


# Linking maternal psychopathology to children's excessive crying and sleeping problems in a large representative German sample—The mediating role of social isolation and bonding difficulties

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## Abstract

Attaining self-regulation is a major developmental task in infancy, in which many children show transient difficulties. Persistent, clinically relevant difficulties in self-regulation include excessive crying or sleeping disorders. Many families with affected children are burdened with multiple psychosocial risk. This suggests that regulatory problems are best conceptualized as the maladaptive interplay of overly burdened parents and a dysfunctional parent–child interaction. The current study examines whether social isolation and bonding difficulties function as mediating mechanisms linking maternal psychopathology to (1) children's excessive crying and (2) sleeping problems. The sample comprised  $N = 6598$  mothers ( $M = 31.51$  years) of children between zero to three years of age ( $M = 14.08$  months, 50.1% girls). In addition to socio demographic data, the written questionnaire included information on maternal depression/anxiety, isolation, bonding, and children's regulatory problems. Hypotheses were tested with a mediation model controlling for psychosocial risk and child characteristics. As expected, maternal symptoms of depression/anxiety were linked to

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infants' excessive crying and sleeping problems. Social isolation and bonding difficulties mediated this association for excessive crying as well as for sleeping problems, but social isolation was a single mediator for sleeping problems only. The findings provide important insights in the mediating pathways linking maternal psychopathology to children's regulatory problems.

## 1 | INTRODUCTION

Attaining self-regulation is a major developmental task in infancy, which builds on children's predisposed capacities (e.g., physiological maturation) as well as on parents' coregulatory support during parent–child interactions (Papoušek, 2011; Tronick, 1989). However, not all infants are equally successful in achieving this task. Whereas transient difficulties in self-regulation are common during the first years of life, a significant minority of infants and toddlers suffers from persistent regulatory problems (Olsen et al., 2019; Wake et al., 2006). These include excessive and inconsolable crying of more than 3 hours per day, 3 days a week over 3 weeks (“rule of threes”, Wessel et al., 1954), and significant problems falling asleep within 30 min or sleeping through the night without multiple, prolonged awakenings over weeks (ZERO TO THREE., 2016).

Prevalence rates greatly vary depending on age, definition, and assessment method, but on average, about six percent of infants older than three months cry excessively (Olsen et al., 2019; von Kries et al., 2006; Wake et al., 2006), and up to every fifth infant seems to have sleeping problems (Castro Dias & Figueiredo, 2020; Olsen et al., 2019; Wolke et al., 1998). Persistent regulatory problems go along with a considerable amount of distress for infants and their families. Furthermore, longitudinal studies and meta-analyses show that these problems are linked to later behavioral difficulties, such as conduct problems, hyperactivity, or attachment disorganization (Bilgin & Wolke, 2020; Hemmi et al., 2011). Hence, understanding risk factors for infants' regulatory problems is of major importance in order to prevent maladaptive trajectories of child and family development.

Theoretical models emphasize that persistent regulatory problems or clinically relevant disorders such as excessive crying disorder and sleep onset or night waking disorder (ZERO TO THREE., 2016) are determined by a multitude of causes. Generally, they are best understood in a relational context. Papoušek (2004) suggests that persistent regulatory problems are often embedded in a family system characterized by high parental psychosocial burden and a dysfunctional parent–child interaction. Maternal psychopathology was found to be particularly salient as it negatively impacts the mother–child relationship as well as child adjustment including self-regulation (Madigan et al., 2018; Petzoldt et al., 2016; Radesky et al., 2013). The parent–child relationship is a core mediating link between parental risk factors such as maternal psychopathology and children's regulatory problems. Social isolation or bonding difficulties due to parent or child factors such as those mentioned above might impair this relationship. Building on this evidence and based on a representative sample of families with young children in Germany, this study aims to further clarify the role of maternal psychopathology (i.e., symptoms of depression and anxiety) for children's regulatory problems (i.e., excessive crying and sleeping problems) by investigating perceived social isolation due to the parental role and difficulties in bonding as likely mediators.

## 1.1 | Risk factors for infants' regulatory problems: A focus on maternal psychopathology

In addition to pre- and perinatal risk factors such as premature birth, child medical conditions (e.g., gastrointestinal reflux) are also significantly linked to early regulatory problems (Schmid et al., 2011; St James-Roberts & Conroy, 2005; Wolke et al., 1998). Yet, generally underlying organic causes seem rare (Akhnikh et al., 2014). Likewise, a difficult child temperament—with high negative affectivity and irritability—is seen as a risk factor and correlate of excessive crying and sleeping disorders (e.g., Sidor et al., 2017). Beyond child characteristics, persistent regulatory problems cannot be understood without their relational context. Highly burdened parents and a dysfunctional parent–child interaction seem to impede children's chances for building self-regulatory competencies (e.g., Papoušek, 2004).

The role of parental characteristics has long been a focus of researchers. Particularly, maternal psychopathology was found to impair the mother–child relationship and be linked to children's compromised adjustment both cross-sectionally (Feldman et al., 2009; Graham et al., 2018; Granat et al., 2017) and longitudinally (e.g., Madigan et al., 2018). Symptoms of postpartum depression and anxiety disorders also increase the risk for infants' regulatory disorders (Richter & Reck., 2013; O'Connor et al., 2007; Petzoldt et al., 2016; Righetti-Veltema et al., 2002) including excessive crying and sleeping problems (Mohr et al., 2019; Radesky et al., 2013; Wake et al., 2006). For example, Righetti-Veltema et al. (2002) found that three-month-old infants of postpartum depressed mothers were significantly more likely to cry excessively or have sleeping difficulties than infants of nondepressed mothers. Furthermore, depressed mothers felt less appreciated after giving birth, experienced lower support from their partner and had more difficulties bonding with their child, that is, felt awkward with the child and expressed less pleasure with the child than nondepressed mothers. The differences found in this study are in line with many research findings suggesting that a dysfunctional parent–child interaction, for example, bonding difficulties, provides a central mediating path in the association of maternal depression and anxiety with children's excessive crying and sleeping problems (Hemmi et al., 2011).

## 1.2 | Social isolation and bonding difficulties as mediators linking maternal psychopathology to infants' regulatory problems

A dysfunctional parent–child interaction can take various forms such as distressing negative reciprocity, high levels of parenting stress, bonding difficulties, high irritability of the child and (associated) feelings of social isolation (Papoušek, 2011).

Thus, parenting stress is a well-documented risk factor for infants' excessive crying behavior (Bailhache et al., 2019; Beebe et al., 1993; Müller et al., 2016; Rautava et al., 1993) and for sleeping problems (Hairston et al., 2016; Olsen et al., 2019; Sadeh et al., 2010). Highly stressed parents are more likely to react aggressively to children's excessive crying, for example, by shaking their infants unwittingly—with serious consequences for the child (see Lang et al., 2022; Reijneveld et al., 2004; Zeifman & St James-Roberts, 2017). But even in less serious cases, early regulatory problems are associated with higher parenting stress in both parent-related subscales of the Parenting Stress Index (PSI), that is, parental distress and dysfunctional parent–child interaction (Sidor et al., 2013).

Associated with—and sometimes part of—parenting stress are negative feelings in the parenting role, for example, helplessness and social isolation or difficulties establishing a positive relationship with the child. This is particularly important in times of heightened distress and mental health impairments, for example, in the course of maternal psychopathology or infants' regulatory problems (Mulsow et al., 2002; cf. Papoušek & Hofacker, 1998).

### 1.2.1 | Social isolation

Lack of social support, for example, not receiving help with childcare or advice on nurturing the child, increases the risk of maternal social isolation. Therefore, it is well known as a substantial correlate of peripartum depression and anxiety, leading mothers to feel isolated or to actively withdraw from potentially beneficial social support systems (Beck, 2001; Biaggi et al., 2016; Field, 2018; Lancaster et al., 2010). Adding to this body of research, in a large cross-sectional study of Australian mothers with newborns, Eastwood et al. (2013) found social exclusion and isolation—as well as a lack of maternal responsiveness and infants' sleeping problems and difficulties being comforted—to be significantly linked to postpartum depression. Focusing on child regulatory problems, a very recent study on the impact of the SARS-CoV-2 pandemic shows that mothers with higher levels of depression and infants born during the first lockdown (vs. those born before the pandemic) were reported to have higher levels of sleeping and crying problems (Perez et al., 2021). However, the association between social isolation and regulatory problems is less clear. In a German clinical sample comparing mothers of extremely and moderately crying infants with a control group, prenatal risk factors such as psychological stress, partnership conflicts, and social isolation were found to be significantly more likely among mothers with excessively crying infants (Papoušek & Hofacker, 1998). Moreover, another study found postpartum, maternal depression and social isolation to be more likely among mothers with excessively and moderately crying babies. Other findings on excessive crying—and to a lesser extent, on sleeping problems—point to the same direction (Bernier et al., 2013; Martini et al., 2017; Rautava et al., 1993; Wurmser & Papoušek, 2004). Yet, a recent study on maternal and infants' sleep disturbances found only maternal sleeping problems to be negatively linked with social support (Mersky et al., 2020). Accordingly, evidence regarding the role of social support for children's regulatory problems is not conclusive. In order to add to this body of research, we test the hypothesis that experienced social isolation mediates the link of maternal mental health problems on infants' self-regulation by undermining the mother–child relationship for which a similar mediating role is assumed (e.g., Tichelman et al., 2019).

### 1.2.2 | Bonding difficulties

Numerous studies show the detrimental effects of depression on parenting and the mother–child relationship (Bernard et al., 2018; Lovejoy et al., 2000; Madigan et al., 2018; Martini et al., 2015; Stevenson-Hinde et al., 2013). Research has consistently linked postpartum depression to bonding impairment (Brockington et al., 2001; Moehler et al., 2006; Reck et al., 2006), which is characterized by a lack of maternal feelings and difficulties in identifying the child's feelings and needs (Brockington et al., 2001; Rossen et al., 2019). The severity of depressive symptoms plays a crucial role in this (Reck et al., 2006), but even subclinical depressive symptoms negatively affect the developing bond between mother and child (Moehler et al., 2006). The same pattern seems to hold for maternal anxiety (Ierardi et al., 2019; Müller et al., 2016; Seymour et al., 2015). Besides its link to depression itself, social support is also longitudinally linked to mother–infant attachment quality (Schmidt et al., 2016). Correspondingly, an intervention study found a stronger decrease in bonding problems among isolated mothers who received support compared to a control group (Yuan & Freeman, 2011).

Mother–infant bonding, in turn, provides a key context for children's self-regulation. Mothers with excessively crying infants report significantly higher values of impaired bonding than those without (Sidor et al., 2012). Moreover, even antenatal positive maternal feelings and bonding are linked to less excessive crying in infants (Kommers et al., 2017), which was also shown by a recent meta-analysis

(Le Bas et al., 2020). Similarly, Hairston et al. (2011) found infants' sleep disturbances to be associated with difficulties in mother–infant bonding, while mothers' higher emotional availability led to fewer night awakenings (Philbrook & Teti, 2016).

Summarizing these findings, available evidence suggests that parental stressors such as social isolation and bonding difficulties are likely to play an important mediating role in linking maternal psychopathology to children's regulatory problems. While many studies disclosed important bivariate links to children's regulatory problems, evidence on the more complex structure of associations between various factors linked with excessive crying or sleeping problems is scarce.

### 1.3 | The current study

This study aims to shed light on the association between symptoms of maternal psychopathology and children's excessive crying and sleeping problems using a representative German community sample of mothers with children aged zero to three years. We expect a significant link of maternal depressiveness and/or anxiety to both child outcomes. Following the model of Papoušek (2004), we employ a cross-sectional mediation model using a weighted sample and controlling for further psychosocial burden. In seeking to explain the link of maternal anxiety and depression symptoms to (1) excessive crying and (2) sleeping problems, we consider social isolation and bonding difficulties as mediators. Furthermore, social isolation is regarded as a predictor for bonding difficulties (see Schmidt et al., 2016). Since our two mediators are not the only potential mechanisms linking maternal psychopathology to children's regulatory problems, we expect a partial mediation only. To identify potential confounders that have to be controlled for when testing the model, we analyzed potential pre-, peri-, and postnatal risk factors known from previous research (Castro Dias & Figueiredo, 2020; Thiel-Bonney & Cierpka, 2015; Wurmser & Papoušek, 2004).

## 2 | MATERIAL AND METHODS

### 2.1 | Sample

The current study was part of a large nationwide representative study called “Children in Germany [Kinder in Deutschland]—KiD 0–3” aiming to investigate the prevalence of psychosocial adversities in infants and toddlers as well as to monitor families' use of preventive support services in Germany (Eickhorst et al., 2016). The KiD 0–3 study was conducted as part of a long-term policy program (*Federal Initiative for Early Childhood Intervention [Bundesinitiative Frühe Hilfen]*) by the National Centre for Early Prevention in accordance with the ethical standards of the national research committee and with the Declaration of Helsinki (1964) in its current version (World Medical Association, 2013). Written informed consent was obtained from all participants included in the study. The sampling strategy and the questionnaire of the national main study was carefully piloted (Eickhorst et al., 2015), and ethical approval for the pilot studies was granted by the General Medical Council in the North-Rhine region (No 2013247).

To ensure high participation rates and representativeness of the sample, families were recruited during one of the routine child development examinations in Germany between age 4–5 weeks (checkup “U3”) and 34–36 months (“U7”). In Germany, almost all children (U3–U7: at least 99.0%; Schmidtke et al., 2018) take these examinations, which are covered by statutory health insurance. Data collection was organized by the market research company Kantar Health Germany. A total of

TABLE 1 Descriptive statistics of the sample

Mean age of mothers (SD)	31.5 years (5.4)
Mean age of the other biological parent (SD)	34.6 years (6.6)
Parental education (ISCED; in %)	14.6% low education 55.1% intermediate education 30.3% high education
Employment status (in %)	22.8% employed 64.7% maternal leave 12.5% not employed/unemployed
Employment status of the other parent (in %)	88.5% employed 4.9% parental leave 6.5% not employed/ unemployed
Welfare receipt ("SGB-II Bezug") (in %)	19.2%
Family Form (in %) <sup>a</sup>	89.0% nuclear family 9.1% single parent family 5.2% stepfamily or partnership with non-biological parent
Child mean age (SD)	14.1 months (10.9)
Child gender: Male (in %)	49.9%
Only child (in %)	46.9%
History of migration child (in %)	29.1%

<sup>a</sup>Due to multiple response format the percentages sum up to >100%.

271 pediatric practices participated as study centers for KiD 0–3 and received financial incentives for their participation.

Altogether, 8063 families completed a written questionnaire, which was available in six languages, between April and September 2015. This was equivalent to a response rate of 75.0%. For the purpose of this study, the sample was constricted to mothers and all other participants were excluded ( $n = 532$  fathers,  $n = 164$  both parents and  $n = 45$  others, e.g., grandparents). Also  $n = 111$  children with chronic diseases or disabilities as well as children older than 38 months (age limit for the routine examination "U7a") were excluded, since we aimed to shed light on normally developed children aged zero to three years. Thus, the final sample comprised  $N = 6251$  mothers with young children (unweighted sample  $N = 6598$ ). Sociodemographic characteristics are provided in Table 1. Due to missing values in items used in the analyses, the number of valid  $N$  varies between analyses. Full information on all variables used in the mediation model was available for  $N = 5264$  regarding the model on excessive crying, and  $N = 5336$  regarding the model on sleeping problems.

## 2.2 | Measures

The questionnaire given to the parent in the waiting room of the pediatric practice included sociodemographic data, psychosocial adversities on the level of child, parent, and family, as well as knowledge and use of prevention services. For the current analyses, the following information and measures were used:

### 2.2.1 | Regulatory problems

*Excessive Crying.* Crying length and duration were measured with three yes/no questions developed by the KiD 0–3 study team according to the 'rule of threes' (Wessel et al., 1954). Additionally, together



with one dichotomized item on a four-point Likert scale (“Are you able to settle child easily?”; scale from “not at all” to “very much”), a sum index with values from 0 to 4 was built based on the diagnostic criteria for excessive crying disorder (ZERO TO THREE., 2016). However, following the logic of the A-criterion of the DSM, at least one response regarding the items assessing the rule of threes had to be confirmative before the item on soothing was counted. The mean value in this sample was low ( $M = 0.16$ ;  $SD = 0.61$ ), but 9.1% of mothers reported at least one symptom of excessive crying. Two percent of the children fulfilled all criteria of excessive crying according to Wessel et al. (1954).

*Sleeping problems.* Sleeping problems were assessed with two items on a four-point Likert scale (e.g., “How much time does child need to fall asleep?”; from “less than 15 min” to “more than 60 min”) and four further yes/no questions adapted from the Questionnaire for Crying, Feeding, and Sleeping (Groß et al., 2013). The first two items were dichotomized according to the diagnostic criteria of clinically relevant sleeping behavior (ZERO TO THREE., 2016). Again, following the A-criterion logic, only if one of the problems falling asleep or sleeping through the night was checked “yes”, the other answers were counted as well. A sum index with values from 0 to 6 was built on the diagnostic classifications for Sleep Onset and Night Waking Disorders (ZERO TO THREE., 2016). The mean value was  $M = 1.20$  ( $SD = 1.28$ ). According to DC: 0%–5%, 10.7% of children fulfilled all criteria of a Sleep Onset Disorder and 2.5% of a Night Waking Disorder.

## 2.2.2 | Maternal psychopathology and parent-child-interaction

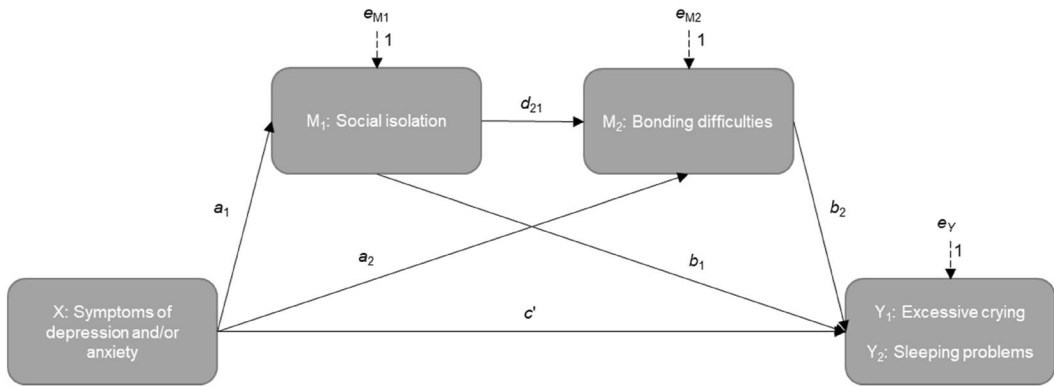
*Symptoms of depression and anxiety.* The German four-item short version of the Patient Health Questionnaire was used (PHQ-4; Löwe et al., 2010). The questionnaire comprises two items asking for symptoms of depression and two items asking for symptoms of anxiety in the last 2 weeks on a six-point scale from “never” to “always”. The scale had a good internal consistency of  $\alpha = 0.81$  with a mean value of 1.61 ( $SD = 1.91$ ).

*Social Isolation* (e.g., “Since becoming a parent it is difficult for me to make new contacts”) and *Bonding Difficulties* (e.g., “I sometimes find it hard to empathize with my child”) were assessed with the corresponding subscales isolation and attachment from the German Parenting Stress Index (Abidin, 1995; Tröster, 2011). Each scale comprised four items on a five-point Likert scale from “is not true at all” to “exactly true”, which were summed up (social isolation:  $M = 8.86$ ;  $SD = 3.54$ ; bonding difficulties:  $M = 7.61$ ,  $SD = 2.91$ ). Both had an acceptable internal consistency with Cronbach's  $\alpha$  between 0.70 and 0.71.

*Confounding variables.* Sociodemographic characteristics and pre-, peri-, and postnatal risk factors, which might be considered confounders (Castro Dias & Figueiredo, 2020; Thiel-Bonney & Cierpka, 2015; Wurmser & Papoušek, 2004), were assessed. These factors include sociodemographic characteristics such as age of mother and child, child gender, immigrant background of the child, other minors (siblings) in the household, maternal education according to the International Standard Classification of Education (ISCED), social welfare receipt (poverty risk), household income, and single parenthood. Other risk factors included were unplanned pregnancy, preterm birth, low birth weight or multiple birth, no breastfeeding, and smoking during pregnancy (see Lorenz, Ulrich, Kindler, & Liel, 2020; Lorenz, Ulrich, Sann, & Liel, 2020, for additional information regarding measures).

## 2.3 | Data analyses

We used the Statistical Package for Social Sciences (IBM™ SPSS® v. 22.0.0.2) for all analyses. Power estimates were computed using “MedPow.R” in “R” (current version 4.0.2). Selection biases were



**FIGURE 1** Mediation model of the statistical effects of maternal depression and anxiety on children's regulatory problems via social isolation and bonding difficulties

countered with a combination of post-stratification- and design-weight according to the German Census data 2011 for families with infants and toddlers for the current analyses. According to guidelines on missing values, this might be the best approach if the sample size is large enough ( $n \geq 1000$ ), that is, there is no lack of statistical power, the proportion of missing data per item does not exceed 10%, and a representative sample was used (Cheema, 2014). Since these requirements were met in this study, we chose to use listwise deletion after employing a sampling weight to deal with missing data.

We were interested in seeing whether symptoms of depression and anxiety were linked to infants' excessive crying and sleeping problems, controlling for sociodemographic and confounding variables. Also, experienced social isolation and bonding difficulties were tested as mediators of this link. In a first step, we examined Pearson correlations between the study and confounding variables, and thereupon integrated significantly associated variables in our models. We carried out conditional process analyses—a regression-based approach—using the SPSS®-macro “PROCESS” (v3.4; Hayes, 2018). We tested the models (one for each dependent variable) depicted in Figure 1. Additionally, we controlled these models for potential confounders if significantly correlated with our outcomes.

The model (see Figure 1) estimates the indirect effects of symptoms of depression and/or anxiety on excessive crying or rather sleeping problems via (1) social isolation (path  $a_1b_1$ ), (2) bonding difficulties (path  $a_2b_2$ ), and (3) social isolation and bonding difficulties in serial (path  $a_1d_{21}b_2$ ). Likewise, (4) the direct effect of symptoms of depression and/or anxiety on excessive crying or sleeping problems, respectively (path  $c'$ ), is tested.

The standard errors and confidence intervals of the indirect (mediated) effects are bootstrapped and bias-corrected ( $n = 5,000$  samples). Empirical  $p$  values are two-tailed (critical  $\alpha = 0.025$  after the Bonferroni adjustment).

### 3 | RESULTS

#### 3.1 | Preliminary analyses

Pearson correlations between study and confounding variables are listed in Table 2. The significantly associated variables were considered as predictors in our models. Social isolation, bonding difficulties, maternal depression and/or anxiety, no breastfeeding, history of migration, unplanned pregnancy, smoking during pregnancy, single motherhood, and social welfare receipt correlated significantly positively with excessive crying while child age, maternal education, maternal age, and siblings within



**TABLE 2** Pearson correlations between study variables and excessive crying as well as sleeping problems

	1	2
1. Excessive crying	-	
2. Sleeping problems	0.204**	-
3. Depression/Anxiety	0.151**	0.128**
4. Social isolation	0.102**	0.154**
5. Bonding difficulties	0.182**	0.211**
6. Child age	-0.088**	-0.238**
7. Maternal education	-0.070**	0.061**
8. Maternal age	-0.100**	-0.009
9. Single motherhood	0.053**	-0.010
10. History of migration	0.037**	0.073**
11. Siblings in the household	-0.026*	-0.079**
12. Welfare receipt	0.059**	-0.003
13. No breastfeeding	0.035**	-0.069**
14. Unplanned pregnancy	0.084**	0.029*
15. Smoking during pregnancy	0.070**	-0.006
16. Neonatal problems	0.020	-0.009

\* $p < 0.05$ . \*\* $p < 0.01$ 

family correlated significantly negatively with excessive crying. Social isolation, bonding difficulties, depression and/or anxiety, maternal education, history of migration, partnership violence, and unplanned pregnancy correlated significantly positive with sleeping problems, while child age, lack of breastfeeding, smoking during pregnancy, maternal age, single motherhood, and siblings correlated significantly negatively with sleeping problems. All associations of these analyses were small to very small.

### 3.2 | Total effect model on excessive crying

As shown in Table 3, there was a significant statistical positive total effect of symptoms of depression and/or anxiety on excessive crying ( $p < 0.001$ ): Mothers with increased symptoms of depression and/or anxiety reported higher levels of excessive crying. Additionally, there were significant positive links of children's excessive crying symptoms ( $p < 0.01$ ) to the following confounders: single parenthood, neonatal problems, and unplanned pregnancy. Maternal and child age were negatively linked ( $p < 0.001$ ) to excessive crying. There were no statistical main effects of maternal education, history of migration, no breastfeeding, smoking, or poverty risk ( $p > 0.01$ ). Overall, this model was significant ( $F(11,5252) = 19,566$ ,  $p < 0.001$ ) and explained 3.9% ( $R^2 = 0.039$ ) of variance in excessive crying.

The total effect of symptoms of depression and/or anxiety on excessive crying was partly due to the significant direct effect (Figure 2, path  $c'$ ;  $B = 0.023$ , S.E. = 0.005,  $t = 4.761$ ,  $p < 0.001$ , 95% CI = [0.013; 0.032]). In addition, two mediating pathways were significant. In line with our hypotheses, the path mediated through bonding difficulties (Figure 2, path  $a_2b_2$ ,  $B = 0.001$ , S.E. = 0.002, 95% CI = [0.007; 0.013],  $\beta = 0.033$ ), and the double mediation through experienced social isolation and bonding difficulties (Figure 2, path  $a_1d_2b_2$ ,  $B = 0.007$ , S.E. = 0.001, 95% CI = [0.005; 0.009],  $\beta = 0.023$ ) was significant in the expected direction: The more symptoms of depression and/or anxiety

TABLE 3 Total effect model on excessive crying

Predictor	<i>B</i>	S.E.	<i>t</i>	<i>p</i>	95% CI lower bound	95% CI upper bound	Standardized coefficient $\beta$
Depression/Anxiety	0.039	0.004	9.433	<0.001	0.031	0.047	0.131
Child age	-0.005	<0.001	-7.977	<0.001	-0.006	-0.004	-0.111
Maternal education	-0.024	0.013	-1.773	0.076	-0.051	0.003	-0.028
History of migration	0.018	0.018	1.012	0.312	-0.017	0.053	0.014
No breastfeeding	0.024	0.021	1.124	0.261	-0.018	0.065	0.016
Unplanned pregnancy	0.050	0.021	2.357	0.019	0.008	0.091	0.035
Neonatal problems	0.015	0.024	0.628	0.530	-0.032	0.062	0.009
Smoking during pregnancy	0.022	0.030	0.720	0.471	-0.037	0.080	0.011
Maternal age	-0.005	0.002	-3.006	0.003	-0.008	-0.002	-0.045
Single motherhood	0.047	0.033	1.435	0.151	-0.017	0.112	0.022
Welfare receipt	-0.019	0.025	-0.765	0.444	-0.069	0.030	-0.013

Note:  $N = 5264$ ; a. Constant:  $B = -0.285$ , S.E. = 0.052,  $t = -5.443$ ,  $p < 0.001$ , 95% CI = [0.182; 0.388].

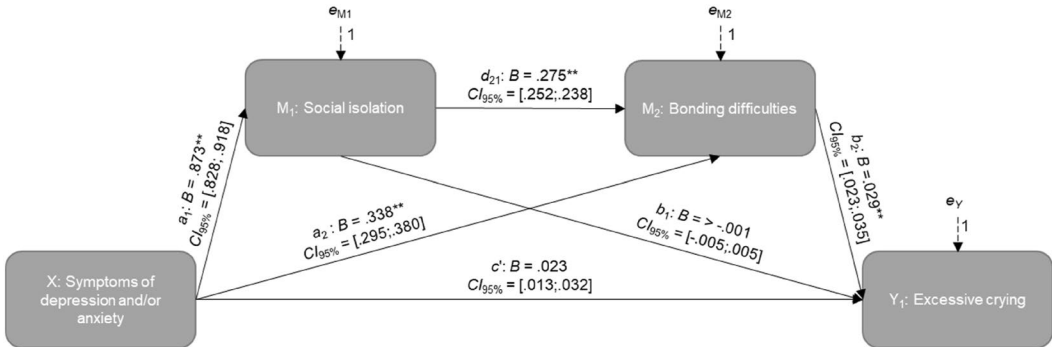


FIGURE 2 Mediation model of the statistical effects of maternal depression and anxiety on the child's excessive crying via social isolation and bonding difficulties. PROCESS-Model 6; Significance level  $*p < 0.05$ .

\*\* $p < 0.01$ ;  $a_1b_1$ : Indirect effect of symptoms of depression and anxiety on excessive crying through social isolation;  $a_2b_2$ : Indirect effect of symptoms of depression and anxiety on excessive crying through bonding difficulties;  $a_1d_{21}b_2$ : Indirect effect of symptoms of depression and anxiety on excessive crying through social isolation and bonding difficulties in serial;  $c'$ : Direct effect of symptoms of depression and anxiety on excessive crying

were reported, the higher were the values for the child's excessive crying symptoms. The path through social isolation only (Figure 2, path  $a_1b_1$ ,  $B = -0.003$ , S.E. = 0.002, 95% CI = [-0.005; 0.005],  $\beta = -0.001$ ) was not significant. Variance inflation can be excluded as the  $VIF \leq 1.530$  for all predictors.

### 3.3 | Total effect model on sleeping problems

As expected, there was a significant positive total effect of symptoms of depression and/or anxiety on sleeping problems ( $p < 0.001$ ), as depicted in Table 4. Mothers with increased symptoms of depression and/or anxiety also reported higher values for their children's sleeping problems. Additionally,

TABLE 4 Total effect model on sleeping problems

Predictor	<i>B</i>	S.E.	<i>t</i>	<i>p</i>	95% CI lower bound	95% CI upper bound	Standardized coefficient $\beta$
Depression/Anxiety	0.096	0.009	10.556	<0.001	0.078	0.114	0.139
Child age	-0.028	0.001	-19.862	<0.001	-0.031	-0.025	-0.259
Maternal education	0.101	0.027	3.678	<0.001	0.047	0.155	0.050
History of migration	0.334	0.039	8.623	<0.001	0.258	0.410	0.123
No breastfeeding	-0.205	0.046	-4.489	<0.001	-0.295	-0.116	-0.061
Unplanned pregnancy	0.027	0.044	0.610	0.542	-0.060	0.114	0.008
Siblings in the household	-0.152	0.034	-4.530	<0.001	-0.218	-0.086	-0.059

Note:  $N = 5336$ ; a. Constant:  $B = 1.232$ , S.E. = 0.077,  $t = 16.003$ ,  $p < 0.001$ , 95% CI = [1.081; 1.383].

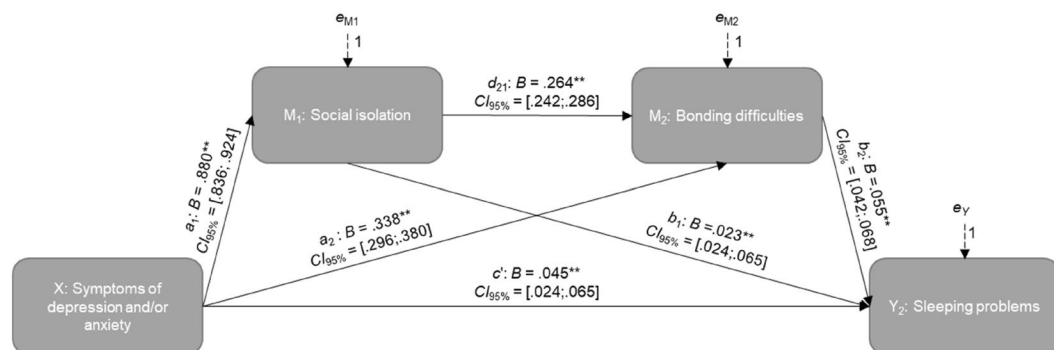


FIGURE 3 Mediation model of the statistical effects of maternal depression and anxiety on the child's sleeping problems via social isolation and bonding difficulties. PROCESS-Model 6; Significance level  $*p < 0.05$ .  $**p < 0.01$ ;  $a_1b_1$ : Indirect effect of symptoms of depression and anxiety on sleeping problems through social isolation;  $a_2b_2$ : Indirect effect of symptoms of depression and anxiety on sleeping problems through bonding difficulties;  $a_1d_{21}b_2$ : Indirect effect of symptoms of depression and anxiety on sleeping problems through social isolation and bonding difficulties in serial;  $c'$ : Direct effect of symptoms of depression and anxiety on sleeping problems

there were significant positive statistical effects ( $p < 0.001$ ) of the following confounders: maternal education, child age, history of migration, no breastfeeding, and siblings within the household. There was no main effect of unplanned pregnancy ( $p = 0.542$ ). Overall, this model was significant ( $F(75,328) = 94.701$ ,  $p < 0.001$ ) and explained 11.1% ( $R^2 = 0.111$ ) of variance in sleeping problems.

The total effect of symptoms of depression and/or anxiety on sleeping problems partly referred to the significant direct effect (Figure 3, path  $c'$ ;  $B = 0.045$ , S.E. = 0.011,  $t = 4.256$ ,  $p < 0.001$ , 95% CI = [0.024; 0.065]). In addition, all three mediating pathways were significant: the path mediated through social isolation only (Figure 3, path  $a_1b_1$ ,  $B = 0.021$ , S.E. = 0.005, 95% CI = [0.010; 0.031],  $\beta = 0.030$ ), the path mediated through bonding difficulties only (Figure 1, path  $a_2b_2$ ,  $B = 0.019$ , S.E. = 0.003, 95% CI = [0.009; 0.016],  $\beta = 0.027$ ), and the double mediated path through experienced social isolation and bonding difficulties (Figure 3, path  $a_1d_{21}b_2$ ,  $B = 0.013$ , S.E. = 0.002, 95% CI = [0.009; 0.016],  $\beta = 0.018$ ). Their directions were in accordance with our expectations. Variance inflation can be excluded as the  $VIF \leq 1.268$  for all predictors.

### 3.4 | Power analysis

The power ( $1-\beta$ ) to detect even small effects (standardized  $B = 0.1$ , Cohen, 1977) in a sample of  $N = 5264$  (excessive crying) respectively  $N = 5336$  (sleeping problems) with a critical  $\alpha$ -error of  $\alpha = 0.05$  virtually equals 1. Thus, in the case of nonsignificant results, the  $H_0$  can be rejected in any case with a low error rate. Nonetheless, effects must be interpreted cautiously with respect to effect sizes. In our analyses, small- and medium-sized effects can only be found among the confounders, although not regarding the independent variable or among the mediators.

## 4 | DISCUSSION

Using data from a large representative sample of mothers with children aged 0–3 years in Germany, this study aimed to investigate whether maternal symptoms of depression and/or anxiety were linked to children's excessive crying and sleeping problems, respectively. We employed a cross-sectional mediation model to examine whether social isolation and bonding difficulties served as single and serial mediators explaining this link. Our findings showed that both models linking maternal psychopathology to excessive crying and sleeping problems of infants and toddlers were confirmed. Feeling isolated and having difficulties in bonding explained this link—at least in part.

In line with our expectations, the model seeking to explain children's sleeping problems was found to be significant. The total effect partly reflected a direct, albeit small, effect of maternal psychopathology but also the mediation through all three pathways, that is, through social isolation, bonding difficulties, and both mediators in serial. To our knowledge, this is the first study to shed light on these mediating pathways. Yet, this partly matches the results of earlier studies, which focused on the links between maternal depression, social isolation, and mother-to-infant bonding (Biaggi et al., 2016; Eastwood et al., 2013; Tichelman et al., 2019). Looking at child factors, previous evidence regarding the association of social isolation and children's sleeping problems was less conclusive. Whereas Bernier et al. (2013) found that mothers' perceived social support was linked to children's sleeping problems—with a more pronounced effect in families with lower socioeconomic capacities, others did not find social isolation to be associated with children's sleeping problems (Martini et al., 2015; Mersky et al., 2020). In the current study, we found evidence of the former findings and could show that the link between maternal psychopathology and children's regulatory problems was mediated by social isolation and bonding difficulties. Furthermore, besides shedding light on these two factors as sole mediators, we found a serial mediation and showed that mothers experiencing more symptoms of depression and/or anxiety might feel more social isolated, which in turn is associated with higher levels of bonding difficulties, and these contribute to children's sleeping problems.

The model of effects of maternal psychopathology on excessive crying was also significant. Although this total effect was partly mediated through bonding difficulties and both social isolation and bonding difficulties in serial, social isolation did not function as a sole mediator in this model. This is not in line with previous studies, which showed that families with children who cry excessively are at higher risk to be socially isolated (Papoušek & Hofacker, 1998). However, these findings were seen in a clinical sample, whereas in the current study, the hypothesized model was investigated in a large community sample with only a minority of parents reporting their children to have problems with excessive inconsolable crying. Indeed, our findings indicate that social isolation plays a statistically significant role, though not by itself but via its negative effects on maternal bonding, that is, mothers' ability to read the child's signals and thus react sensitively to the child. This highlights the role of dysfunctional parenting behavior as the core mediator of effects emanating from more distal factors and affecting child development.

However, focusing on the effect size of our results, surprisingly, the (direct) link of maternal depression and anxiety to children's regulatory problems was weaker than expected. So while findings of both mediation models support our assumptions, we must recognize that the statistical effects are rather low, first and foremost in the model on excessive crying. Existing literature points to a consistent, rather medium-sized link of maternal depression and/or anxiety to infant crying and sleeping problems (e.g., O'Conner et al., 2007; Petzoldt et al., 2016; Righetti-Veltima et al., 2002). The investigated mediators have also been shown to affect children's regulatory capacities in previous findings (Hairston et al., 2011; Sidor et al., 2012). Maybe the differing results found here are due to the fact that we did not use a clinical sample, neither for mothers' psychopathology nor for infants' and toddlers' regulatory problems. Instead, the results were obtained from a representative community sample with mothers reporting on their own and on the child's well-being. In these samples, the size of these associations could possibly be rather low.

In any case, the results indicate that other factors may also play a salient role, particularly explaining children's excessive crying. Inspecting standardized coefficients of the investigated covariates, child age was the most pronounced and consistent predictor of excessive crying and of sleeping problems, with fewer difficulties as child age increased. Other covariates varied regarding both outcomes. Besides an unplanned pregnancy reported by the mother—a risk factor that has to be considered more consistently in diagnostics and intervention—and a lower age of mothers, none of the additionally included covariates was significantly related to children's excessive crying. A history of migration was also substantially linked to sleeping problems. In contrast, maternal education and social welfare receipt, as well as siblings in the household and being breastfed, showed only minor links to children's sleeping problems. While these results are in line with other studies (Castro Dias & Figueiredo, 2020; Schmid et al., 2011; Thiel-Bonney & Cierpka, 2015), socioeconomic burden and other psychosocial stressors have been proven stronger elsewhere (e.g., Schmid et al., 2011).

The proposed sequence of effects is only one of several possible and plausible sequences of the factors involved, particularly because of the cross-sectional nature of this study. We focused on the maladaptive interplay of regulatory problems, overly burdened parents, and dysfunctional parent-child interaction, which was proposed by Papoušek (2004) from a psychosocial risk perspective. However, another sequence of effects also seems plausible. Bailhache et al. (2019), for example, found infant crying to be associated with parenting stress cross-sectionally. Moreover, the former indirectly predicted parenting stress 18 months later, mediated by maternal attachment. Likewise, aiming to disentangle the temporal course of these effects, a recent study showed that poorer mother-to-infant bonding was associated with poor infant sleep, which led to maternal insomnia linked to further bonding impairments (Kalmbach et al., 2021). As the current study used cross-sectional data, it did not allow suitable analyses to determine the direction of effects. Altogether, it is plausible to assume that the factors involved are part of a dynamic mutual interplay, which seems to affect family well-being even in the longer term (Lux & Friedmann, *in press*). Future longitudinal studies might shed light on these issues by using causal analytic approaches, such as cross-lagged panel designs.

**Limitations.** The advantages of this large representative sample also come with limitations, particularly regarding assessment. We already pointed to the cross-sectional nature of the data, and to the fact that the effect size was rather small. Since data collection was conducted during parents' waiting time prior to children's regular health checkups and the goal was to investigate a variety of indicators of psychosocial burden, this study had to rely on short—and if possible, validated—measures. To indicate children's excessive crying and sleeping problems, only brief screening measures could be used. These were carefully developed, employing diagnostic criteria and adapting items from a larger commonly used questionnaire on sleeping, feeding, and crying in Germany (Groß et al., 2013). However, in-depth or clinically validated measures of regulatory problems would have been preferred and might have yielded different results. Furthermore, our study had to rely on maternal reports for all measures. This is often also the case in clinical

practice, when parents consult their pediatrician regarding regulatory problems of the child. However, this may have increased shared method variance. Hence, our findings must be interpreted with caution.

## 5 | CONCLUSION

The findings presented here support previous findings suggesting an association between maternal psychopathology and regulatory problems during infancy and toddlerhood. More importantly, we contribute to available research and build on it by showing that this link is partly mediated by social isolation and impaired bonding. These significant findings on the (serial) mediating pathways provide an important guideline for prevention programs to support families with children suffering from regulatory problems. Further prospective longitudinal studies are urgently needed to validate our results and to consider bidirectional associations evident in previous studies (Olsen et al., 2019; Sadeh et al., 2010), thus aiming to disentangle causes and consequences.

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## CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

## INFORMED CONSENT

Informed consent was obtained from all participants included in the study.

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