

## **Parental psychological distress and early regulatory problems: Evidence from the UK Household Longitudinal Study**

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**Abbreviations:** UKHLS: UK Household Longitudinal Study, GHQ: General Health Questionnaire.

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## Abstract

**Importance:** Early regulatory problems (excessive crying, sleeping, or feeding difficulties) may be the starting point of a childhood dysregulation trajectory leading to psychiatric problems. One contributing factor to the development of regulatory problems could be parental psychological distress.

**Objective:** To explore whether the timing of psychological distress (i.e., before, during, or after pregnancy) matters for the likelihood of regulatory problems, and to explore if these effects differ between maternal and paternal psychological distress.

**Design, Setting, Participants:** We used data from the UK Household Longitudinal Study, which is a stratified random sample of UK households in 2009, with additional ethnic minority boost samples. The sample included 1,280 parents from waves 3 to 13 (2011-2012 to 2021-2022).

**Exposures:** In the waves (years) before and after the infant was born, both mothers and fathers reported on their psychological distress using the 12-item General Health Questionnaire.

**Main Outcomes and Measures:** Mothers reported on their children's regulatory problems in the first year of life. Pooled probit regressions were estimated individually for multiple regulatory problems and each regulatory problem controlling for a range of covariates.

**Results:** Parental psychological distress before or during pregnancy did not predict the development of multiple regulatory problems. However, children were 3.7 percentage points more likely to experience multiple regulatory problems if their mothers had psychological in the postnatal period. There was also an association between mother's psychological distress during pregnancy and feeding problems (3.6 percentage points), and in the postnatal period with crying (5.4 percentage points) and sleeping problems (8.6 percentage points). In contrast, father's psychological distress before or during pregnancy had no impact on the development of early regulatory problems. However, father's psychological distress in the postnatal period was associated with 4 percentage point increased likelihood of crying problems.

**Conclusions and Relevance:** While maternal psychological distress during pregnancy had some association with specific regulatory problems, the postnatal period was the most critical time for both mothers and fathers in influencing children's regulatory problems. These findings emphasize the importance of addressing parental psychological well-being, especially after childbirth, to potentially reduce the risk of early childhood dysregulation and subsequent psychiatric issues.

*Keywords:* Parental psychological distress, infant regulatory problems, UK Household Longitudinal Study, Understanding Society

Developing self-regulation is among the most important skills for a child to accomplish given the life-long positive outcomes such as better financial security, interpersonal relationships, and academic performance.<sup>1,2</sup> Early signs of difficulty self-regulating include excessive crying (e.g., difficulties in self-soothing when crying), sleeping difficulties (e.g., difficulties in settling back to sleep at night), and feeding difficulties (e.g., food refusal, picky eating), which are labelled as ‘regulatory problems’.<sup>3</sup> Approximately 20% of infants experience some regulatory problems during the first year of life which can occur in isolation (i.e., single regulatory problems) or co-exist (i.e., multiple regulatory problems).<sup>4,5</sup> They are highly-stressful and challenging for parents,<sup>3,6</sup> and are among the most common reasons parents seek help from a medical professional regarding their child’s health during the early years.<sup>7</sup>

Increasing evidence suggests that regulatory problems are associated with adverse outcomes including an increased risk of dysregulation and behavioural and attention problems during childhood,<sup>8-15</sup> which could be long-lasting into adulthood, particularly for infants who experienced multiple regulatory problems.<sup>16-19</sup> Since regulatory problems are early markers of the risk for future psychopathology, it is essential to identify factors that might underpin these early emerging problems in self-regulation.<sup>3,20</sup> However, there is little understanding about the factors associated with to the development of regulatory problems.

Parental psychological distress is one key factor which could be associated with the development of early regulatory problems.<sup>21-24</sup> However, three issues remain unclear. First, it’s unclear whether the timing of parental depression (i.e., before, during or after pregnancy) has differential effect on the development of regulatory problems. Second, the existing studies mainly focused on mother’s psychological distress neglecting the potential impact of father’s psychological distress. Given the correlation between mother’s and father’s mental health<sup>25</sup> and the potential genetic transmission through fathers,<sup>26</sup> it is plausible that father’s mental health would also have an impact on children’s regulatory problems. Last, the effects might differ depending on the birth order and sex of the child. First born children might receive more

parental attention which could either exacerbate or mitigate the effects of psychological distress on regulatory problems.<sup>27</sup> Gender-specific expectations and socialization practices could also play a role, with parents potentially interacting differently with boys than girls, influencing the association between psychological distress and regulatory problems.<sup>28, 29</sup>

The main aim of this study was to investigate whether the timing of the psychological distress (i.e., before, during, or after pregnancy) matters for multiple and single regulatory problems and whether the effects are similar for maternal and paternal psychological distress. The secondary aim was to investigate whether the associations are moderated by sex and birth order of the baby (i.e., firstborn vs later born). In line with the previous evidence, several child (i.e., sex, birth order, age) and parent-related (i.e., education, employment, ethnicity) and perinatal factors (i.e., low birth weight, preterm birth, breastfeeding) which might have an impact on the association between parental psychological distress and regulatory problems were included in the analyses.<sup>3, 30</sup>

## **Methods**

### **Participants**

The data used in this study come from Understanding Society, the UK Household Longitudinal Study (UKHLS),<sup>31</sup> a stratified clustered sample of approximately 30,000 UK households in 2009, with additional ethnic minority boost samples. UKHLS annually collects extensive information on social, economic, health and behavioural information of all household members. Adult participants (16 or older) are interviewed face-to-face or through a self-completion online survey, while for children under the age of 10 their parents or responsible adults provide information about them.<sup>32</sup> Data are available for all variables are available and both mother and father in the same household for N=1,280 infants. (See Appendix Figure A1 for full description).

## Measures

**Regulatory problems.** Parents reported their infants' crying problems using two questions: 1) *'How easy or difficult is it for you to calm or soothe child when s/he is upset?'* The 5-point response scale (from 'very easy' to 'very difficult') was recoded to reflect a crying problem (0 = very easy, somewhat easy, about average; 1 = somewhat difficult and very difficult); 2) *'How often does child usually fuss and cry during a typical 24-hour period (e.g., yesterday)?'* The 5-point response scale (from 'most of the time' to 'rarely if at all') was recoded to reflect a crying problem (0 = some of the time, not very often, rarely if at all; 1 = a lot of the time and most of the time). These two questions were summed and dichotomised (0 = no crying problems; 1 = 1 or 2 crying problems).

Parents reported on sleeping problems of their infants using two questions: 1) *'How long does it usually take you to settle child for his or her nighttime sleep once you have started the process?'* The answers in minutes were grouped to reflect the presence of a sleeping problem (0 = 30 minutes or less; 1 = more than 30 minutes)<sup>3</sup>; 2) *'How many times does child usually wake him/herself up at night?'* The answers were recoded based on the 90<sup>th</sup> percentile to reflect a sleeping problem (0 = 3 times or less; 1 = 4 times or more). These two questions were summed and dichotomised (0 = no sleeping problems; 1 = 1 or 2 sleeping problems).

Parents reported on infants' feeding problems using two questions: 1) *'How true is the following statement about child? Child refuses to eat?'*; 2) *'How true is the following statement about child? Child seems to have no appetite?'* The 3-point response scale (from 'not true' to 'certainly true') was recoded to reflect a feeding problem (0 = not true; 1 = somewhat true and certainly true) for both questions. These two questions were summed and dichotomised (0 = no feeding problems; 1 = 1 or 2 feeding problems).

Crying, sleeping, and feeding problems scores were also summed to create an overall regulatory problems variable: 0 = no or one regulatory problem (either crying, sleeping, or feeding problems); 1 = multiple problems (co-occurrence of crying, sleeping or feeding problems).

Infant regulatory problems were first collected in Understanding Society in Wave 3 (2011-2012). Questions are asked to biological mothers of newborns. We have pooled together data from waves 3 to 13 (2011 – 2022).

### **Parental psychological distress before birth.**

One wave (year) before the pregnancy, during pregnancy and one wave after the infant was born, both mothers and fathers reported on their psychological distress using the shortened version of the General Health Questionnaire (GHQ-12) which is a validated, reliable questionnaire to measure psychological distress.<sup>33</sup> It has 12 items (e.g., *felt capable of making decisions about things*) using a 4-point Likert type response scale (1 = More so than usual, 2 = About the same as usual, 3 = Less so than usual, and 4 = Much less than usual). To create an overall scale, the individual values from the 12 items are scored with 1 and 2 coded as 0, and 3 and 4 as 1. This results in a scale from 0 to 12. Following a commonly adopted approach, we dichotomised the scale with a cut off of 3 or more defining moderate psychological distress.<sup>34</sup>

### **Covariates.**

A comprehensive set of covariates related to child's and parents' characteristics and perinatal period have been included to account for potential confounding factors and to enhance the robustness of the analysis. Specifically, child-related covariates included age (six months or older = 1), sex (female = 1), whether the child is the firstborn of both parents (firstborn = 1). Parent-related covariates included mother's and father's ethnicity (white British = 1), educational attainment (degree or other higher degree = 1), and employment status (employed = 1). Perinatal factors included if the child was born early (at least a week before expected due date) (preterm = 1), an indicator for whether the child was born weighing 2,500 grams or less (low birthweight = 1), and if the child was breastfed (breastfed = 1). A detailed summary of the measures discussed earlier is provided in the Appendix in Table A1.

## Statistical Analyses.

Binary probit models were conducted in STATA 18 to estimate the probability of infants presenting crying, sleeping, feeding and multiple regulatory problems when the parent experiences psychological distress while controlling for a range of child and parent-related characteristics (step 1) and perinatal factors (step 2). Models were estimated individually for multiple regulatory problems and each regulatory problem. Marginal effects (percentage points) were reported which shows how much the probability of regulatory problems changes in response to a change in the predictor (i.e., occurrence of psychological distress), keeping the other variables constant. All analyses were conducted using weights to correct for oversampling of ethnic minorities. For the moderation analyses, the following interaction terms were entered into the analysis in the last step of two separate models. First, moderation by sex: ‘maternal psychological distress\*female sex’; ‘paternal psychological distress\*female sex’. Second, for birth order: ‘maternal psychological distress\*first born’; ‘paternal psychological distress\*first born’.

## Results.

The rates of regulatory problems as reported by mothers were as follows: crying problems (N=116, 9.1 %), sleeping problems (N=275, 21.5%), feeding problems (N=106, 8.3 %), and multiple regulatory problems (N=81, 6.3%). Overall, N= 408 (31.9%) had any regulatory problems.

The rates of maternal psychological distress were N= 446 (34.8%) before birth, N=449 (35.1%) during pregnancy, and N=453 (35.4%) in the postnatal period. The rates of paternal psychological distress were N=333 (26%) before birth, N=307 (24%) during pregnancy, and N=373 (29.1%) in the postnatal period.

Table 1 shows the characteristics of children and parents for children who have different level of regulatory problems. The percentages of regulatory problems according to parental psychological distress before, during, or after pregnancy are displayed in Figure 1.

### **Mother's and father's psychological distress and multiple regulatory problems**

The results of the probit regressions show that when the impact of child and parent-related covariates were considered, children were 3.8 percentage points more likely to experience multiple regulatory problems if their mothers had psychological distress, than not, in the postnatal period (Table 2). When the impact of the perinatal factors was considered, the associations between mother's psychological distress and multiple regulatory problems remained similar (3.7 percentage points difference for those with distress compared to those without) (Table 2, Figure 2). There was no association between mother's psychological distress before and during pregnancy and the likelihood of multiple regulatory problems. No significant associations were observed between father's psychological distress at any time point and multiple regulatory problems.

### **Mothers' and father's psychological distress and single regulatory problems**

For the individual regulatory problems when the impact of child and parent-related covariates were considered, an association between mother's psychological distress during pregnancy and feeding problems was found (3.6 percentage points difference for those with distress compared to those without). In the postnatal period, both mother's and father's psychological distress (5.4 and 4 percentage points differences, respectively) were associated with crying problems. Further, there was an association between mother's psychological distress in the postnatal period and sleeping problems (8.6 percentage points difference for those with distress compared to those without) (Appendix Table A2).

When the impact of the perinatal factors was considered, the strength of the associations remained similar. Mother's psychological distress during pregnancy increased the likelihood of children's feeding problems by 3.6 percentage points compared to mothers not experiencing distress. In the postnatal period, both mother's and father's psychological distress (5.4 and 4 percentage points higher than those without distress, respectively) were associated with crying problems. Further, there was an association between mother's psychological distress in the



postnatal period and sleeping problems (8.6 percentage points higher than those without distress) (Figure 3). No other significant associations were found. Detailed results are presented in Appendix Table A2.

### **Mother's and fathers' psychological distress in the postnatal period and regulatory problems: Child sex and birth order as moderators**

Child's sex and birth order did not moderate the associations between mother's and father's psychological distress and regulatory problems (Appendix Table A3).

## **Discussion**

To the best of our knowledge, this is the first study to assess the association between both mother's and father's psychological distress and early regulatory problems at three key time points: before pregnancy, during pregnancy and the postnatal period. The findings indicate that maternal psychological distress during the postnatal period is significantly associated with an increased likelihood of multiple regulatory problems, while no such association was observed before or during pregnancy. Regarding single regulatory problems, mother's psychological distress during pregnancy was associated with feeding problems, while postnatal psychological distress was associated with crying and sleeping problems. Interestingly, father's psychological distress before, during or after pregnancy was associated with the likelihood of multiple regulatory problems. However, father's psychological distress during the postnatal period was associated with increased likelihood of crying problems. No evidence of moderating impact of child's sex and birth order was found.

Our findings highlight the impact of maternal psychological distress during the postnatal period on early regulatory problems, with a greater influence observed on single regulatory problems (i.e., crying or sleeping problems) compared to multiple regulatory problems. Specifically, the rate of multiple regulatory problems was 3.7 percentage points higher in infants whose mothers experienced psychological distress during in the postnatal period, compared to

those whose mothers did not. However, maternal postnatal psychological distress had a more pronounced impact on single regulatory problems, with 5.4 percentage points increase in crying problems and an 8.6 percentage points increase in sleeping problems. This suggests that when one regulatory problem is present, maternal psychological distress may exacerbate the problem. On the other hand, when an infant experiences multiple regulatory problems, the factors influencing these problems could be more complex. For example, other factors such as neurodevelopmental vulnerability could have an impact on the development of multiple regulatory problems<sup>3</sup> and could decrease the specific impact of maternal psychological distress.

Maternal psychological distress during the postnatal period is often linked to disruptions in sensitive caregiving behaviours, emotional availability and attainment which are crucial for children's regulation of emotions and behavior.<sup>35,36</sup> These disruptions could directly influence an infant's ability to self-regulate a combination of crying, sleeping or feeding behaviours. However the association appears more specific when looking at single crying and, particularly, sleeping problems.<sup>24</sup> Sleep regulation requires consistent routines and a calm environment, yet evidence shows that symptoms of maternal depression are associated with having difficulties in setting a bedtime routine and being in tune with babies' signals.<sup>37</sup> It is also possible that the link between maternal postnatal depression and sleep problems in children is bidirectional<sup>38</sup> or reporting bias. Mothers with depressive symptoms may be more likely to report and express concern over their infants' sleep problems, while sleep problems of their children may impact on mothers mental health. Existing evidence testing this bidirectional association suggests that the influence of maternal depression on infant sleep is stronger.<sup>39</sup>

The only significant association during pregnancy was between maternal psychological distress and increased risk of feeding problems. This finding contrasts with previous studies that have linked maternal prenatal distress to infant crying and sleeping problems,<sup>24,40</sup> as well as studies showing associations between preconception maternal mental health symptoms and

increased night waking in infancy,<sup>41</sup> and emotional reactivity.<sup>42</sup> This suggests that other factors such as genetic predispositions, environmental influences, or postnatal caregiving practices might be more important for the occurrence of these problems.<sup>43-45</sup> However, maternal psychological distress during pregnancy could have influence feeding problems through hormonal changes (e.g., cortisol) or other biological factors that might interfere with milk production and the infant's ability to feed effectively.<sup>46</sup> Maternal depression during pregnancy is associated with difficulties in establishing and maintaining breastfeeding, which provides important sensory and nutritional experiences for infants.<sup>47</sup> In addition, prenatal psychological distress could increase the likelihood of preterm birth which is associated with increased feeding difficulties in infants.<sup>30</sup>

Psychological distress in fathers before birth and during pregnancy did not affect the likelihood of regulatory problems in children. However, when fathers experienced psychological distress in the postnatal period, their children showed 4% higher crying problems. This finding suggests that direct exposure to paternal psychological distress might play a role in the development of crying problems. This could be because paternal psychological distress tends to be more prevalent in the postnatal period in comparison to pregnancy or before birth.<sup>48</sup> This finding aligns with previous research showing that postnatal depression in fathers is linked to increased likelihood of psychiatric disorders in children even after adjusting for the impact of maternal depression and paternal education level.<sup>49</sup> There could be several explanations for the impact of paternal psychological distress in the postnatal period on infant crying problems. Paternal psychological distress could potentially lead to insensitive or inconsistent caregiving and could impact the overall family dynamic increasing stress levels within the household, which could indirectly affect infant crying.<sup>50</sup>

The strengths of the current study include the prospective design using measurements before birth to until early childhood, inclusion of several important covariates, and both maternal and paternal psychological distress in the same analysis in a UK population representative sample. However, there are also limitations. First, the assessment of regulatory

problems was made via parental annual questionnaires which may be less accurate than daily diary recordings. Thus, it is possible that our assessment of early regulatory problems reflects parental perception. However, regulatory problems are commonly assessed using parental perception which has predictive validity given the link between parent-reported early regulatory problems and adulthood psychiatric diagnoses, self-reported mental health problems, and cortisol levels.<sup>17, 51</sup> Second, while the definition of sleep problems in the current study was in line with previous research, however, it is important to note the large variation in infant sleep patterns during the early years<sup>52</sup> which may have influenced our findings.

In conclusion, this study provides new insights into the role of maternal and paternal psychological distress in the development of early regulatory problems in infants. While maternal distress during the postnatal period was significantly associated with increased multiple regulatory problems and single crying and sleeping problems, the impact of paternal distress was more limited, primarily affecting crying problems. These findings emphasize the importance of postnatal mental health support for both parents, as psychological distress during this period may disrupt caregiving behaviours and exacerbate specific regulatory issues in infants.

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**Table 1. Characteristics of the sample according to early regulatory problems**

	No regulatory problems (N=872, 68.1%)	Single regulatory problems (N=327, 25.5%)	Multiple regulatory problems (N=81, 6.3%)	p
Female sex	421(48.3%)	174 (53.2%)	43 (53.1%)	.262
First born	275 (31.5%)	139 (42.5%)	23 (28.4%)	.001
Age				
Preterm	192 (22%)	86 (26.3%)	18 (22.2%)	.288
Low birth weight	50 (5.7%)	22 (6.7%)	10 (12.3%)	.065
Breastfeeding				
Mother White Ethnicity	728 (83.5%)	253 (77.4%)	51 (63%)	<.001
Father White Ethnicity	744 (85.3%)	260 (79.5%)	53 (65.4%)	<.001
Mother Employed	315 (36.1%)	89 (27.2%)	26 (32.1%)	.014
Father Employed	699 (80.2%)	265 (81%)	69 (85.2%)	.540
Mother higher education degree attainment	547 (62.7%)	213 (65.1%)	55 (67.9%)	.531
Father higher education degree attainment	472 (54.1%)	190 (58.1%)	46 (56.8%)	.450

**Table 2.** Associations between parental psychological distress before and during pregnancy, and after birth and multiple regulatory problems

Steps		Before Pregnancy			During Pregnancy			After birth			
		Marginal effect	SE	p	Marginal effect	SE	p	Marginal effect	SE	p	
1	Maternal psychological distress	0.0170	0.0147	0.249	0.0263	0.0159	0.099	<b>0.0384</b>	<b>0.0177</b>	<b>0.031</b>	
	Paternal psychological distress	-0.0016	0.0153	0.916	0.0137	0.0168	0.417	0.0028	0.0153	0.855	
	<i><b>Infant characteristics</b></i>										
	Age (six months or older)	-0.0170	0.0187	0.364	-0.0169	0.0187	0.368	-0.0135	0.0181	0.456	
	Sex (female)	0.00176	0.0143	0.902	0.00176	0.0144	0.903	0.00117	0.0144	0.935	
	First born both parents	-0.0107	0.0149	0.471	-0.0103	0.0153	0.500	-0.0112	0.0150	0.456	
	<i><b>Maternal characteristics</b></i>										
	Ethnicity (white British)	-0.0421	0.0264	0.113	-0.0412	0.0267	0.124	-0.0384	0.0264	0.147	
	Education (degree or other higher degree)	-0.0002	0.0142	0.987	0.0011	0.0146	0.939	-0.0007	0.0140	0.955	
	Employment status (employed)	-0.0089	0.0151	0.555	-0.0119	0.0147	0.422	-0.0080	0.0150	0.593	
	<i><b>Paternal characteristics</b></i>										
	Ethnicity (white British)	-0.0601	0.0333	0.072	-0.0633	0.0348	0.070	-0.0626	0.0347	0.072	
	Education (degree or other higher degree)	-0.0008	0.0133	0.947	-0.0023	0.0133	0.860	-0.0047	0.0133	0.724	
	Employment status (employed)	0.0027	0.0188	0.884	0.0054	0.0186	0.771	0.0036	0.0187	0.846	
	2	Maternal psychological distress	0.0157	0.0146	0.285	0.0285	0.0160	0.076	<b>0.0379</b>	<b>0.0171</b>	<b>0.028</b>
Paternal psychological distress		-0.0022	0.0151	0.882	0.0093	0.0164	0.570	0.00401	0.0152	0.792	
<i><b>Infant characteristics</b></i>											
Age (six months or older)		-0.0168	0.0181	0.356	-0.0164	0.0181	0.366	-0.0138	0.0175	0.433	
Sex (female)		0.00006	0.0142	0.996	-0.0005	0.0143	0.970	-0.0007	0.0143	0.959	
First born both parents		-0.0136	0.0148	0.358	-0.0135	0.0151	0.373	-0.0144	0.0149	0.334	
<i><b>Maternal characteristics</b></i>											
Ethnicity (white British)		-0.0312	0.0240	0.196	-0.0308	0.0240	0.201	-0.0277	0.0238	0.245	
Education (degree or other higher degree)		0.0015	0.0141	0.914	0.0029	0.0146	0.843	0.0014	0.0139	0.917	
Employment status (employed)		-0.00598	0.0152	0.695	-0.00895	0.0148	0.546	-0.00515	0.0151	0.733	

<b><i>Paternal characteristics</i></b>									
Ethnicity (white British)	-0.0623	0.0330	0.060	-0.0660	0.0343	0.056	-0.0651	0.0346	0.062
Education (degree or other higher degree)	0.0021	0.0131	0.871	0.0004	0.0131	0.975	-0.0020	0.0131	0.875
Employment status (employed)	0.0072	0.0178	0.684	0.0099	0.0176	0.570	0.0086	0.0175	0.621
<b><i>Perinatal factors</i></b>									
Preterm birth	-0.0208	0.0188	0.270	-0.0245	0.0190	0.198	-0.0224	0.0193	0.247
Low birthweight	0.0797	0.0283	0.005	0.0812	0.0284	0.005	0.0811	0.0280	0.004
Breastfeeding	0.0057	0.0179	0.749	0.0067	0.0182	0.713	0.0059	0.0179	0.741

Marginal effects at sample means, which reflect percentage points. Bold face type indicates significant findings.

**Figure 1.** Percentages of crying, sleeping, feeding and multiple regulatory problems according maternal and paternal psychological distress

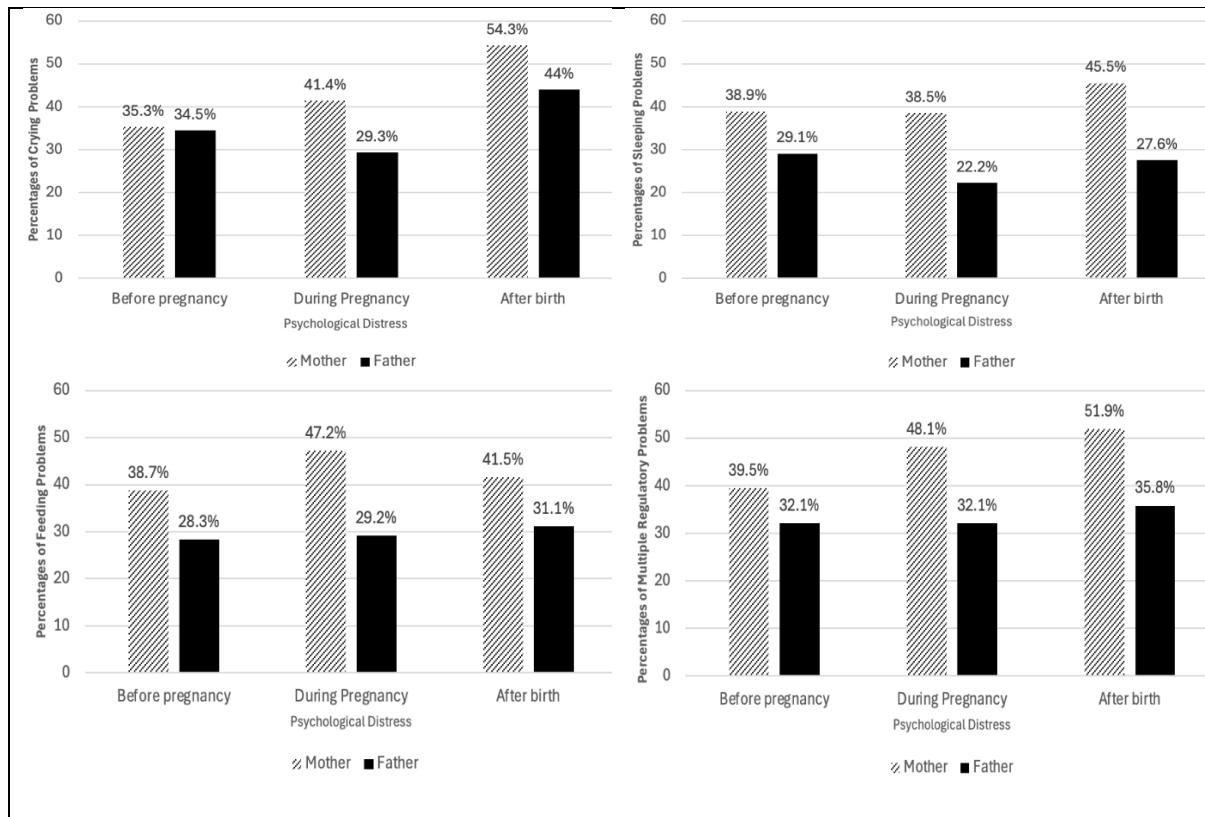
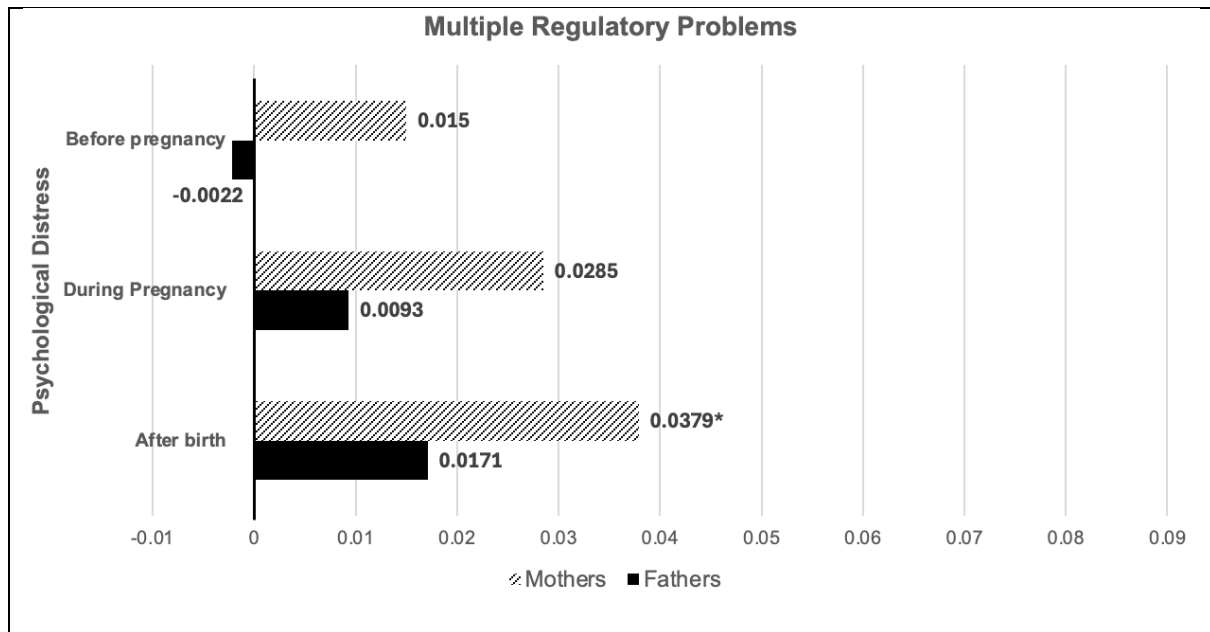


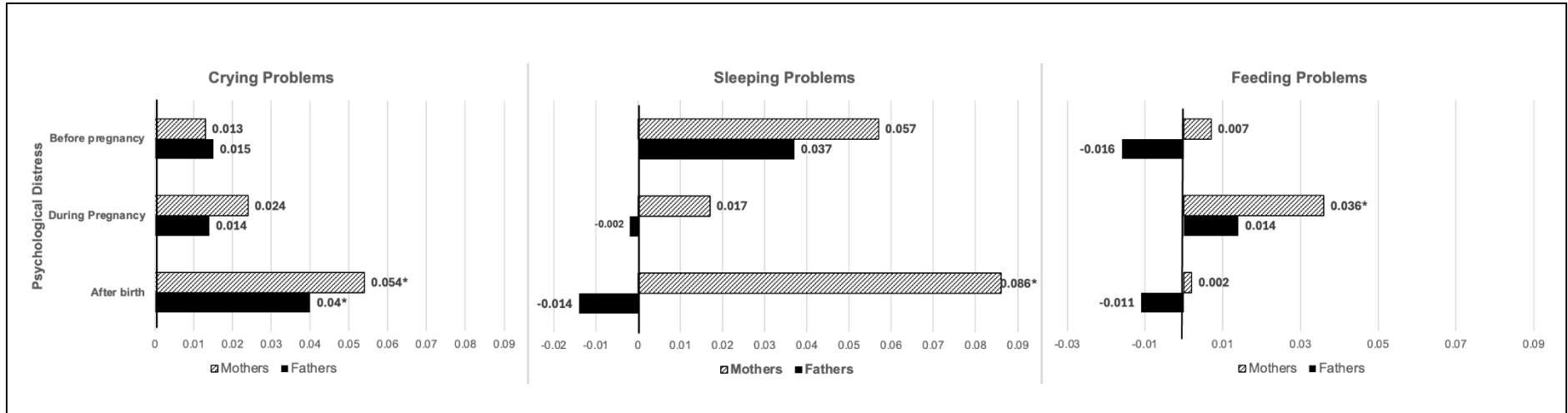
Figure 2. Associations between parental psychological distress before and during pregnancy, after birth and multiple regulatory problems



\* $p < .05$



Figure 3. Associations between parental psychological distress before and during pregnancy, after birth and single regulatory problems



\*p<.05

## Appendix.

Table A1. Detailed summary of measures

Measure	Associated variables		Waves	Respondent
	Variable	Label		
Regulatory problems	<b>nbclmprb</b>	Problems calming child	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	Child's biological mother
	<b>nbfuss</b>	Amount of fussing or crying		
	<b>nbsleep</b>	Time for child to settle into sleep		
	<b>nbwakes</b>	Number of times child wakes at night		
	<b>nbrefeat</b>	Refuses to eat statement		
	<b>nbnoapp</b>	No appetite statement		
General Health Questionnaire (GHQ-12)	<b>scghq2_dv</b>	Subjective wellbeing (GHQ): Caseness	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Child's biological mother  and  Child's biological father  Note: Each parent responds individually these set of questions as part of their adult interview.
Child's age	<b>doby_dv</b>	Year of birth	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	Child's biological parent
	<b>dobm_dv</b>	Month of birth		
Child's sex	<b>sex_dv</b>	Sex		
Firstborn	<b>ch1by_dv</b>	First biological child birth year		
	<b>ch1bm_dv</b>	First biological child birth month		
Preterm	<b>bwtxp</b>	Child born when expected		
	<b>bwtel</b>	Child born early or late		
Breastfed	<b>brfed</b>	Breastfeed		
Birthweight	<b>bwtlb</b>	Birthweight in pounds		
	<b>bwtoz</b>	Birthweight in ounces		
	<b>bwtk</b>	Birthweight kilograms		
Parental age	<b>dvage</b>	Age from date of birth	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	Child's biological mother  and
Parental employment status	<b>jbstat</b>	Current labour force status		
Parental ethnicity	<b>racel_dv</b>	Ethnic group		

**Table A1. Detailed summary of measures**

Measure	Associated variables		Waves	Respondent
	Variable	Label		
Parental education	<b>hiqual_dv</b>	Highest qualification		Child's biological father  Note: Each parent responds individually these set of questions as part of their adult interview.
Household income	<b>fihhmnet3_dv</b>	Total household net income	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	Household participant answering the household questions
	<b>ieqmoecd_dv</b>	Modified OECD equivalence scale		
Other adults	<b>nadoecd_dv</b>	Number of adults aged 14+ in the household, OECD definition		

**Table A2. Parental psychological distress before and during pregnancy, after birth and single regulatory problems including perinatal controls**

Model	Crying Marginal effects (SE)	p	Sleeping Marginal effects (SE)	p	Feeding Marginal effects (SE)	p
<b><i>Before pregnancy</i></b>						
Maternal psychological distress	0.013 (0.020)	0.506	0.037 (0.028)	0.192	0.007 (0.014)	0.629
Paternal psychological distress	0.015 (0.021)	0.453	0.057 (0.032)	0.076	-0.016 (0.015)	0.281
<b><i>During pregnancy</i></b>						
Maternal psychological distress	0.024 (0.020)	0.227	0.017 (0.028)	0.522	<b>0.036 (0.017)</b>	<b>0.036</b>
Paternal psychological distress	0.014 (0.021)	0.499	-0.002 (0.030)	0.931	0.014 (0.017)	0.429
<b><i>Post pregnancy</i></b>						
Maternal psychological distress	<b>0.054 (0.023)</b>	<b>0.023</b>	<b>0.086 (0.032)</b>	<b>0.008</b>	0.002 (0.017)	0.903
Paternal psychological distress	<b>0.040 (0.020)</b>	<b>0.045</b>	-0.014 (0.029)	0.638	-0.011 (0.015)	0.487

Marginal effects at sample means, which reflect percentage points. Robust standard errors in parentheses. Bold type face indicates statistical significance.

All analyses were controlled for the following covariates: age, sex (female = 1), firstborn of both parents, mother's and father's ethnicity, educational attainment, employment status, preterm, low birthweight, and breastfed.

**Table A3.** Moderating role of child sex and birth order on the association between parental psychological distress after birth and early regulatory problems

Moderator	Multiple		Crying		Sleeping		Feeding	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
<b><i>Child's sex</i></b>								
Maternal GHQ	0.092 (0.2081)	<b>0.036</b> <b>(0.0170)</b>	0.230 0.1742	<b>0.053</b> <b>(0.0236)</b>	<b>0.377</b> <b>(0.1514)</b>	<b>0.087</b> <b>(0.0324)</b>	0.168 (0.2061)	0.003 (0.0177)
Maternal GHQ * Sex	0.424 (0.2874)		0.193 0.2445		-0.134 (0.2135)		-0.301 (0.2833)	
Paternal GHQ	-0.038 (0.2013)	0.004 (0.0151)	0.277 0.1666	<b>0.041</b> <b>(0.0203)</b>	-0.0001 (0.1535)	-0.014 (0.0297)	-0.357 (0.1962)	-0.011 (0.0160)
Paternal GHQ * Sex	0.158 (0.2887)		-0.041 0.2477		-0.100 (0.2141)		0.506 (0.2657)	
Child' sex	-0.201 (0.1931)	0.0005 (0.0142)	-0.167 0.1767	-0.017 (0.0180)	0.242 (0.1347)	0.045 (0.0265)	-0.101 (0.1622)	-0.004 (0.0154)
<b><i>First born</i></b>								
Maternal GHQ	0.234 (0.1662)	<b>0.036</b> <b>(0.0170)</b>	0.188 (0.1532)	<b>0.051</b> <b>(0.0235)</b>	0.267 (0.1382)	<b>0.086</b> <b>(0.0321)</b>	0.087 (0.1759)	0.003 (0.0175)
Maternal GHQ * First born	0.261 (0.2998)		0.424 (0.2605)		0.097 (0.2077)		-0.180 (0.2958)	
Paternal GHQ	0.078 (0.1717)	0.004 (0.0152)	0.166 (0.1483)	<b>0.041</b> <b>(0.0202)</b>	0.082 (0.1409)	-0.016 (0.0295)	-0.132 (0.1588)	-0.011 (0.0158)
Paternal GHQ * First born	-0.130 (0.3261)		0.303 (0.2784)		-0.362 (0.2214)		0.104 (0.2644)	
First born	-0.198 (0.2067)	-0.014 (0.0148)	<b>-0.475</b> <b>(0.2049)</b>	-0.027 (0.0178)	<b>0.387</b> <b>(0.1353)</b>	<b>0.088</b> <b>(0.0288)</b>	0.110 (0.1615)	0.011 (0.0169)
<b><i>Total of infants</i></b>	<b>1,274</b>	<b>1,274</b>	<b>1,274</b>	<b>1,274</b>	<b>1,274</b>	<b>1,274</b>	<b>1,274</b>	<b>1,274</b>

Marginal effects at sample means. Robust standard errors in parentheses. Bold and italic: Statistically significant at the 99% confidence level; bold: Statistically significant at the 95% confidence level.

Figure A1. Final sample sizes used in the analysis

