

Inconsolable Infant Crying and Maternal Postpartum Depressive Symptoms

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KEY WORDS

prevention, crying, colic, maternal depression

ABBREVIATIONS

aOR—adjusted odds ratio

CI—confidence interval

EPDS—Edinburgh Postnatal Depression Scale

RCT—randomized controlled trial

Dr Radesky conceptualized and designed the study, completed the data analysis, drafted the article, and approved the final article as submitted; Drs Zuckerman and Silverstein aided in analysis design, reviewed and revised the article, and approved the final article as submitted; Drs Rivara, Taylor, Lengua, and Ms Barr designed and conducted the randomized controlled trial from which the study data were derived, critically reviewed the article, and approved the final article as submitted; and Dr Barr designed and conducted the randomized controlled trial from which the study data were derived, designed study instruments, aided in analysis design, reviewed and revised the article, and approved the final article as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Studies reveal that mothers of infants with colic (defined by Wessel's criteria of >3 hours per day of distress) are more likely to develop depression. No studies have examined whether the consolability of infant crying predicts maternal depression risk.



WHAT THIS STUDY ADDS: Prolonged inconsolable infant crying has a stronger association with maternal depressive symptoms than overall daily duration of fussing and crying, suggesting that a mother's report of inability to soothe her infant may be a powerful indicator of her depression risk.

abstract

OBJECTIVE: To quantify the extent to which maternal report of inconsolable infant crying, rather than colic (defined by Wessel's criteria of daily duration of fussing and crying >3 hours), is associated with maternal postpartum depressive symptoms.

METHODS: Participants were 587 mothers who were recruited shortly before or after delivery and followed longitudinally. At 5 to 6 weeks postpartum, mothers recorded the duration and mode (fussing, crying, or inconsolable crying) of their infant's distress by using the *Baby's Day Diary*. The Edinburgh Postnatal Depression Scale (EPDS) was administered at enrollment and at 8 weeks postpartum. Using regression models that included baseline EPDS scores and multiple confounders, we examined associations of colic and inconsolable crying with later maternal EPDS scores at 8 weeks postpartum.

RESULTS: Sixty mothers (10%) met the EPDS threshold for "possible depression" (score ≥ 9) at 8 weeks postpartum. For mothers reporting >20 minutes of inconsolable crying per day, the adjusted odds ratio for an EPDS score ≥ 9 was 4.0 (95% confidence interval: 2.0–8.1), whereas the adjusted odds ratio for possible depression in mothers whose infants had colic was 2.0 (95% confidence interval: 1.1–3.7). These associations persisted after adjusting for baseline depression symptoms.

CONCLUSIONS: Maternal report of inconsolable infant crying may have a stronger association with postpartum depressive symptoms than infant colic. Asking a mother about her ability to soothe her infant may be more relevant for potential intervention than questions about crying and fussing duration alone. *Pediatrics* 2013;131:e1857–e1864

Infant colic, traditionally defined as paroxysms of fussing and crying lasting >3 hours per day for >3 days per week, peaks at ~6 weeks of age¹ and occurs in ~20% of infants.² Colic is stressful for caregivers and is associated with elevated depression risk in the postpartum period in several cross-sectional and longitudinal studies.^{3–6} Because maternal depression is a highly prevalent mental health disorder^{7,8} and is associated with adverse child social-emotional and cognitive outcomes,⁹ efforts to prevent or intervene early in the course of maternal depression are important to reduce depression-related morbidity in both mother and child.¹⁰

Most previous studies of the relationship between infant crying and maternal depression have used Wessel's colic criteria to characterize infants' crying behavior. Wessel's criteria were initially defined arbitrarily, based on the total daily duration of fussing and crying, and are now applied widely as a standard definition for colic in both clinical and research reports. Wessel's criteria do not distinguish between different modes of crying (eg, fussing, crying, or inconsolable crying), which may be important for understanding caregiver emotional reactions to infant distress.^{11,12} Evidence suggests that inconsolable crying is particularly upsetting to caregivers and engenders feelings of frustration in the parenting role.¹³ No previous studies have examined whether inconsolable crying predicts maternal depression outcomes.

We therefore conducted a retrospective cohort study nested within a completed randomized controlled trial (RCT)¹⁴ to investigate longitudinal associations of inconsolable infant crying at 5 to 6 weeks of age with maternal depressive symptoms at 8 weeks postpartum, while controlling for preexisting depression, which may influence infant colic^{15–17} and irritability.¹⁸ We hypothesized that

prolonged inconsolable infant crying, rather than the total daily duration of distress (ie, colic), would have a stronger longitudinal association with maternal depression symptoms.

METHODS

Study Design and Participants

Data for this analysis were originally collected for the purposes of an RCT evaluating the efficacy of the *Period of PURPLE Crying* (National Center on Shaken Baby Syndrome, Farmington, UT)¹⁹ educational materials in changing parent knowledge and behaviors regarding infant crying and the dangers of shaking an infant.¹⁴ Study design and procedures of the parent RCT have been reported in greater detail elsewhere.¹⁴ Briefly, mothers of singleton infants were recruited at prenatal classes, maternity wards, and at initial newborn visits to pediatric offices in western Washington State between December 9, 2004, and October 9, 2006. Participants were told that they were enrolling in an evaluation of the *Period of PURPLE Crying* educational program; they were thus not informed of the current study's hypothesis regarding infant crying and depression. Participants were excluded if mothers were non-English speaking or if infants were <34 weeks' gestation or had serious medical conditions. All study procedures were approved by the human subjects committees of Seattle Children's Hospital, the University of British Columbia, and Boston University Medical Center.

At study recruitment, mothers provided informed consent, completed a baseline interview, and were given instructions on completing the *Baby's Day Diary*²⁰ (Fig 1), a 24-hour record of infant and caregiver behaviors to be completed when their infants were 5 to 6 weeks old. Mothers were contacted at 5 weeks postpartum to remind them to

complete the diary, and again the day after diary initiation to answer questions about diary completion. Mothers completed a follow-up interview by telephone at 8 weeks postpartum.

In the initial RCT, baseline depression scores were collected from mothers recruited from prenatal classes and pediatric clinics ($n = 715$). For this nested retrospective cohort study, we selected only mothers recruited through these venues. Of these mothers, 587 (82%) completed the *Baby's Day Diary* and were included in the present analyses. Demographic characteristics were similar between mothers included in the analyses and the control participants (data not shown).

Crying Assessment

Minutes per day of infant distress (fussing, crying, and inconsolable crying) per 24 hours and inconsolable crying per 24 hours were abstracted from the *Baby's Day Diary*²⁰ (Fig 1), a validated instrument whose estimates of duration and frequency of crying bouts correlate highly with audiotaped recordings ($R = .90$ and $.85$, respectively).^{21,22} Quality of recording using the *Baby's Day Diary* has been found not to be biased by caregiver depression symptoms.⁵ Over four 24-hour periods, mothers recorded durations of infant behavioral states (awake alert, fussing, crying, inconsolable crying, feeding, and sleeping); mothers were instructed to report inconsolable crying whenever their infant had "crying that cannot be soothed." Total minutes of each infant behavioral state were averaged over 4 days to arrive at daily duration per 24 hours of fussing, crying, and inconsolable crying for each infant. Infants were dichotomized as to whether they met modified Wessel's colic criteria (average of >3 hours of distress per day), hereafter referred to as "colic." Because we did not have several weeks of crying

Date _____

Please check that the baby ruler is completed with baby codes throughout the day

Baby Codes

- Sleeping
- Awake and Content
- Awake and Fussy
- Awake and Crying
- Unsoothable Crying
- Feeding
- Cannot Remember

Parent Codes

- Body Contact Carrying/Holding

Baby NIGHT (12:00 to 6:00)

Baby MORNING (6:00 to 12:00)

Baby AFTERNOON (12:00 to 6:00)

Baby EVENING (6:00 to 12:00)

Please mark an X for each time you place your baby in a car seat.

Please place a circle each time you pick up your crying baby to comfort your baby.

Circle One Number How frustrating to you was your baby's crying today?

0 1 2 3 4 5

Not at all Hardly A little Somewhat Very Extremely

Please write a letter for the position of your baby each time you place your baby in bed.

B-Back F-Front S-Side

Please place a check mark for each time you put your crying baby down, walk away and take a break.

Was this a typical day? Yes No

If no, please explain _____

You Should Use This Area To Practice

Please Answer These Questions At The End Of Each Day

FIGURE 1
Sample page from the Baby's Day Diary.

reports, we could not classify them based on traditional Wessel's criteria (>3 hours of distress per day for >3 days per week for >3 weeks). We categorized inconsolable crying as a dichotomous variable: none versus any reported inconsolable crying. In addition, to understand the different associations of brief and prolonged inconsolable crying with depressive symptoms, we created a 3-category variable of 0 minutes per day, 20 minutes or less per day, or >20 minutes per day. We chose this 20-minute cutoff because it was roughly 1 SD above the mean for the study sample.

Depression Symptom Assessment

We assessed maternal depressive symptoms with the Edinburgh Postnatal

Depression Scale (EPDS), a validated instrument widely used in clinical and research settings.^{23,24} The EPDS score is a sum of responses to 10 questions about mood and self-harm ideation by using a 2-week recall. A score >12 is considered a positive screen indicative of clinically significant maternal depression, whereas a score of 9 or greater is considered "possible depression."²³ Recent reports have suggested that the lower thresholds of 9 or 10 are more sensitive for detecting episodes of major or subsyndromal depressive disorder in new mothers.^{8,25} This scale was administered over the telephone during the third trimester of pregnancy for mothers recruited at prenatal classes, and either over the telephone or in person to mothers

recruited at pediatricians' offices. The EPDS was administered again to all participants by telephone at the 8 week interview. For mothers with missing data on 1 or 2 EPDS questions ($n = 6$), the value for that response was set as 0. We modeled EPDS score as a dichotomous variable, using a ≥ 9 cutoff as our a priori main outcome measure.

Statistical Analyses

We used Spearman correlations, Kruskal-Wallis tests, and χ^2 tests of association to examine bivariate relationships between infant crying, 8-week EPDS scores, and participant demographic variables.

We built multivariable logistic regression models, individually by using infant colic and inconsolable crying

duration measures as the independent variable, and using 8-week EPDS score ≥ 9 as the dependent variable, by backward elimination techniques. Possible covariates were included based on observation of bivariate relationships with crying duration or EPDS scores, or based on their theoretical relevance to the study question. Covariates included infant gender and gestational age; maternal age, parity, marital status (married/partner or single/divorced/separated), education (high school or less, some college, or college/graduate degree), income ($< \$60\,000$, $\$61\,000$ – $100\,000$, or $> \$101\,000$ annual income), race (self-identified as white or nonwhite), and postpartum employment (unemployed and seeking work, on maternity leave, working, or planning to stay at home), parity, and breastfeeding status (exclusive breastfeeding, formula only, or both). Including recruitment site in the model did not change effect estimates, so it was not included in the final model.

To examine whether preexisting depression symptoms explained the associations between infant crying and 8-week depressive symptoms, we adjusted for baseline EPDS score as a continuous variable in a separate step. We also created interaction terms between baseline maternal depression symptoms and infant inconsolable crying durations to examine whether the effect of inconsolable crying on 8-week depressive symptoms would be stronger in mothers with more pronounced preexisting depression symptoms.

RESULTS

Participating mothers were predominantly white (73.1%), married (88.6%), primiparous (80.1%), held a college degree or higher (70.9%), and were an average of 31 years old (SD 5.2; Table 1). The distribution of inconsolable crying

was positively skewed (Fig 2). Most mothers (56.7%) reported no inconsolable crying, 30.0% reported inconsolable crying ≤ 20 minutes per day, whereas 13.3% reported > 20 minutes per day of inconsolable crying. Approximately 25% ($n = 148$) reported an average of > 3 hours of infant distress daily and therefore met criteria for colic.

There was some overlap between infants who experienced colic and those who cried inconsolably. Of the 148 infants with colic, 95 (64.2%) also had inconsolable crying of any recorded duration, and 45 (30.4%) cried unsoothably for > 20 minutes per day. However, of the 254 infants with any inconsolable crying recorded, 62.6% did not meet colic criteria.

Ten percent of mothers ($n = 60$) had an 8-week EPDS score ≥ 9 . Correlation between baseline EPDS scores and EPDS scores at 8 weeks postpartum was moderately strong ($R = 0.31$). Twenty (3.5%) mothers met criteria for possible depression at both time points, 101 (17.1%) had possible depression at one time point or the other, and 459 (79.4%) of mothers did not meet these criteria at either assessment.

Inconsolable infant crying was not significantly related to any maternal or household characteristics other than elevated baseline EPDS score (Table 1). Rates of possible depression at 8 weeks postpartum were higher among mothers with an elevated baseline EPDS score and those planning to stay at home. Mothers who were nonwhite, primiparous, formula-feeding their infant, or those with annual household incomes $< \$60\,000$ were more likely to have an 8-week EPDS score ≥ 9 , although these associations did not reach statistical significance.

Mothers with an 8-week EPDS score ≥ 9 had recorded an average of 170.5 minutes (SD 69.0) of total daily distress

when the infant was 5 to 6 weeks old, compared with 140.8 minutes (SD 66.6) in mothers with an 8-week EPDS score < 9 ($P = .001$). Mothers scoring ≥ 9 at 8 weeks had recorded significantly more inconsolable crying per 24-hour period than those scoring < 9 , with a median of 7.5 minutes (interquartile range, 2.5) per day versus a median of 0 minutes (interquartile range, 8.75), respectively (P for Kruskal-Wallis test = .001). After adjusting for multiple confounders, the adjusted odds ratio (aOR) for having an 8-week EPDS score ≥ 9 was approximately twice as high in mothers of infants with colic at 5 to 6 weeks of age compared with those whose infants did not have colic (aOR: 2.0 [95% confidence interval (CI): 1.1–3.7]; Table 2). This association was unchanged after adjusting for baseline depression symptoms. Using the dichotomous variable of any versus no inconsolable crying, associations were very similar to those for colic (aOR: 2.1 [95% CI: 1.2–3.7]). Mothers who recorded > 20 minutes per day of inconsolable infant crying at 5 to 6 weeks of age had ~ 4 times the odds of having an 8-week EPDS score ≥ 9 compared with mothers who reported no inconsolable crying (aOR: 4.0 [95% CI: 2.0–8.1]). Adjusting for baseline depression symptoms attenuated the relationship slightly, but it remained significant.

Interaction terms for baseline depressive symptoms and inconsolable crying were examined, modeling both the depression and crying variables as categorical and continuous variables. None of these interaction terms were statistically significant (data not shown). Due to limitations on sample size, we were not able to perform stratified analyses to examine whether the relationship between inconsolable infant crying and 8-week EPDS score ≥ 9 varied by presence of depressive symptoms at baseline.

TABLE 1 Demographic Characteristics of Participants and Associations With 8-Week EPDS Score ≥ 9 (Possible Depression) and Minutes of Inconsolable Crying Per Day

	Study Sample (<i>n</i> = 587), <i>n</i> (%)	8-Week EPDS ≥ 9 Possible Depression, <i>n</i> (%)	Daily Minutes of Inconsolable Crying, Mean (SD)
Age, y			
<25	76 (13.0)	7 (9.2)	8.9 (17.2)
25–34	380 (65.7)	44 (11.6)	7.4 (12.5)
≥ 35	131 (22.3)	9 (6.9)	7.0 (13.4)
Education			
High school or less	48 (8.3)	4 (8.3)	9.0 (17.7)
Some college	121 (21.9)	11 (9.1)	8.7 (17.5)
College degree or higher	411 (71.9)	45 (11.0)	7.0 (11.3)
Race			
White	428 (73.2)	39 (9.1)	7.2 (12.8)
Nonwhite	157 (26.8)	20 (12.7)	8.4 (14.9)
Yearly household income			
<\$60 000	167 (30.0)	23 (13.8)	7.9 (14.9)
\$60 000–\$100 000	218 (39.2)	24 (11.0)	8.6 (14.3)
>\$100 000	171 (30.8)	13 (7.6)	6.1 (11.0)
Marital status			
Married/partner	520 (88.6)	52 (10.0)	7.3 (13.1)
Single/divorced	67 (11.4)	8 (11.9)	8.5 (15.4)
Maternal employment			
Unemployed	89 (15.2)	8 (9.0)	7.3 (13.0)
On maternity leave	294 (50.1)	20 (6.8)	7.2 (12.9)
Working	36 (6.1)	5 (13.9)	8.5 (13.0)
Plan to stay at home	168 (28.6)	27 (16.1) ^a	7.8 (14.5)
Primiparous			
Yes	470 (80.1)	51 (10.9)	7.4 (12.7)
No	117 (19.9)	9 (7.7)	8.0 (15.8)
Infant gender			
Boy	300 (51.3)	27 (9.0)	7.0 (13.1)
Girl	287 (48.7)	33 (11.5)	8.0 (13.6)
Breastfeeding status			
Exclusively breastfeeding	382 (65.1)	35 (9.2)	7.1 (12.0)
Formula only	67 (11.4)	10 (14.9)	7.9 (19.0)
Breast milk and formula	138 (23.5)	15 (10.9)	8.3 (13.7)
Baseline EPDS			
≥ 9	81 (14.0)	20 (24.7)	13.2 (18.4)
<9	506 (86.0)	38 (7.7) ^b	6.6 (12.2) ^c

^a $P < .05$ (χ^2 test).^b $P < .0001$ (χ^2 test).^c $P < .0001$ (Kruskal-Wallis test).

DISCUSSION

The results of this longitudinal analysis are the first to reveal an association between a mother's experience of the consolability of infant crying and risk of postpartum depressive symptoms. Inconsolable infant crying was most strongly associated with depressive symptoms when it was prolonged (ie, >20 minutes per day). This is consistent with previous findings that the length of inconsolable bouts is more important in predicting caregiver frustration levels than how often these bouts occur each day.¹³ Colic was

positively associated with depression risk in our analysis, which is consistent with published studies.^{3–5} However, it is notable that only >20 minutes of inconsolable crying per day was an even more powerful indicator of depression risk than having to manage >3 hours of infant distress per day, which itself can be very stressful for parents. Our study also revealed that this relationship remained strong after adjusting for preexisting depression symptoms in late pregnancy and the peripartum period, supporting the likelihood that this relationship was not simply due

to the effect of existing depression symptoms on both infant irritability¹⁸ and development of postpartum depression.

The observed relationship between inconsolable crying and maternal depression may have several possible mechanisms. Inconsolable crying is associated with higher parent frustration levels¹³ that can contribute to higher parenting stress and lower parenting confidence. After trying to manage repeated bouts of inconsolable crying, maternal depression symptoms may result from a learned helplessness reaction.²⁶ Alternatively, the inconsolable crying variable was likely more predictive of maternal depressive symptoms because, unlike Wessel's description of infant crying and fussing behavior alone, the inconsolable crying variable naturally includes the caregiver's experience of not being able to soothe their infant regardless of what they try. Thus, by using a "dyadic" variable, we captured not only the infant's characteristics but also maternal perceptions and experiences of how their infant responds to them. These perceptions and experiences are more likely to be related to their own feelings of decreased self-efficacy, a known mediator of postpartum depression.²⁷

Because there was only a 2- to 3-week time interval between crying assessment and depression symptom measurement, causality cannot be firmly established; maternal depression symptoms may have coevolved with crying intensity. However, the transactional model of child development²⁸ posits bidirectional interactions between the child (ie, genetic endowment, temperament) and his social environment (ie, caregivers' responses, mental health, parenting practices) that determine outcomes for both caregiver and child. An infant with difficult-to-soothe crying likely contributes to maternal stress,

Frequency

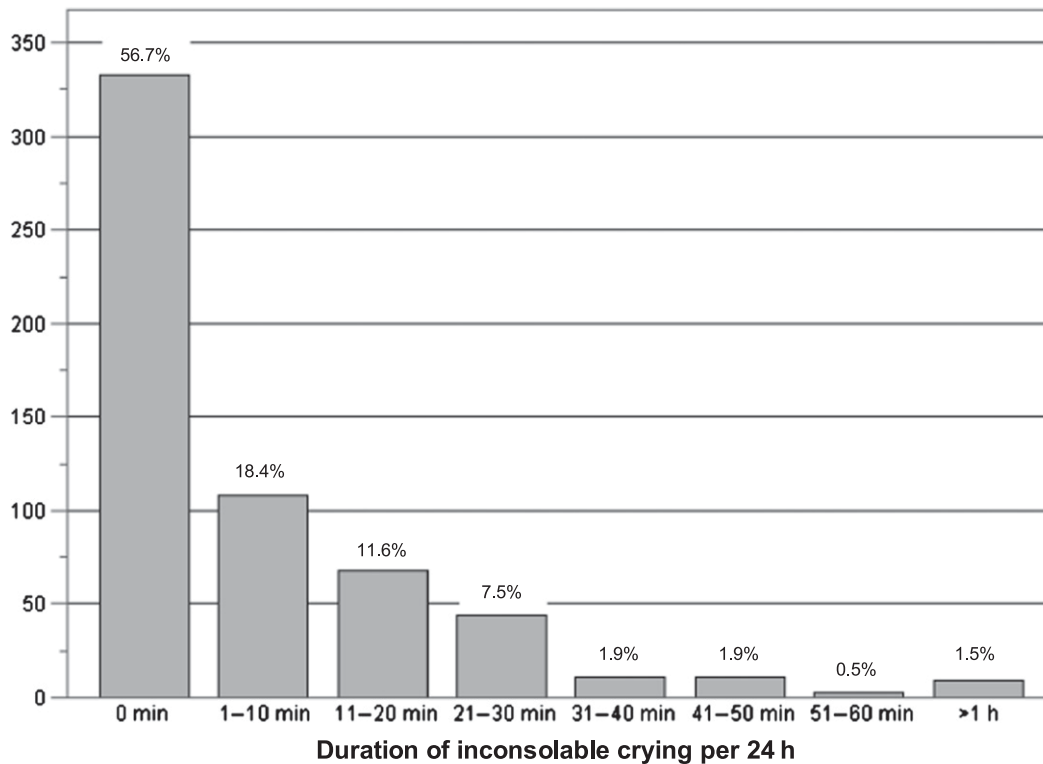


FIGURE 2

Average daily minutes of infant inconsolable crying reported at 5 to 6 weeks of age in 587 mother-infant pairs in the control arm of the *Period of PURPLE Crying* RCT.

ineffective soothing attempts, continued infant irritability, maternal fatigue and helplessness, and so on.

It is also possible that mothers with incipient depression symptoms had a heightened sensitivity to infant dis-

tress and were more likely to interpret their infant's cues in a negative light, which could bias their report of crying as inconsolable. Depressed mothers have been reported to be more likely to describe difficult temperaments in

their children²⁹ and a higher frequency of cry-fuss behaviors than are objectively recorded.³⁰ This potential reporting bias has been termed the *depression-distortion* phenomenon, and has been both supported and refuted empirically.^{31,32} Although recording practices on the *Baby's Day Diary* have been shown not to vary by parental depression symptoms,⁵ it has not been evaluated as to whether reporting of different modes of crying (ie, fussing, crying, inconsolable crying) on this instrument varies by depression status.

Limitations to this study include the small number of participants with an EPDS score >12. However, many recent studies examining different EPDS cut-offs in primary care have revealed that using a lower cutoff, such as 9 or 10, increases the sensitivity of the EPDS to detect minor and major depressive

TABLE 2 Maternal Reports of Different Modes of Crying and Risk of Possible Depression (EPDS ≥ 9) at 8 Weeks Postpartum

	EPDS ≥ 9 , n (%)	Adjusted ^a Odds Ratio (95% CI)
All fussing/crying ≤ 3 h/24 h	38/433 (8.7)	(ref)
All fussing/crying > 3 h/24 h (colic) + baseline EPDS score	22/154 (14.9)	2.0 (1.1–3.7) 2.1 (1.1–3.9)
No inconsolable crying	25/333 (7.5)	(ref)
Any inconsolable crying + baseline EPDS score	35/254 (13.8)	2.1 (1.2–3.7) 1.9 (1.1–3.5)
0 min inconsolable crying	25/333 (7.5)	(ref)
≤ 20 min inconsolable crying per day + baseline EPDS score	17/176 (9.7)	1.4 (0.7–2.7) 1.3 (0.6–2.6)
> 20 min inconsolable crying per day + baseline EPDS score	18/78 (23.1)	4.0 (2.0–8.1) 3.4 (1.6–6.9)

^a Includes maternal education (years), marital status (married, live with partner, or single/separated/divorced), maternal employment status (work at home, stay at home, unemployed, or maternity leave), parity (primiparous or multiparous), and breastfeeding status (breast only, formula only, or both).

episodes (sensitivity 59%–100% vs 34%–100% for cutoff of 12) without significantly compromising specificity (44%–97% vs 49%–100% for a cutoff of 12).²⁴ We chose to use the 9 cutoff a priori for these reasons. In addition, our measure of infant colic was an average of infant distress over 1 to 4 days of recording, rather than using Wessel's method of measurement over 3 weeks, so some misclassification of exposure is possible. However, this would tend to bias our results toward the null. There remains the possibility that unmeasured confounders contributed to the observed associations between inconsolable crying duration per day and depression. Because this analysis was performed in a relatively older, well-educated and primarily white cohort, our results may not be generalizable to minority or low income populations.

CONCLUSIONS

Our results suggest that a mother's experience of not being able to calm

her crying infant is a stronger indicator of postpartum depressed mood than overall duration of the infant's daily cry-fuss behaviors. Inconsolable infant crying is distressing to caregivers, affecting their parenting self-confidence³³ and their behavioral responses toward their child, and may have important and lasting effects on the parent-child relationship.³⁴ Although parents are likely prepared for the fact that their infant will cry, many may be unprepared for the discomfort and frustration that occurs when they are unable to console their child. As the frustration accompanying inconsolable crying could be considered a modifiable risk factor for maternal depression, it would be potentially fruitful to study whether depression could be prevented or modified by approaches such as providing developmental guidance regarding the normalcy and transience of inconsolable crying, offering suggestions for soothing techniques, or providing emotional support. Such guidance is avail-

able through programs such as the *Fussy Baby Network*³⁵ or the *Period of PURPLE Crying*.¹⁹ To our knowledge one such trial is in progress in Australia.³⁶

There are potential clinical implications as well. Although many pediatricians routinely ask about infants' crying, our results suggest that we should ask about ease of infant consolability and how the parents are responding emotionally. By providing anticipatory guidance to parents about the expected feelings of helplessness when their attempts to soothe their infant fail, we may be able to help them tolerate this common early difficulty in the parent-child relationship, bring about greater parental self-understanding, and provide an opportunity to offer help.

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