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Regular Article

Disentangling the trajectories of maternal depressive symptoms and partnership problems in the transition to parenthood and their impact on child adjustment difficulties

J. K. Ray[1], L. L. Stürmlinger[1,2], M. von Krause[3], U. Lux[4,5] and A.-L. Zietlow[1]

[1]Faculty of Psychology, Institute of Clinical Psychology and Psychotherapy, Technische Universität Dresden, Dresden, Germany, [2]Department of Psychology, School of Social Sciences, University of Mannheim, Mannheim, Germany, [3]Faculty of Behavioral and Cultural Studies, Institute of Psychology, University of Heidelberg, Heidelberg, Germany, [4]Department Family and Family Policies, German Youth Institute (DJI), Munich, Germany and [5]Department of Psychology and Pedagogy, Ludwig-Maximilians-Universität (LMU), Munich, Germany

Abstract

Maternal perinatal depression (PND) and partnership problems have been identified to influence the development of later child adjustment difficulties. However, PND and partnership problems are closely linked which makes it difficult to draw conclusions about the exact transmission pathways. The aim of the present study was to investigate to what extent PND symptoms and partnership problems influence each other longitudinally and to examine the influence of their trajectories on child adjustment difficulties at the age of three. Analyses were based on publicly available data from the German family panel "pairfam". $N = 354$ mothers were surveyed on depressive symptoms and partnership problems annually from pregnancy (T0) until child age three (T4). Child adjustment difficulties were assessed at age three. Results of latent change score modeling showed that partnership problems predicted change in PND symptoms at T0 and T3 while PND symptoms did not predict change in partnership problems. Child adjustment difficulties at age three were predicted by PND symptoms, but not by partnership problems. Partnership problems predicted externalizing, but not internalizing symptoms. Results underline the effects of family factors for the development of child adjustment difficulties and emphasize the importance of early interventions from pregnancy onwards

Keywords: Perinatal depression; partnership quality; child development; family mental health; prenatal risk

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Perinatal depression (PND) is a worldwide phenomenon with substantial transgenerational impact on family mental health. With prevalence rates between 17% and 20% (Cuijpers & Karyotaki, 2021; Dadi et al., 2020; Wang et al., 2021), a large number of studies have shown consistent small to medium effects of PND on the psychosocial functions and quality of life of affected women (Slomian et al. 2019). Research emphasizes that even subclinical PND symptoms have an impact on affected mothers and their infants (Goodman et al., 2020; Goodman & Tully, 2009). In sum, these findings suggest that PND is a worldwide cross-cultural phenomenon of utmost relevance independent of diagnostic status.

PND does not only put a strain on affected mothers but can spill over to the next generation and hence put healthy development of their children at risk. For instance, mothers with PND more frequently report lower postpartum bonding (Eitenmüller et al., 2022; Figueiredo et al., 2009; Reck et al., 2016), higher parenting stress (Reck et al., 2016) and interact less sensitively during mother–infant interaction (Bernard et al., 2018; Licata et al., 2016). The impact on the mother–child relationship exists equally for depression and high levels of subclinical depressive symptoms (Behrendt et al., 2016). Several systematic reviews and meta-analyses consistently describe negative effects of PND on broad domains of child development, such as cognitive, socio-emotional or behavioral development (Rogers et al., 2020; Slomian et al., 2019; Stein et al., 2014). Of particular importance are the effects of PND on child adjustment difficulties: Early childhood internalizing and externalizing symptoms can, on the one hand, be part of early childhood emotional and behavioral disorders, and on the other hand, serve as precursors to mental illness across the life span (Arslan et al., 2021). Internalizing and externalizing symptoms can be observed in children as young as 2–5 years old (Egger & Angold, 2006). At this age, children face important developmental tasks and challenges, for example, the entry into day care. To cope with increasing socio-emotional demands, children at this age typically develop more pronounced emotion regulation skills and interpersonal skills. However, infants and toddlers of mothers with PND show more internalizing symptoms, such as emotional difficulties (Reck et al., 2016), and more externalizing symptoms, such as hyperactivity or physical aggression (Kingston et al., 2018).

Corresponding author: J. K. Ray; Email: jana.ray@mailbox.tu-dresden.de

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PND affects not only children in infancy and toddlerhood, but continues to unfold its impact even beyond early childhood: Meta-analyses revealed that children of perinatally depressed mothers show impacted mental health in all developmental stages up until adolescence (Rogers et al., 2020; Stein et al., 2014).

Finally, not only the mere presence and severity but also timing and persistence of PND seem to play a crucial role. The effect of PND on child adjustment difficulties unfolds independently of whether PND symptoms occur prenatally or postnatally (Rogers et al., 2020). In addition, Kingston et al. (2018) found that particularly the *trajectory* of PND beyond the immediate postnatal period is crucial for the development of child adjustment difficulties: Children of perinatally depressed mothers with persisting symptoms from pregnancy to 1 year postnatal showed higher levels of internalizing and externalizing symptoms (Kingston et al., 2018). Hence, when studying the intergenerational effect of PND on child adjustment, it is crucial to examine longitudinal trajectories of PND.

PND does not only concern mothers and children but acts in and is influenced by the whole family system. The transition to parenthood itself is a challenging time for families associated with increasing partnership problems (Doss & Rhoades, 2017) such as lower relationship satisfaction (Mitnick et al., 2009) often persisting over several years after birth (Doss et al., 2009). There is growing evidence that partnership problems affect PND symptoms (review by Pilkington, Milne, Cairns, Lewis, & Whelan, 2015). Perinatal partnership problems, for example, high partnership stress (Banker & LaCoursiere, 2014) and low partnership quality (Faisal-Cury et al., 2020) predict PND beyond the influence of previous depressive symptoms. Even *pre*natally partnership problems seem to promote PND (Florsheim & Burrow-Sanchez, 2021). In turn, other studies report an inverse association, for example, PND was identified as a risk factor for steeper declines of partnership quality during the transition to parenthood (Trillingsgaard et al., 2014). In sum, research results speak in favor of a reciprocal association, which is supported by longitudinal results suggesting that partnership quality and depression in mothers reciprocally affect each other up to adolescence (Gustavson et al., 2012). However, evidence on such reciprocal effects between depression and partnership in the transition to parenthood is scarce. To our knowledge, there are no studies that examine the trajectories and reciprocal influences between PND and partnership quality in a longitudinal design during the developmentally important time period from pregnancy to early childhood.

Just as PND symptoms influence child adjustment difficulties, so does parental partnership quality: Especially parental partnership problems, for example, in the form of conflicts, affect child psychopathology (Harold & Sellers, 2018). More precisely what seems to affect children the most is not *whether* parents have conflicts, but *how* they behave during conflicts (reviewed in Zemp et al., 2016). While destructive or unresolved interparental conflicts leads to higher internalizing and externalizing behaviors in children (Jouriles et al., 2016), they seem to profit from higher constructiveness in interparental conflicts (Zemp et al., 2020). Thus, negative effects of interparental conflict on child well-being may be balanced by high positivity and constructive conflict behavior (Zemp et al., 2014, 2019; van Eldik et al., 2020). However, not only conflict, but also other aspects of the parents' partnership are likely to affect child development. This can be seen in findings showing that high partnership quality, for example, couple supportiveness and closeness or high coparenting quality are linked to less negative parenting, a better parent–child relationship quality as well as fewer externalizing (Holland & McElwain, 2013; Parkes et al., 2019) and internalizing behaviors in the offspring (Hughes et al., 2020).

The effect of partnership problems on child development has been mostly studied in samples of older children. As elaborated above the transition to parenthood represents an important time window in which the effect of maternal depression on child symptoms has its beginnings. Even though there are some findings showing an effect of perinatal partnership problems (e.g., Holland & McElwain, 2013; Hughes et al., 2020) on child adjustment difficulties, studies examining the effect of *prenatal* partnership problems (Ramsdell & Brock, 2021) are rare. The question that arises is whether there are timing effects regarding the impact of partnership problems on children. In other words, if the effect differs depending on whether partnership problems occur in pregnancy, in the postpartum period or even later during infancy and toddlerhood. To add further complexity, the strong association between perinatal partnership problems and PND makes it more challenging to answer this question. Therefore it is necessary to differentiate between the impact of PND symptoms on the one hand and partnership problems on the other hand on child adjustment.

To sum up, the interplay of PND symptoms and partnership problems in the transition to parenthood, and their respective consequences for child adjustment, are not yet fully understood. Because PND and partnership problems each seem to show high persistence over the transition to parenthood and additionally seem closely interrelated, this study intends to disentangle how both influence each other over the transition to parenthood. Second, this study aims at disentangling the respective influences of timing of PND symptoms and partnership problems on child adjustment difficulties. Hence, the trajectories and cross-lagged associations between PND and partnership problems shall be examined longitudinally using a statistical model which focuses on differential change over time and is able account for the complexity of the underlying processes. For all analyses, we chose a Bayesian estimation approach because it brings many methodological advantages, the most important ones in our case being that it allows for principled uncertainty quantification (Wagenmakers et al., 2018) and often helps in avoiding convergence issues in complex longitudinal models (Kievit et al., 2018).

The first research question we examined was: (1) To which extent is change in depressive symptoms between two measurement points predicted by partnership problems (beyond previous depressive symptoms)? To which extent is change in partnership problems predicted by depressive symptoms (beyond previous partnership problems)? It was hypothesized that change in depressive symptoms and change in partnership problems are positively predicted by the other factor. Research question (2) was: At which time points between pregnancy and early childhood do (change of) partnership problems and maternal depressive symptoms predict child adjustment difficulties at the age of three? It was hypothesized that (change of) partnership problems and maternal depressive symptoms predict child adjustment difficulties. The study was preregistered at https://aspredicted.org/TC8_5GW.

Methods

Study design

In this study, data from the German nationwide family panel (pairfam), release 11.0 (Brüderl et al., 2020) was analyzed. The

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pairfam study started the first wave of measurements of a representative German sample in 2008. Annually participants are interviewed and provide self-report via questionnaires, allowing the analysis of longitudinal family processes. A more detailed description of the study can be found in Huinink et al., 2011). In this study, we analyzed a subsample of all participants who reported a pregnancy in waves 2 to 7 and provided data for 4 more waves after pregnancy in order to examine the time period of the transition to parenthood longitudinally. This way, we were able to analyze a 5-year longitudinal sample starting in pregnancy (T0: pregnancy; T1: first-year postpartum; T2: second-year postpartum; T3: third-year postpartum) to the fourth year after birth when the child was 3 years old (T4) including data from waves 2–11 (years 2008–2019). Wave 1 was excluded due to inconsistent operationalization of core variables for our analyses (i.e., depressive symptoms). Maternal depressive symptoms and partnership quality were assessed every wave, enabling consideration of the trajectories of individuals' depressive symptoms and partnership problems during the transition to parenthood and the first years postpartum. Child adjustment difficulties were assessed at the age of 3 years (T4). To control for child factors prior to age three early infant temperament was considered in the first-year postpartum (T1) as a control variable. The study design is visualized in Figure 1.

Sample

Our sample includes all participants from the pairfam panel who reported being pregnant in wave 2 to 7 and participated for the next four consecutive waves until child age 3 (see Figure 1). All pregnant participants were merged into one data set so that T0–T4 refer to the respective waves of pregnancy to 4 years postpartum for all participants (displayed in Figure 1).

Excluded were cases with prematurely born babies (before 36 weeks gestational age) and twin births. In cases where women had complete data for more than one pregnancy in the waves of interest, only the first pregnancy available was used for this study. Participants were only included in the study when the child had lived with the mother at all measurement points.

Furthermore, participants who dropped out of the panel within our waves of interest ($n = 165$) were excluded. It was chosen to exclude dropouts to ensure that the same families were considered longitudinally, both for H1 and H2. By this procedure it was guaranteed that only those families were considered for modeling the longitudinal trajectories of PND symptoms and partnership problems (H1) from whom values for child adjustment at age three were available (H2). There were no differences regarding PND symptom and partnership scores at T0 in dropouts versus participants (Appendix A5). Because the pairfam scales, as usual for panel scales, consist of only few items each, participants with more than 10 percent missing data on one of the used scales within each wave were excluded to ensure a more reliable assessment of these scales.

The final sample consisted of $N = 354$ pregnant women with a mean age of $M = 30.78$ ($SD = 5.11$) years at T1. 87.2 % of the mothers were born in Germany. 86.4 % reported to have the same partner over all waves (detailed analysis in Appendix A4). Only 11.3 % of the participants did not live together with their partner, 66.7 % were married. 44.3 % of participants had tertiary education degrees according to the International Standard Classification of Education (ISCED). 51.1 % of the children in our sample were female and for 39.2 % of the participants, it was their first child. In this sample 4.8% ($N = 17$) of mothers reached cutoffs for clinically relevant depressive symptoms.

Measures

Perinatal depressive symptoms

Symptoms of perinatal depression (PND) were measured with the trait scale of the "State-Trait-Depression Scales" (STDS Form Y-2; Spaderna et al., 2002). The STDS was validated against other established depression questionnaires and is able to capture depressive mood symptoms even in subclinical populations (Spaderna et al., 2002). It consists of 10 items (e.g., "I am sad"). Answer options range from 1 = *Almost never* to 4 = *Almost always*. The total mean score with a possible range from 1 to 4 can be calculated, higher scores implying higher levels of depressive symptoms. A value of 2.5 or higher in the total score indicates the presence of clinically relevant depressive symptoms (Lehr et al., 2008). Spaderna et al. (2002) reported a very good internal consistency for the trait scale ($\alpha = .91$). In the current study, Cronbach's α ranged between .84 and .90 for T0–T4.

Partnership problems

To operationalize partnership problems, a rather broad definition was chosen in order to capture the construct in its broadness. Hence, different scales from the pairfam panel capturing parental conflict behavior as well as general relationship quality were combined to a single mean score. First, to address parental conflict, four items with respect to the partner's verbal aggression (e.g., "How often did your partner insult or verbally abuse you?") and constructive behavior (e.g., "How often did your partner listen to and ask questions of you in order to understand better?") during conflict adapted from the "Questionnaire for the measurement of communication quality" (KOMQUAL; Bodenmann, 2000) were included in the score. *Withdrawal* during conflict was assesses by two items based on the "Conflict Resolution Inventory" (Kurdek, 1994; e.g., "How often did your partner refuse to talk about the subject?"). These same six items were additionally asked about participants' own verbal aggression, constructive behavior and withdrawal. Second, to capture components of the parental partnership which go beyond conflict behavior, the score was extended by the pairfam scale "Network of Relationships Inventory" (NRI; Buhrmester & Furman, 2009). This scale contained the four subscales *intimacy* (e.g., "How often do you share your secrets and private feelings with [name of current partner]?"), *admiration* (e.g., "How often does [name of current partner] show that he/she appreciates you?"), *dominance* (e.g., "How often does [name of current partner] make you do things his/her way?") and *conflict* (e.g., "How often are you and [name of current partner] annoyed or angry with each other?"), each measured by two items. Answers were given on a scale from 1 = *Never* to 5 = *Always*. In total, 20 items were used to operationalize parental partnership problems, with higher values indicating more partnership conflicts. For this newly created scale, Cronbach's alpha indicated a good internal consistency at all time points ($\alpha = .81–.83$).

Child adjustment difficulties

Adjustment difficulties were rated by mothers on a 6-item short version of the "Strengths and Difficulties Questionnaire" (SDQ; R. Goodman, 1997; German version by Woerner et al., 2002) from 1= *not true* to 3 = *certainly true* for children age 3 to 5 years. SDQ ratings at age 3 – as the earliest measurement of children's

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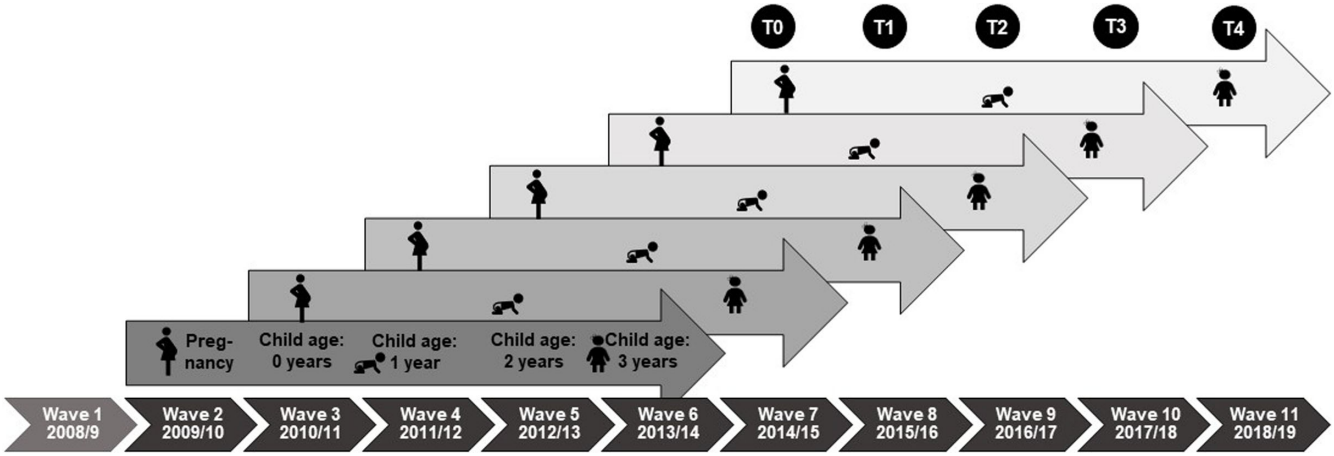

Figure 1. Study design and selection of sample.

adjustment difficulties in the pairfam panel - were chosen as outcome considering the importance of early internalizing and externalizing symptoms for life span mental health. Furthermore, 3 years is the typical age at which children in Germany start kindergarten and face new socio-emotional challenges. The SDQ short scale (Thönnissen, Wilhelm, Alt, Reim, & Walper, 2020) contains 2 items each from the three subscales: *conduct problems* (e.g., "My child often refuses to follow instructions from adults") and *hyperactivity* (e.g., "My child is always fidgety") which both represent externalizing symptoms, as well as *emotional symptoms* (e.g., "My child has many fears, is easily scared") which represent internalizing symptoms. A total mean score was calculated with higher values indicating more adjustment difficulties. The standard version of the SDQ (5 items per subscale) showed good internal consistency ($\alpha = .82$; Woerner et al., 2004). In this study, the short version of the SDQ with 2 items per subscale showed internal consistency of $\alpha = .62$.

Infant temperament

As a control variable for child factors prior to age three infant temperament rated by the mother at the first-year postnatal (T1) was used. The scale consists of 4 items from the Socioeconomic Panel (SOEP, 2007; Questionnaire "Mother and Child" for mothers of newborn children). Answers can be given on a scale from 1 = *Not at all* to 5 = *Absolutely*. Higher scores on this scale indicate a more positive temperament of the infant. In the current study, Cronbach's alpha of $\alpha = .69$ indicated moderate internal consistency of the scale.

Statistical analyses

For statistical analyses, we used the R environment (R Core Team, 2021) and the packages tidyverse (Wickham et al., 2019), haven (Wickham et al., 2022), psych (Revelle, 2022), bayesplot (Gabry et al., 2019), correlation (Makowski et al., 2020) and car (Fox & Weisberg, 2019). In complex developmental processes, such as the family dynamics studied here, changes in the target variables depend on their earlier manifestations and are simultaneously influenced by external variables. A suitable statistical model to represent such dynamic systems is the latent change score model (Cáncer et al., 2021). Hence, to test our hypotheses, we estimated a bivariate latent change score model, utilizing the Bayesian structural equation modeling framework provided in the R package blavaan (Merkle et al., 2021). Figure 2 shows a graphical representation of the studied model. Changes in PND symptoms and partnership quality between time points were modeled to depend on previous levels of both these variables, reflecting both autoregressive and across-construct dynamics. Child adjustment at age 3 was regressed on initial levels of PND symptoms and partnership quality, on all change scores, and on child temperament assessed at T1. For the bivariate latent change score model, we used the standard full information likelihood approach implemented in "blavaan", utilizing all available data from each person for parameter estimation, without any deletions or person-based imputations. We preregistered the postulated hypotheses and statistical methods prior to conducting any analyses on the data (https://aspredicted.org/TC8_5GW). It is important to note that in the preregistration it was planned to estimate a bivariate dual latent change model including, on the one hand, latent change scores from one measurement occasion to the next, and, additionally, for both partnership quality and PND, latent intercept and latent slope factors loading on each of the change scores. However, when running the model, there were severe convergence problems, as indicated by divergent transitions, overly high tree depths, low effective sample sizes, and high Rhat values (Merkle et al., 2021). In addition, the estimated latent slope factors did not exhibit any considerable variance and were difficult to interpret due to an unclear pattern in loadings on the change scores. We thus decided to cut the latent slope and intercept factors from the model and opted for a bivariate latent change model. For the final model we used three MCMC chains with 12,000 iterations each and discarded the first 2,000 samples as burnin. Model diagnostics indicated that the chains converged successfully – visual inspection of the chains showed no anomalies, and all parameters had Rhat values < 1.01 and effective sample sizes $>$ 15,000. We used DIC-based fit indices, as these best approximate the behavior of maximum likelihood-based fit indices in the case of a model with low number of degrees of freedom (see Garnier-Villarreal & Jorgensen, 2020).

Results

Descriptive statistics are displayed in Table 1 for PND symptoms and partnership problems at time points T0 to T4. Both measures tend to show higher values at later time points. We further analyzed the underlying dynamic through structural equation modeling. The full model code for our bivariate latent change scores structural equation model can be found in the

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Table 1. Descriptives of main study variables

Variable	*N*	Mean	*SD*	Minimum	Maximum
PND T0	354	1.64	0.41	1.00	3.50
PND T1	347	1.65	0.43	1.00	3.60
PND T2	349	1.74	0.47	1.00	3.80
PND T3	344	1.75	0.49	1.00	4.00
PND T4	352	1.79	0.46	1.00	3.50
PP T0	332	2.18	0.45	1.15	3.80
PP T1	331	2.26	0.47	1.10	3.75
PP T2	326	2.33	0.48	1.10	3.65
PP T3	328	2.31	0.48	1.20	3.80
PP T4	332	2.34	0.49	1.05	3.95
SDQ (T4)	354	1.51	0.35	1.00	2.67
Child Temp. (T1)	354	4.53	0.51	1.00	5.00

PND = perinatal depressive symptoms; PP = partnership problems; SDQ = Child Adjustment Difficulties; SD = standard deviation.

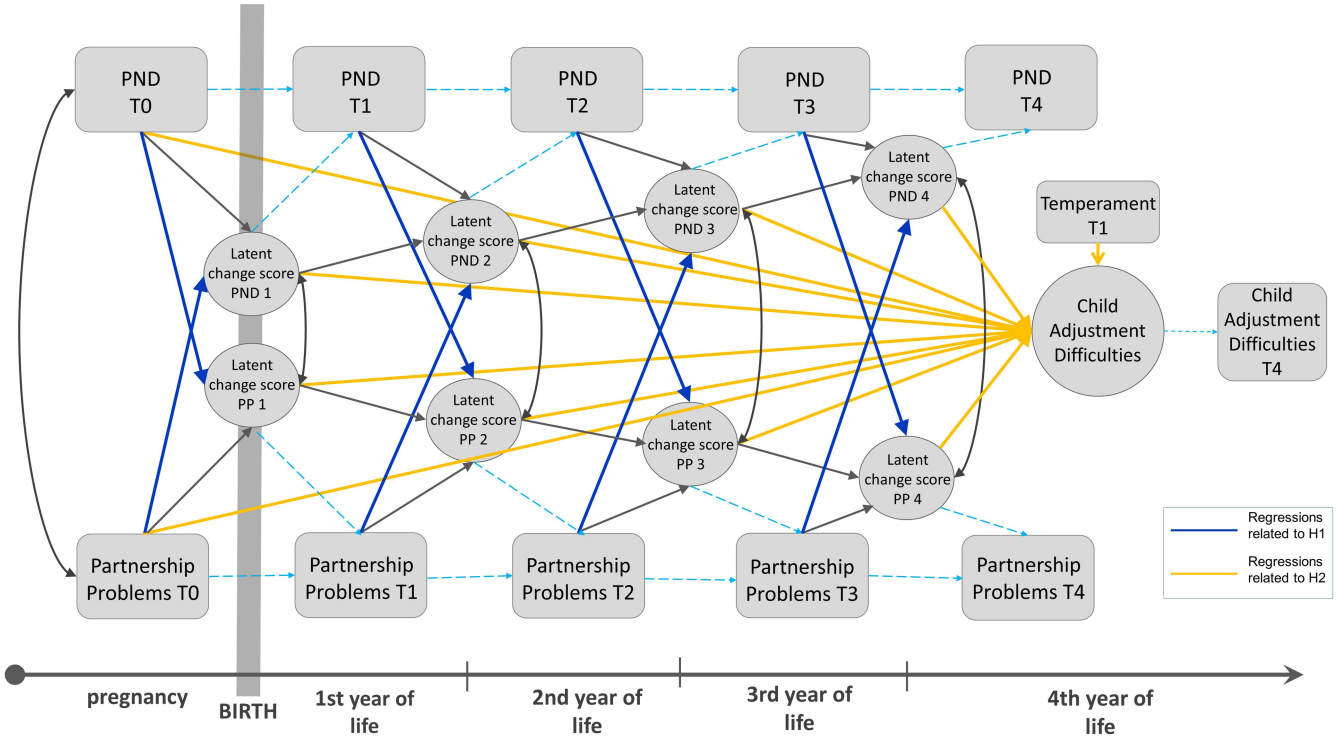

Figure 2. Theoretical bivariate latent change score model.

Open Science Framework (https://osf.io/9mhqc/?view_only=ee385bea4fa3478daafc37d0939206b3). The model results are depicted in Figure 3. Table 2 shows the (manifest, not latent) correlations of all study variables used.

We estimated a bivariate latent change score model including both partnership problems and PND symptoms, each across five time points (T0–T4). Change scores were regressed on the previous level of the respective measure (e.g., partnership problems), the previous level of the other measure (in the case of partnership problems that is PND symptoms), and, if applicable, also on the previous change score of the same measure (in the example this would again be partnership problems). Change scores as well as initial levels of partnership problems and PND symptoms were free to covary within each time point. We additionally predicted child adjustment difficulties at T4 (at age 3) from the initial levels of partnership problems and depressive symptoms, all change scores, and child temperament as assessed at T1 (during the first year of life).

The model showed good overall fit, with adequate posterior medians for the Bayesian RMSEA (0.064), Bayesian CFI (0.981), as well as the experimental MCMC-sample-based estimate of SRMR (0.069). Full results of all model parameter estimates as well as fit

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Table 2. Correlations of main study variables

Parameter	Ch. Temp	SDQ	PP T4	PP T3	PP T2	PP T1	PP T0	PND T4	PND T3	PND T2	PND T1
PND T0	−0.12 **	0.15 **	0.30 ***	0.33 ***	0.32 ***	0.38 ***	0.47 ***	0.50 ***	0.54 ***	0.50 ***	0.53 ***
PND T1	−0.14 **	0.17 ***	0.28 ***	0.30 ***	0.33 ***	0.55 ***	0.34 ***	0.59 ***	0.59 ***	0.60 ***	
PND T2	−0.10 *	0.24 ***	0.36 ***	0.38 ***	0.46 ***	0.41 ***	0.33 ***	0.71 ***	0.71 ***		
PND T3	−0.05	0.22 ***	0.41 ***	0.47 ***	0.41 ***	0.39 ***	0.39 ***	0.70 ***			
PND T4	−0.09	0.28 ***	0.48 ***	0.46 ***	0.40 ***	0.41 ***	0.36 ***				
PP T0	−0.05	0.10	0.60 ***	0.63 ***	0.61 ***	0.67 ***					
PP T1	−0.10	0.16 ***	0.63 ***	0.68 ***	0.67 ***						
PP T2	−0.09	0.16 ***	0.71 ***	0.73 ***							
PP T3	−0.04	0.18 ***	0.81 ***								
PP T4	−0.08	0.14 **									
SDQ	−0.13 **										

PND = perinatal depressive symptoms; PP = partnership problems; SDQ = child adjustment difficulties. Bayesian posterior means reported. Prior distribution Beta (1/(1/3), 1/(1/3)). Stars relate to Bayes factors larger 3 (*), 10 (**), 30 (***), compared to a null model.

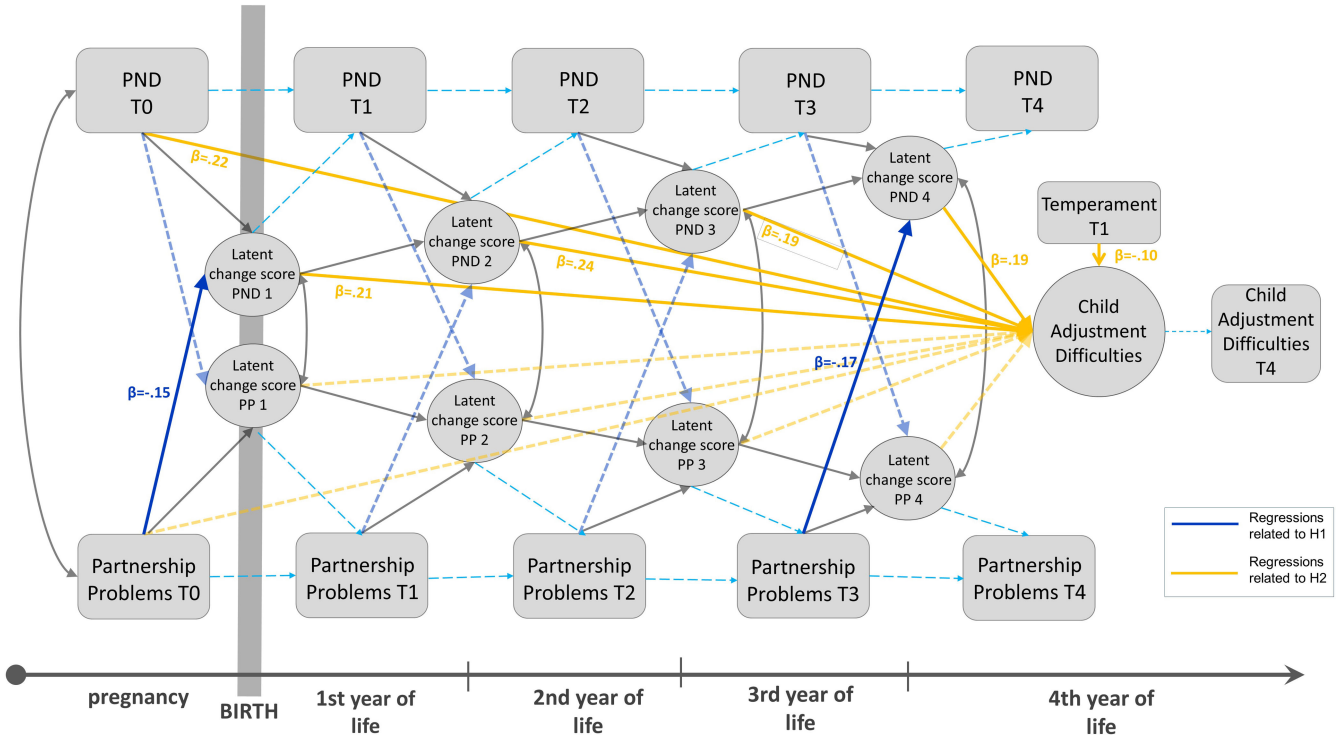

Figure 3. Bivariate latent change scores model of perinatal depressive symptoms (PND) and partnership problems (PP) predicting child adjustment difficulties. Estimates shown denote the medians of the joint standardized posterior distribution of regression weights and covariances. Dashed lines in light blue indicate fixed parameters. Dashed transparent lines indicate parameters for which the 95% bayesian credible intervals of the posterior distribution included 0.

indices can be found in Table 3. Figure A3 in the online supplementary materials shows the trace plots of the MCMC chains for all model parameters.

Figures 4 and 5 show the posterior probability distribution of parameter values and thus depict both the most probable parameter values as well as their uncertainty. Figure 4 shows the posterior distributions of the variance and covariance parameters in the model. Participants differed from one another in both initial levels and changes in partnership quality and PND symptoms, as indicated by the variances of the respective parameters.

Figure 5 shows the posterior distributions of standardized regression parameters. The posterior distributions of the unstandardized regression weights (that are also reported in Table 2) are shown in Figure A1 in the Appendix.

Reciprocal associations between PND symptoms and partnership problems over time

Change scores in partnership problems and PND symptoms were positively correlated within each time period of change. Higher

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Table 3. Fully unstandardized results for the bayesian bivariate latent change score model

	Posterior Median	Posterior SD	Lower End 95% CI	Upper End 95% CI
All Loadings				
	1	(fixed)		
Regressions				
PP T1 on PP T0	1	(fixed)		
PP T2 on PP T1	1	(fixed)		
PP T3 on PP T2	1	(fixed)		
PP T4 on PP T3	1	(fixed)		
PND T1 on PND T0	1	(fixed)		
PND T2 on PND T1	1	(fixed)		
PND T3 on PND T2	1	(fixed)		
PND T4 on PND T3	1	(fixed)		
Change PP 1 on PP T0	− 0.325	0.048	− 0.419	− 0.230
Change PP 2 on PP T1	− 0.202	0.053	− 0.306	− 0.098
Change PP 2 on Change PP 1	− 0.305	0.055	− 0.415	− 0.195
Change PP 3 on PP T2	− 0.133	0.045	− 0.222	− 0.044
Change PP 3 on Change PP 2	− 0.329	0.048	− 0.424	− 0.236
Change PP 4 on PP T3	− 0.095	0.039	− 0.171	− 0.018
Change PP 4 on Change PP 3	− 0.266	0.049	− 0.362	− 0.168
Change PND 1 on PND T0	− 0.471	0.056	− 0.581	− 0.360
Change PND 2 on PND T1	− 0.224	0.060	− 0.341	− 0.108
Change PND 2 on Change PND 1	− 0.251	0.054	− 0.358	− 0.146
Change PND 3 on PND T2	− 0.140	0.048	− 0.235	− 0.045
Change PND 3 on Change PND 2	− 0.343	0.051	− 0.443	− 0.243
Change PND 4 on PND T3	− 0.262	0.039	− 0.339	− 0.184
Change PND 4 on Change PND 3	− 0.397	0.047	− 0.489	− 0.304
Change PP 1 on PND T0	0.038	0.055	− 0.071	0.147
Change PP 2 on PND T1	− 0.021	0.053	− 0.123	0.083
Change PP 3 on PND T2	− 0.001	0.043	− 0.085	0.084
Change PP 4 on PND T3	0.019	0.036	− 0.051	0.089
Change PND 1 on PP T0	0.131	0.050	0.032	0.227
Change PND 2 on PP T1	0.044	0.051	− 0.055	0.143
Change PND 3 on PP T2	0.060	0.044	− 0.026	0.145
Change PND 4 on PP T3	0.129	0.037	0.055	0.201
SDQ on PND T0	0.202	0.062	0.078	0.323
SDQ on Change PND 1	0.189	0.066	0.059	0.318
SDQ on Change PND 2	0.224	0.069	0.088	0.360
SDQ on Change PND 3	0.190	0.080	0.035	0.345
SDQ on Change PND 4	0.190	0.067	0.060	0.320
SDQ on PP T0	0.030	0.055	− 0.077	0.138
SDQ on Change PP 1	0.088	0.071	− 0.051	0.228
SDQ on Change PP 2	0.059	0.072	− 0.081	0.198
SDQ on Change PP 3	0.004	0.076	− 0.144	0.153
SDQ on Change PP 4	− 0.088	0.072	− 0.229	0.052
Covariances				
PP T0 & PND T0	0.096	0.012	0.075	0.120

(*Continued*)

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Table 3. (*Continued*)

	Posterior Median	Posterior SD	Lower End 95% CI	Upper End 95% CI
Change PP1 & Change PND1	0.061	0.008	0.046	0.077
Change PP2 & Change PND2	0.043	0.007	0.029	0.058
Change PP3 & Change PND3	0.036	0.006	0.024	0.048
Change PP4 & Change PND4	0.019	0.005	0.010	0.028
Intercepts				
Change PP 1	0.721	0.100	0.525	0.914
Change PP 2	0.586	0.106	0.381	0.794
Change PP 3	0.309	0.096	0.121	0.494
Change PP 4	0.219	0.083	0.055	0.381
PP T0	2.189	0.025	2.140	2.238
Change PND 1	0.503	0.103	0.300	0.704
Change PND 2	0.359	0.105	0.153	0.565
Change PND 3	0.148	0.096	− 0.041	0.334
Change PND 4	0.202	0.083	0.038	0.365
PND T0	1.636	0.022	1.593	1.679
SDQ	1.412	0.208	1.003	1.827
Variances				
Change PP 1	0.121	0.010	0.103	0.141
Change PP 2	0.118	0.010	0.101	0.138
Change PP 3	0.096	0.008	0.082	0.112
Change PP 4	0.075	0.006	0.064	0.088
PP T0	0.213	0.017	0.183	0.248
Change PND 1	0.133	0.010	0.115	0.155
Change PND 2	0.128	0.010	0.110	0.149
Change PND 3	0.104	0.008	0.090	0.121
Change PND 4	0.085	0.007	0.073	0.099
PND T0	0.169	0.013	0.146	0.196
SDQ	0.117	0.009	0.101	0.136
Fit Indices			Lower End 90% HPD	Upper End 90% HPD
BRMSEA	0.064	0.008	0.051	0.078
BCFI	0.981	0.005	0.973	0.988

CI = credible interval; HPD = highest probability density credible intervals; PP = partnership problems; PND = perinatal depressive symptoms; SDQ = child adjustment difficulties. All other model parameters fixed to zero. (Uninformitive) priors: Regressions Normal (0,10), Correlations Beta (1,1), Intercepts Normal (0, 10), Variances [SD] Gamma (1, .5).

previous levels of PND symptoms as well as more (positive) previous change in PND symptoms predicted lower subsequent change in PND symptoms. In the same way, higher previous levels in partnership problems as well as greater magnitude of previous change in partnership problems predicted lower increases in partnership problems during the following time period. Change in PND symptoms from T0 (pregnancy) to T1 (postpartum period) was positively predicted (i.e., amplified) by partnership problems before birth. Likewise, change in PND symptoms between T3 and T4 was predicted by previous partnership problems at T3. Change in PND symptoms at any other time points was not predicted by partnership problems. On the other hand, change in partnership problems was not predicted by PND symptoms at any time point.

Prediction of overall child adjustment difficulties by PND symptoms and partnership problems

Regarding our main research questions, we found that prenatal levels of PND symptoms, change in PND symptoms from T0 to T1 (over the birth of the child) as well as changes in PND symptoms from T1 to T2, from T2 to T3 and from T3 to T4 positively predicted overall child adjustment difficulties at T4 (age 3). A more positive child temperament at T1 also predicted

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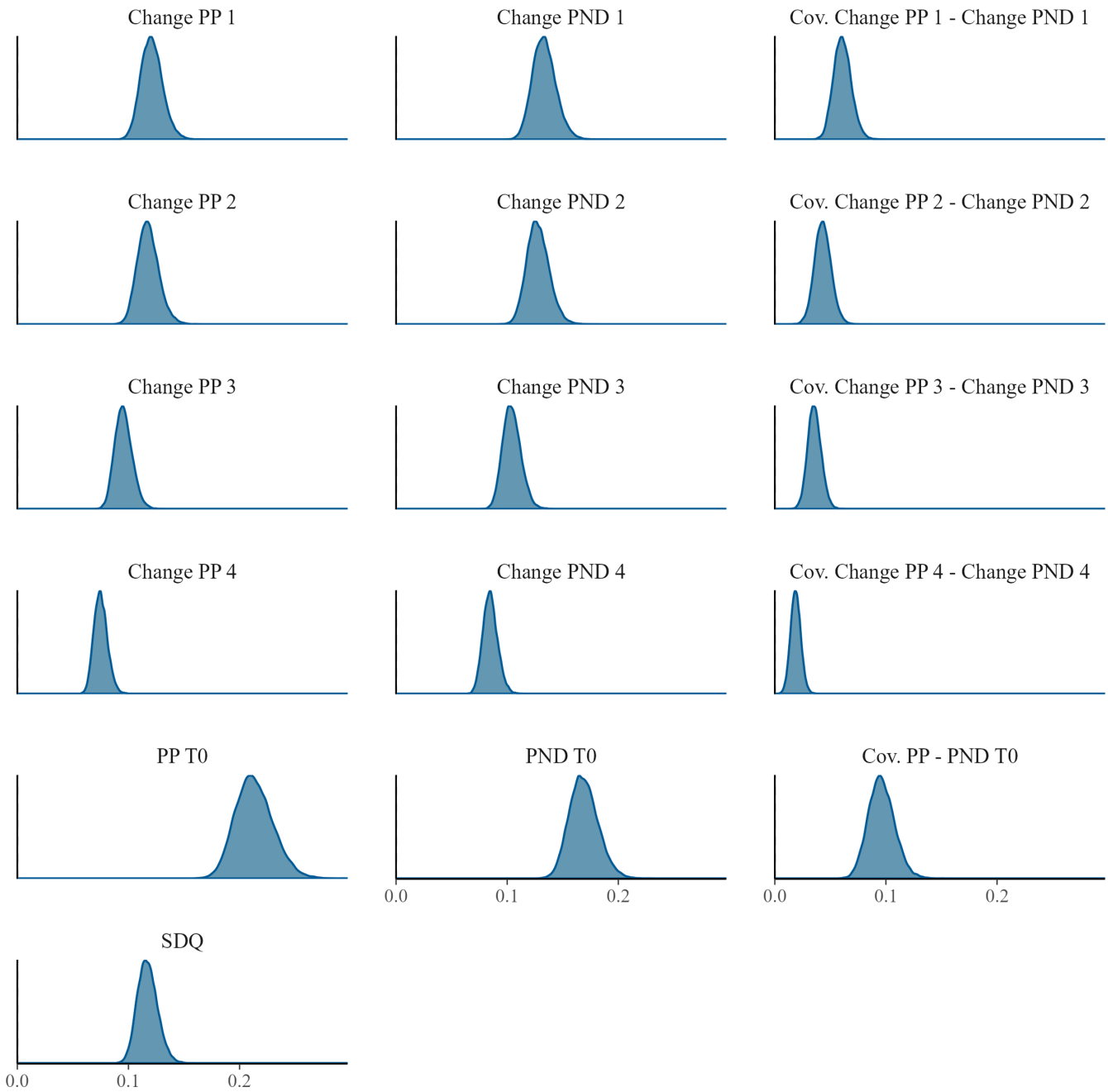

Figure 4. Posterior distributions of variances and (unstandardized) covariances. Change = latent change scores; cov. = covariance. *Y*-axis is free for each sub-plot; PP = partnership problems. PND = perinatal depressive symptoms; SDQ = child adjustment difficulties.

fewer overall adjustment difficulties at T4. For all other predictors of child adjustment difficulties, the 95% Bayesian credible intervals of the estimated coefficients included zero, as shown in Table 3 and their full posterior distributions plotted in Appendix A2. All predictors jointly explained 10.2% of the variance in child adjustment difficulties.

Finally, change score intercept posterior medians were positive throughout – however, when analyzing total levels of change it is important to take the predictors into account. The intercepts reflect mean rates of change assuming all predictors are zero. As the change scores are regressed on, among others, previous levels of the same variable, that are not zero on average, the intercept relates to a level of change that does not reflect the actual "mean" in the data and must thus be interpreted accordingly. Figure A2 in the Appendix shows the posterior distributions of the intercept parameters.

Different patterns for internalizing versus externalizing symptoms

To explore potentially differential effects for internalizing versus externalizing symptoms, we repeated the Bayesian regression of child adjustment difficulties on maternal PND symptoms, partnership problems, and infant temperament in an exploratory approach separately for each of the SDQ subscales as separate outcome. While internalizing symptoms (subscale *emotional symptoms*) were only predicted by PND symptoms in pregnancy

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Figure 5. Posterior distributions of standardized regression weights. Change = latent change scores; PP = partnership problems; PND = perinatal depressive symptoms; SDQ = child adjustment difficulties. Dashed lines indicate zero. *Y*-axis is free for each sub-plot. These distributions correspond to the values reported in figure 2. Table 1 as well as figure A1 in the appendix show the estimates of unstandardized regression weights.

(ß posterior mean = .15) and change in PND symptoms between T0 and T1 (ß posterior mean = .19), externalizing symptoms (subscales *hyperactivity* and *conduct problems*) were associated with different patterns: Hyperactivity was predicted by child temperament (ß posterior mean = –.13), PND symptoms in pregnancy (ß posterior mean = .18), change in PND symptoms between T1 and T2 (ß posterior mean = .28), between T2 and T3 (ß posterior mean = .20) and between T3 and T4 (ß posterior mean = .13). On the other hand, conduct problems were predicted by change in partnership problems between T1 and T2 (ß posterior mean = .18).

Discussion

The current study aimed to disentangle the interrelation of maternal depressive symptoms and partnership problems in the transition to parenthood and early childhood and their associations with child adjustment difficulties. Our results emphasize the

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crucial role of the perinatal period in intrafamilial transmission processes. PND symptoms and partnership problems both increased in the transition to parenthood and remained elevated over the study period (3 years postnatal) compared to baseline. Regarding reciprocal influences, only partnership problems predicted aspects of change in PND symptoms, not vice versa. Moreover, overall child adjustment was predicted by prenatal depressive symptoms and subsequent changes in depression from pregnancy to 3 years postpartum, but not by partnership problems. When distinguishing between internalizing and externalizing symptoms, analyses revealed that internalizing symptoms were only predicted by PND symptoms. On the other hand, externalizing symptoms in the form of *conduct problems* were solely associated with partnership problems. Moreover, externalizing symptoms in the form of *hyperactivity* were predicted by both PND symptoms *and* partnership problems in addition to the influence of infant temperament.

Examining the longitudinal trajectories of PND symptoms, latent change score intercepts for PND were positive at all time points, suggesting a progressing increase in PND symptoms over the first 4 years postpartum. This adds to previous findings showing prenatal depression to facilitate the persistence of PND to the postpartum period and beyond (Martini et al., 2015; Slomian et al., 2019). Main results and exploratory analyses showed that PND symptoms predicted both child internalizing and externalizing behavior. More precisely, for the development of hyperactive behavior *prenatal* PND symptoms as well as change in PND symptoms after the immediate postnatal period (from T2 on) seems to be crucial. However, change in PND symptoms in the time around childbirth (between T0 and T1) could be less relevant for the prediction of hyperactivity. In contrast, the change in PND symptoms in the time around birth (T0–T1) appears to be important for the development of internalizing problems. Additionally, internalizing symptoms were predicted by *prenatal* PND symptoms. Taken together, maternal PND symptoms, especially in the immediate perinatal period, could be critical for the development of internalizing symptoms - independently of partnership problems and the further change in depression. This is in line with previous research, convincingly showing that perinatal depression and particularly *prenatal* depression impacts later child adjustment difficulties (Pearson et al., 2013).

Because prenatal depression can act as a precursor to the persistence of PND (Martini et al., 2015; Slomian et al., 2019), prenatal depressive symptoms seems to be of particular importance in family mental health. Underlying mechanisms discussed in the field of research are, among others, intrauterine neuroendocrinological influences (Gelman et al., 2015) and epigenetic processes (Carnevali & Buoli, 2021) in PND, putting prenatally depressed women and their families at risk for further mental health burden. Notably, the present results indicate that maternal PND symptoms play a significant role for child adjustment difficulties although the STDS captures only depressive mood symptoms, not other aspects of depression and most participants' STDS scores were below the cut-off for clinically relevant depressive symptoms. This affirms findings that even subclinical maternal depressive symptoms have significant long-term effects on child development (Goodman et al., 2020; Goodman & Tully, 2009). In sum, our findings regarding PND symptoms emphasize previous findings (Hughes et al., 2020; Rogers et al., 2020) showing how even subclinical perinatal depressive symptoms lead to a cumulation of risk factors by facilitating child adjustment difficulties, adding further psychosocial risk for families already at risk through perinatal depression itself.

Results concerning partnership problems suggest an increase of partnership problems during the transition to parenthood with persistence over 4 years postnatal. This matches results by Kuersten-Hogan et al. (2021) who found prenatal partnership quality to significantly predict postnatal partnership quality. Regarding the hypothesized reciprocal influences with PND symptoms, we found effects of partnership problems on change in PND symptoms, but not vice versa. These results are in line with previous findings suggesting a similar pattern of partnership quality having a greater impact on depression than depression has on partnership quality in mothers (Thomas et al., 2019), pregnant women (Xie et al., 2022) and in couples in general (Proulx et al., 2007). Interestingly, partnership problems predicted change in PND symptoms only at two measurement points. Change in subsequent PND symptoms was predicted by prenatal partnership problems and partnership problems at T3 (third year of child's life). The role of prenatal partnership problems for PND symptoms was previously shown in a meta-analysis by Pilkington and colleagues (2015): While postnatal depressive symptoms were predicted by more prenatal partnership conflict and less prenatal closeness between partners, results were significant but less consistent for the effect of postnatal partnership factors. In contrast, in the present study we find no effect of postnatal partnership problems on PND symptoms in the first or second year after birth. However, partnership problems in the third year after birth predicted subsequent PND symptoms. One possible explanation for this result could be that pregnancy is a particularly vulnerable period and some families are pregnant again when the first child is 2 years old. However, in our sample only few families report subsequent pregnancies. Moreover most subsequent pregnancies are reported at T2, not T3 (T1 = 1%; T2 = 8.5 %; T3 = 7.3 %; T4 = 5.9 %). Further, it is possible that other stressors in the third year of a child's life (toddlerhood) make family mental health especially vulnerable. For example, in toddlerhood families experience increased stress trough important developmental steps and processes such as the transition to kindergarten (Ray & Smith, 2010; Stormont et al., 2005). Thus, it might be that the effect of partnership on PND symptoms manifests particularly in phases of increased distress, in which mothers might be more vulnerable for depressive symptoms (Chhabra et al., 2020).

Contrary to our hypothesis and results reported in literature (e.g., Jouriles et al., 2016; Zemp et al., 2016) we did not find an effect of partnership problems on overall child adjustment difficulties. It is possible that the influence of partnership problems on overall child adjustment difficulties is accounted for by shared variance when considered together in a model with PND symptoms. Another explanation for the lacking effect of partnership problems on overall child adjustment difficulties could be the heterogeneity in the operationalization of child adjustment difficulties measured by SDQ. The SDQ subscales capture qualitatively distinct characteristics of child adjustment difficulties: While SDQ *emotional symptoms* capture aspects of internalizing symptoms, SDQ *conduct problems* and SDQ *hyperactivity* describe externalizing symptoms. Exploratory analyses suggested that partnership problems might only affect externalizing behavior, but not internalizing behavior. This is in line with previous studies (e.g., Zemp et al., 2014) which found partnership problems (like frequent destructive conflict behavior) to predict only child externalizing, but not internalizing symptoms. However, research has previously described spillover effects of parental partnership interactions on child psychopathology for internalizing symptoms as well (Erel & Burman, 1995; Rhoades, 2008; Stroud et al., 2015). A possible explanation for our results might be that younger children,

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as in our study, are more likely to express their distress as reaction to parental conflict more directly in form of externalizing behavior and that internalizing symptoms in the aftermath of partnership problems could manifest later in childhood or adolescence (discussed in Zemp et al., 2016). Sleeper-effects of interparental conflict on children were reported previously (Holmes, 2013).

Furthermore, our results indicate that conduct problems and hyperactivity in young children, which are often summarized under the umbrella term "externalizing behavior", may be based on different developmental mechanisms. Firstly, hyperactivity appears to be multifactorial and is predicted by infant factors (infant temperament) next to maternal and partnership factors. Secondly, hyperactivity seems to be especially influenced by prenatal influences. Both findings could speak in favor of a stronger involvement of biological factors in the development of hyperactivity. This is in line with researchers arguing that hyperactivity is a core symptom of later ADHD, which in turn is also discussed to be caused by biological and (epi)genetic mechanisms (Hamza et al., 2019; Posner et al., 2020). Conduct problems, on the other hand, could rather be seen as a child's reaction to parental conflicts. This would explain why partnership seems to play a role only in the postnatal phase where the child is more directly exposed to parental conflict. This is consistent with findings demonstrating the impact of parental conflict on child adjustment difficulties (Zemp et al., 2016).

Overall our model explains 10.2% of variance in child adjustment difficulties. Considering that some of the regressors lie several years in the past, this is a considerable effect size. Other longitudinal studies on intergenerational transmission of maternal psychopathology find small effect sizes of a similar magnitude (e.g., Bouvette-Turcot et al., 2020). At the same time, this indicates that childhood adjustment difficulties are not merely determined by exposure to maternal PND symptoms and partnership problems in early childhood. Multiple other bio-psycho-social factors such as experienced parenting (Pinquart, 2021), exposure to violence (Doroudchi et al., 2023), hormonal and biological changes (Cicchetti & Handley, 2017; Meyer et al., 2009) or socioeconomic status (Peverill et al., 2021) contribute to the development of child adjustment difficulties and may function as risk or protective factors. Nonetheless the presented results are clinically relevant as they noticeably illustrate how risk factors can accumulate in affected families: Prenatally depressed women are at risk for persistence of symptoms (Rogers et al., 2020). This process can be exacerbated by prevalent partnership problems in pregnancy. Both prenatal depressive symptoms and partnership problems in turn may pave the way for child adjustment difficulties in increasing neurodevelopmental vulnerability to postpartum adverse influences (O'Donnell & Meaney, 2017). Based on a prenatally established susceptibility, the persistence of PND symptoms and partnership problems beyond birth could further influence child development postnatally. Thus, postnatally persisting PND symptoms can unfold their effect on the mother–child relationship (Reck, et al., 2016) and mother–child interaction (Bernard et al., 2018). Likewise, postnatal partnership problems facilitate coparenting problems and negative parenting behavior (Lux et al., 2021). Hence, prenatal psychosocial influences in families lead to an accumulation of risk via pathways that have yet to be fully understood, shaping family mental health in the long term.

Besides some definite strengths, the present study has some limitations. First, the data for the present study stem from survey panel data and thus had to rely on short self-report indicators consisting of scales with few items only which can impact the validity. In this study the SDQ showed lower than desirable internal consistency. Keller and Langmeyer (2017) who provided an Item Response Theory approach on psychometric properties of the SDQ in the pairfam sample conclude that "the summation to a single sum score seems justified, in particular for screening purposes, given the assumption of a high comorbidity of psychological problems in children." (Keller & Langmeyer, 2017, p. 267).

Second, the depression questionnaire used in the pairfam panel does not measure clinical diagnosis of depression, but depressive mood symptoms. Other symptoms of clinical depression diagnosis, such as cognitive (e.g., rumination) and somatic symptoms (e.g., change in appetite), are not measured in pairfam. Therefore, the present results cannot be directly generalized to the population of mothers with Major Depression diagnoses. However, studies in mothers with perinatal depression diagnosis found similar results regarding the role of PND for child outcomes (e.g., Gerardin et al., 2011). Moreover, it has to be noted that depressive mood symptoms alone are not specific to Major Depression, but also occur in other common mental disorders (e.g., personality disorders or anxiety disorders) or even in individuals without any psychiatric diagnoses. That the present results refer to subclinical mood symptoms in healthy individuals does not diminish their relevance. On the contrary, the potential for even subclinical symptoms of PND to affect child adjustment in the long-term points to the importance of providing adequate health care for even subclinically depressed (expectant) mothers and their families.

Third, we could not estimate latent measurement models for our constructs of interest but had to rely on sum scores due to the limited sample size. Specifically, the operationalization of partnership problems in the present study may not be precise enough as the generated score included several aspects of partnership problems. Some research suggests that a more detailed breakdown of partnership problems into various facets of partnership conflict and closeness or affection could bring further insight (Du Rocher Schudlich et al., 2011). Finally, partnership problems, PND symptoms and child adjustment difficulties could only be studied from the mother's perspective. This may have led to increased shared method variance. Several authors discussed the role of the informant, for example, in influencing associations between partnership conflict and child adjustment (e.g., Clements et al., 2014). Despite their limitations, large surveys allow testing hypotheses and nuanced examinations in large samples with longitudinal design (Davis-Kean & Jager, 2012). Through this, it was possible to follow more than 300 expectant mothers over the transition to parenthood. In conclusion, our study adds evidence for the significance and interrelations of perinatal depressive symptoms and partnership problems in explaining children's adjustment difficulties at the age of three in a large German sample of mothers.

In future studies observational data and developmental tests should be used. Measures differentiating between various facets of relationship quality could enhance knowledge whether certain aspects of partnership conflict and cognitive or emotional aspects of the relationship such as intimacy or commitment affect PND and child adjustment difficulties differently. Moreover, as paternal depression has found to be closely related to maternal perinatal depressive symptoms (Thiel et al., 2020), future research should include both maternal and paternal perinatal depression, as well as their interplay in the prediction of child adjustment difficulties.

Finally, the results provide important implications for clinical practice. The long-lasting impact of (even subclinical) symptoms

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of PND and partnership problems on child adjustment underlines the importance of prevention starting already during pregnancy. Regular screening of depressive symptoms in perinatal care as well as the first years postpartum could detect mothers suffering from perinatal depressive symptoms and hence prevent long-lasting negative effects on child development. If necessary, mothers with depressive symptoms should receive adequate treatment for depression which was shown to be effective in the perinatal period (Cuijpers & Karyotaki, 2021). Furthermore, since partnership problems have long-term implications for both maternal PND symptoms and adjustment difficulties in children, it is crucial for expectant parents to be provided with comprehensive information regarding the transformations that occur within their relationship during the transition to parenthood. In families where partnership problems are prominent, it is advisable to offer relationship counseling that focuses on enhancing conflict resolution skills and overall relationship satisfaction. By implementing interventions early, starting from pregnancy and beyond, it may be possible to disrupt the cycle of familial transmission. This could be achieved by alleviating maternal mental health burden during the transition to parenthood. Consequently, the chances of long-term adjustment difficulties in children could be reduced.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0954579423001335.

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