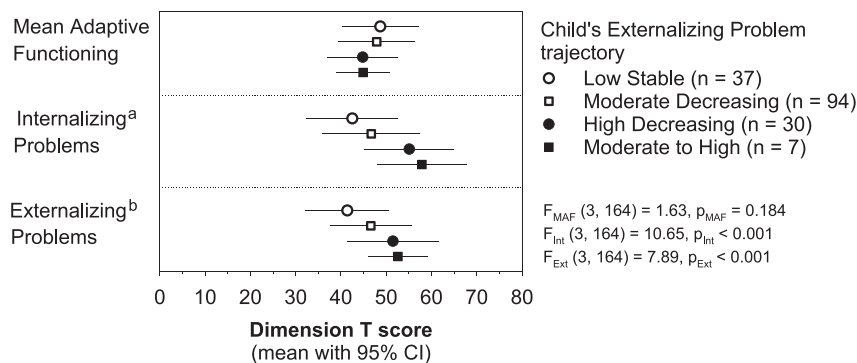


Post hoc comparisons with Bonferroni correction: statistically significant ($p < 0.05$) differences between

^a Low Stable and all other trajectory groups, Moderate Decreasing and High Stable, and Moderate Increasing and High Stable

^b Low Stable and all other trajectory groups.

Maternal adjustment dimension



Post hoc comparisons with Bonferroni correction: statistically significant ($p < 0.05$) differences between

^a Both Low Stable and Moderate Decreasing, and both High Decreasing and Moderate to High

^b Low Stable and all other trajectory groups.

Fig. 3. Maternal outcome (Mean Adaptive Functioning and Internalizing and Externalizing Problem scores) by maternal depressive symptoms (MDS) trajectory and child Internalizing and Externalizing Problem trajectories.

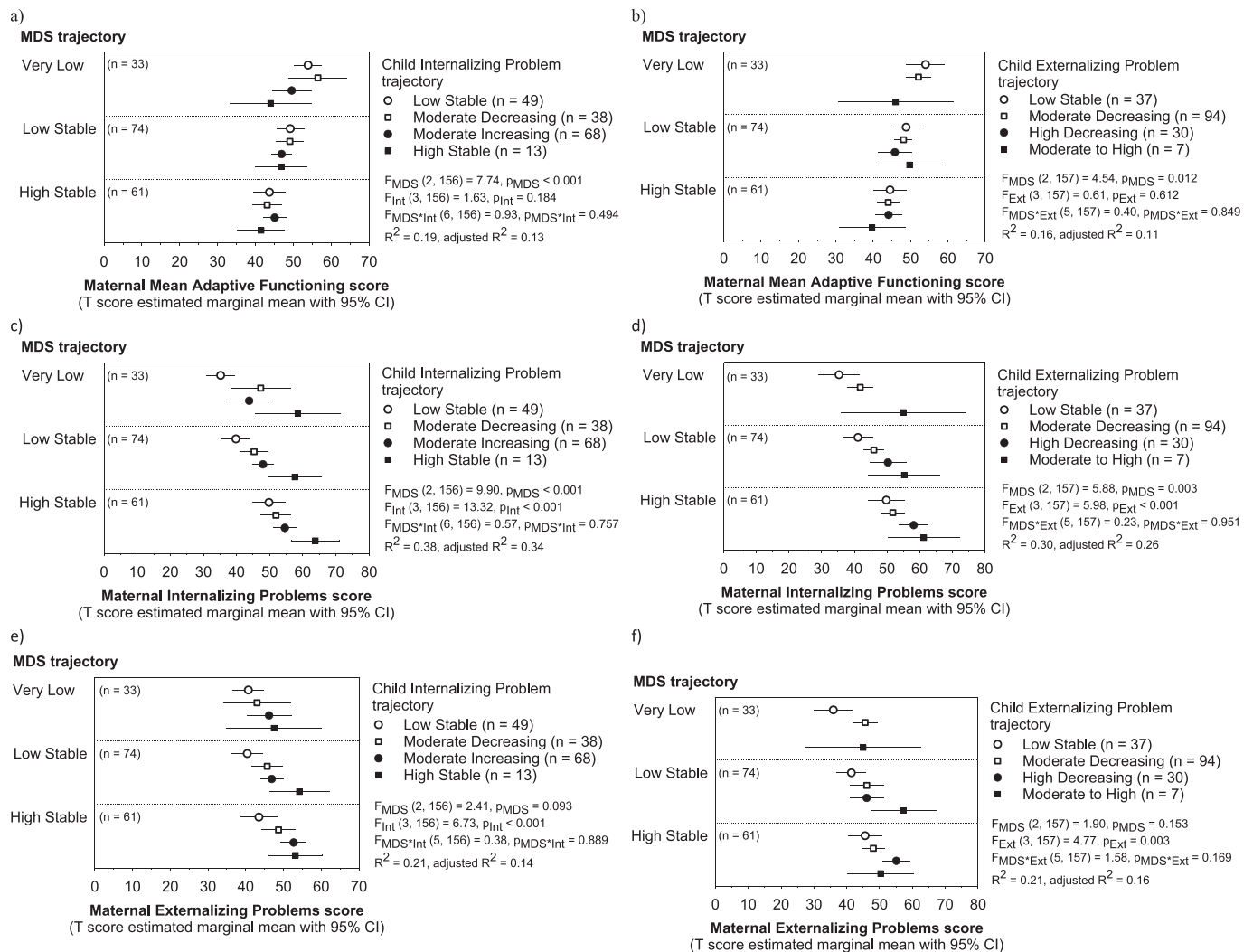


Fig. 4. Maternal Mean Adaptive Functioning, Internalizing Problems and Externalizing Problems scores in the Adult Self Report (ASR) by maternal depressive symptom (MDS) trajectory and the child’s Internalizing and Externalizing Problem trajectory. MDS at the various time points were screened with the Edinburgh Postnatal Depression Scale (EPDS) and child problems with the Child Behavior Checklist (CBCL). Results of two-way ANOVAs.

mental health vulnerability. On the other hand, mothers who reported higher child problem trajectories did not have significantly lower adaptive functioning compared with mothers who reported lower problem trajectories in their children. This indicates that the positive and negative measures of mental health may not be only the opposite ends of one dimension of well-being but also separate constructs. This might also reflect the possibility that besides a linear dose-response relationship, some relationships between stress and its impact on well-being might work in a curvilinear manner, moderate stress exposures leading to more optimal outcomes than low levels of exposure (Liu, 2015). In their study of reciprocal influences between mothers’ and children’s symptoms, Kouros and Garber (2010) unexpectedly found that among mothers with high initial levels of depression, children’s depressive symptoms preceded declines in mothers’ depressive symptoms. They discussed that the children’s dysphoria might have led to a situation where the mothers had to downregulate their own distress in order to be able to help their children, i.e., the child’s need for regulation might help the mother to find extra resources or address the sources of her child’s problems, which may originate from the same sources as the mother’s own distress. Orchard et al. (2023) have also discussed the enduring impact of caregiving on maternal neural and cognitive changes throughout the developing motherhood. They have suggested a framework for understanding how increased environmental complexity

confers an initial cognitive challenge to new mothers. This increased cognitive load requires the mother’s continuous adaptation throughout the developmental stages of the child and results in increased maternal cognitive reserve later in life. It could be assumed that the special needs of a child bring along an increased challenge to the mother’s adaptability, and may enhance resilience (Rutter, 2012) if the mother’s adaptive capacity is not exceeded. This provides interesting questions for future research.

6. Strengths and limitations

The strengths of the present study include the long follow-up time and the use of internationally well-validated questionnaires. For maternal outcome, we included not only mental health symptoms but also a positive dimension of psychosocial adjustment. In the attrition analysis, there were no statistically significant differences between the participant and drop-out groups in the key measures.

Some limitations should be noted. Concerning maternal outcome, the cumulative attrition at different stages of the study limited the sample size, even though the response rates were acceptable at the individual data collection times. Cumulative attrition cannot be avoided in a study with an extensive follow-up time. It is possible that the attrition affected the results, although no statistically significant differences were

observed for the variables considered.

Mothers of sons were underrepresented in the sample. This should not, however, cause bias in the main results because the gender of the child was not associated with maternal outcome. Even though the sample was of moderate size, it was relatively small particularly regarding the two-way ANOVAs. Subjective reports are important cornerstones generally in the assessment of individuals' health and well-being, and maternal reports of their children's well-being. It should be noted as a limitation, however, that the same mothers reported their children's problems, their own depressive symptoms, and their outcome. Reporter bias could explain some of the associations because depressed mothers' reports can be negatively biased (Madsen et al., 2020). The results should therefore be considered as tentative and be confirmed in larger samples.

7. Conclusions

Over a third of the mothers belonged to the elevated subthreshold depressive symptom trajectory over the period of 27 years from the first pregnancy. The assignment in the lowest depressive symptom trajectory was associated with the most optimal and the highest depressive symptom trajectory with the least optimal maternal outcomes regarding both adaptive functioning and symptom dimensions. Elevated child problem patterns were also associated with maternal outcomes concerning internalizing and externalizing problems. These associations showed a dose-response-like relationship. The results emphasize the interconnectedness of the mother's and child's well-being. As stated by Costello (2016), early detection and intervention in either maternal or child distress can prevent the development of more complicated problems in both children and their mothers. However, maternal adaptive functioning was not significantly affected by the child's elevated problem levels, and this finding underlines the adaptive capacity of the mothers and the multi-faceted relations between stress and resilience in motherhood.

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Author statement

Ilona Luoma, Marie Korhonen, Raili Salmelin, and Arja Siirtola contributed to the study conception and design and performed the material preparation and data collection. Statistical analyses were performed by Ilona Luoma and Raili Salmelin. Illustrations were provided by Raili Salmelin. The first draft of the manuscript was written by Ilona Luoma and Minna Valkonen-Korhonen. All authors critically commented on previous versions of the manuscript. All authors read and approved the final manuscript.

CRediT authorship contribution statement

Ilona Luoma: Conceptualization, Formal analysis, Funding acquisition, Investigation, Data curation, Project administration, Writing – original draft, Writing – review & editing. **Marie Korhonen:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Raili K. Salmelin:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Arja Siirtola:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Mirjami Mäntymaa:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Minna Valkonen-Korhonen:** Investigation, Writing – original draft, Writing – review & editing. **Kaija Puura:** Supervision, Writing – original draft,

Writing – review & editing.

Declaration of competing interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

Availability of data and material

The datasets of this study will not be made publicly available because approvals given by the ethics committees do not allow sharing of the datasets. Questions concerning the datasets can be addressed to the corresponding author.

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Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval for the first four stages (T1–T4) of the longitudinal study was granted by the Ethics Committee of the City of Tampere. Study stages T5–T7 were approved by the Ethics Committee of Pirkanmaa Hospital District, and the latest study stage (T8) was approved by the Regional Ethics Committee of the Expert Responsibility Area of Tampere University Hospital (ref number R15115).

Consent to participate

Informed consent was obtained from the participating mothers at study stages T1–T8 and additionally from the firstborn children at stages T7 and T8.

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