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Distinguishing infant prolonged crying from sleep-waking problems

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Abstract

Objective—Infants who cry a lot, or are unsettled in the night, are common sources of concern for parents and costly problems for health services. The two types of problems have been linked together and attributed to a general disturbance of infant regulation. Yet the infant behaviours involved present differently, at separate ages and times of day. To clarify causation, this study aims to assess whether prolonged crying at 5–6 weeks (the peak age for crying) predicts which infants are unsettled in the night at 12 weeks of age (when most infants become settled at night).

Methods—Data from two longitudinal studies are analysed. Infant crying data were obtained from validated behaviour diaries; sleep-waking data from standard parental questionnaires.

Results—A significant, weak relationship was found between crying at 5–6 weeks and 12-week night waking and signalling in one study, but not the other. Most infants who met the definition for prolonged crying/colic at 5–6 weeks were settled during the night at 12 weeks of age; they were not more likely than other infants to be unsettled.

Conclusions—Most infants who cry a lot at 5–6 weeks of age 'sleep through the night' at 12 weeks of age. This adds to evidence that the two types of problematic behaviour have different causes, and that infant sleep-waking problems usually involve maintenance of signalling behaviours rather than a generalised disturbance.

Infants who cry a lot, or are unsettled in the night, are common sources of concern for parents and costly problems for health services.[1] Yet services vary and are not evidence-based, so that parents consult popular baby-books, which give contradictory advice.[2] In a minority of cases, infant crying triggers abuse[3,4] or is associated with later psychological disturbances in the child.[5–8] These are good reasons for wanting to develop evidence-based services which help parents to manage infant crying and sleeping. This requires an understanding both of parental and infant factors, including why subgroups of infants cry a lot or remain unsettled in the night.[9–13]

Early empirical studies found that infants who had night waking problems at 4–8 or 14 months of age were likely to have cried a lot in early infancy.[14,15] This led to reports linking infant crying and sleep problems and attributing them to a general disturbance in infants'

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regulatory systems.[16] However, the early studies were retrospective, potentially exaggerating the relationship. Recent longitudinal analyses have found:

1. Infant crying, and parental concern about it, peak at around 5–6 weeks of age, with the crying occurring mainly in the daytime and evenings.[17–19] Infant sleep-waking problems occur at night and after 3 months of age.[20–22]
2. Parents report that most infants 'sleep through the night' by 3 months of age, while problems are due mainly to infant night waking.[23–25] However, infra-red video recordings show that most babies continue to wake up in the night.[26–28] The key distinction is not why infants awake, but why a quarter continue to 'signal' parents upon waking rather than resettling autonomously.[26–28] Since signalling for feeding at night is normative before 3 months of age, it is the failure to inhibit signalling which requires an explanation.
3. Prospective relationships between infant crying in the first 3 months and night waking and signalling after 6 months of age are weak.[29–31] For the most part, different infants exhibit prolonged crying in early infancy or unsettled night-time behaviour after 6 months of age.[63132]

Evidence that these two types of problematic infant behaviour are usually distinct is of practical importance, since their causes, including the contributions of parenting, may be different. To clarify causation, this study assesses the prospective relationship between prolonged crying at 5–6 weeks (the peak age for crying)[17–19] and infant night waking with signalling at 12–14 weeks of age. This age was selected because most infants stop signalling in the night by this stage, while those who continue are likely to have long-term sleep-waking problems.[31] This study assesses whether one type of problematic behaviour which is common in early infancy predicts another which commonly develops 2 months later. To allow partial replication, data from two separate longitudinal studies are analysed.

METHODS

Study 1 of the crying or sleeping infants study (COSI) enrolled 610 singleton newborn infants without medical complications in a UK community hospital, assigning them randomly at 1–2 weeks of age to a behavioural programme, an information leaflet group, or a control group involving routine service.[3334] Approximately 70% of infants in each group were breast fed, 20% formula fed, 10% fed breast and formula milk; by 12 weeks, 35% were solely breast fed. Because the behavioural programme proved effective in enabling settled infant night-time behaviour at 12 weeks of age, data will be included solely from the control and leaflet groups, which did not differ in crying or sleeping behaviour.

Study 2, a cross-cultural study (CCS), enrolled 237 singleton newborns without medical complications in England or Denmark.[35] Most were in community hospitals, but a minority were recruited via childbirth organisations because their parents planned to employ 'proximal care' that involved holding infants ≥80% of the time between 8:00 and 20:00, frequent breast feeding, and rapid responses to infant cries. All infants were breast fed at birth; by 12 weeks 37% of London infants, 70% Copenhagen infants and 85% proximal care infants were solely breast fed. The study compared London, Copenhagen and Proximal parenting, to assess differences in infant crying or sleeping development.

Both studies used validated behaviour diaries kept by parents to measure infant crying at 5–6 weeks of age.[36–38] Parents shaded in the onset and end time of behaviours on time rulers, against a 5-min scale of time. Infant behaviours logged were sleeping, awake-content, fussing, crying and feeding. In COSI, fuss/crying was recorded as a composite variable, while CCS distinguished fussing, crying and 'unsoothable crying' (defined on the diary as

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'bouts of hard-to-soothe or unsoothable fussing or crying'). The composite fuss/crying measure commonly employed by infant crying studies[36–38] was obtained by adding the three crying subtypes in the CCS data. COSI collected diaries for three consecutive 24-h days at 5-6 weeks and 12 weeks, while CCS kept diaries for four consecutive 24-h days at 5–6 weeks and two at 12 weeks. Data were averaged across the diaries at each age to produce more reliable figures for the frequency and duration of fuss/crying bouts, and total minutes of fuss/crying per 24 h, for each infant.

Infant sleep-waking at 12 weeks was measured by parental questionnaire. In both studies, parents recorded the number of nights in the last week the infant slept for ≥5 h without waking and signalling, a previously-used measure of 'sleeping through the night'.[343940] Neither study examined the longitudinal relationship between infant crying and night waking with signalling. Both received Medical Research Ethics Committee approval.

Statistical methods

Descriptive (mean/SD) figures were calculated for each crying and sleeping measure. Duplicate two-tailed parametric and non-parametric analyses were used to examine relationships between 24 h crying at 5–6 weeks and the number of nights/ week infants slept for ≥5 h at 12 weeks of age. The findings were similar and the non-parametric results (Spearman correlations; Mann–Whitney tests) are reported because of skews in some data. Partial correlation and analysis of covariance were used to control for group variations in feeding methods at 12 weeks (solely breast fed vs other methods). Post-hoc power calculations were made to indicate the power of sample sizes to detect a difference of one night in the sleep outcome measure, with $p<0.05$ (two-tailed).[41] For analysis 2 in table 2, COSI sample sizes give 69% power to detect a significant difference, the CCS samples only 53% power. For analysis 3 in table 2, the CCS sample sizes provide 82% power.

RESULTS

Table 1 gives descriptive figures for the behaviours. Sample size variations are due to attrition over age or parents who did not complete questionnaires. The mean total minutes of fuss/crying in the two studies is similar, and comparable with other studies, indicating the robustness of the findings. Infants who fuss/cry for ≥3h/24 h are often considered to have prolonged crying or 'colic' (the 'modified rule of threes' definition of colic).[42] These rates, too, are similar between the studies. Both studies show the reductions in fuss/crying amounts and % of colic cases between 5–6 and 12 weeks, which are typical in the literature. 'Unsoothable' crying bouts were distinguished only in the more recent CCS study, following evidence that these bouts are particularly trying for parents and confined to early infancy.[4344] All three indices of prolonged fuss/crying at 5–6 weeks were included to provide a comprehensive means of distinguishing infants who cried a lot.

Table 1 also summarises how many nights in the last week infants slept for ≥5 h at 12 weeks. This figure is lower for CCS than COSI, because the CCS proximal care infants slept for ≥5 h less often than other groups in the original study.[35] Comparing like with like, the COSI control and CCS community group infants were very similar (and not significantly different), sleeping ≥5 h/night during 5.17 (2.40) nights/week, and 5.01 (2.34) nights/week, respectively, at 12 weeks of age.

Table 2 summarises the relationships between the measures of prolonged crying at 5–6 weeks and the outcome measure of how many nights/week infants slept for ≥5 h at 12 weeks of age.

Just one longitudinal analysis, the correlation between crying amounts at 5–6 weeks and how many nights infants were settled at 12 weeks of age in COSI, is statistically significant. However, the correlation (−0.142) is weak, representing a small effect size according to Cohen's criteria.[45] In both studies, infants with prolonged crying/ colic at 5–6 weeks were not more likely than other infants to wake and signal in the night at 12 weeks. Although this comparison approaches statistical significance in CCS, these prolonged criers tended to wake and signal parents during fewer nights at 12 weeks. Most prolonged criers in both studies were settled in the night at 12 weeks of age. For instance, in the larger, COSI, study 60.5% of prolonged criers at 5–6 weeks had sleep bouts lasting ≥5 h during 6 or 7 nights/ week at 12 weeks of age (as did 61.8% of infants without prolonged crying at 5–6 weeks of age). CCS infants with and without unsoothable crying bouts at 5–6 weeks were also similar in waking and signalling at 12 weeks (table 2). Relationships between crying and sleep-waking remained unchanged after control for feeding method. There were no gender differences in crying or sleeping.

DISCUSSION

Recent studies have cast new light on 'infant sleep problems'. Instead of 'sleeping through the night' by 3 months as parents report, most infants continue to wake up in the night.[26–28] The key issue is not why infants awake, since this is normal, but why around 25% of infants continue to 'signal' their parents upon waking rather than resettling autonomously like their peers.[26–28]

Against this background, this study found weak relationships between infants' amount of crying at 5–6 weeks and the number of nights per week they woke and signalled parents at 12 weeks of age. This relationship was significant but meagre in the larger group studied, and non-significant in the other group. In both studies, the majority of infants who met criteria for prolonged crying or 'colic' at 5–6 weeks of age were settled in the night at 12 weeks of age, and 'prolonged criers' were not more, or less, likely than other infants to wake and signal parents in the night at 12 weeks. This finding suggests that the two sorts of problematic behaviour have different causes, rather than being due to a common underlying disturbance.

One proviso stems from evidence that parents report infant fuss/crying and night waking with signalling accurately, but miss occasions when infants wake in the night without attracting parental attention.[1626–2846] The implication is that parental reports distinguish 'biological' sleep from quiet awakening poorly, highlighting the need for objective measurements for this purpose. However, the clinical phenomenon involves parental concerns and complaints to professionals and, for this purpose, parental reports are the method of choice. A second proviso is that just one outcome measure, the number of nights infants remained settled for 5 h or more without signalling parents at 12 weeks of age, was used to measure settled infant sleep-waking. This measure was chosen because of use in previous studies,[33343940] while relationships between fuss/cry problems in the early months and sleeping problems at 8–24 months of age are similarly weak.[2930] The decision to target 12 weeks of age here reflects the evidence that most infants stop night waking and signalling by this age and retain this habit once developed, while infants who do not stop by 5 months of age are particularly likely to develop chronic sleeping problems.[1631] On the evidence here, this developmental sleep-waking 'milestone' is not predicted by prolonged 'colicky' crying 2 months earlier.

One reason for cautious generalisation is that studies have distinguished a small group, of around 5% of infants, who both cry a lot and have sleeping and other problems.[47–49] However, unlike the infants assessed here, such cases are defined by: (1) prolonged crying

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which occurs beyond 4 months of age; (2) multiple areas of problematic behaviour, including crying, sleeping, feeding and/or other difficulties; (3) adverse long-term outcomes, including psychological and behavioural disturbances.[47–49] Because they occur beyond the age when infant crying and sleeping behaviours undergo developmental transitions, and because of their much poorer outcomes, these cases may have generalised regulatory disturbances.[750] Future research should benefit from distinguishing these different groups and developmental pathways, while health services may wish to prioritise cases with persistent, multiple, difficulties.

The importance of this study's finding derives from the implication that, in most cases, prolonged crying in early infancy and sleeping problems after 12 weeks have distinct causes. This is consistent with evidence that infant sleeping problems usually involve a delay in inhibiting night-time signalling behaviours, so that most cases involve normal developmental processes and the factors which maintain or inhibit infant signalling at night. These factors probably involve the parenting environment. Four randomised controlled trials have found that 'limit-setting' parenting prevents continuation of night waking and signalling beyond 3 months of age.[34394051] In contrast, comparative research has found that 'infant-demand' care reduces overall crying by a third at 5–6 weeks, but increases the number of infants who continue to wake and signal in the night at 12 weeks of age.[35] That both methods of care have benefits, and limitations, helps to explain the controversy in the popular press about which is 'better'. Guidelines have been published to help professionals to support parents in progressing from infant-demand to limit-setting care.[11] Randomised controlled trials which evaluate this guidance should establish whether it generalises and is cost-effective.

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What is already known on this topic

- Infants who cry a lot, or are unsettled in the night, are common sources of concern for parents and costly problems for health services.
- Although the two types of problem have been linked together and attributed to a general disturbance of infant regulation, there is emerging evidence that infant sleep-waking problems usually involve normal developmental processes and environmental factors which maintain infant signalling behaviours at night.

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What this study adds

- Contrary to the idea of a general underlying disturbance, most infants with prolonged crying/colic at 5–6 weeks were settled at night at 12 weeks of age, and they 'slept through the night' as often as other infants.
- The finding that the two types of problematic behaviour usually occur in different infants adds to evidence that they have different causes, and that infant sleep-waking problems usually involve maintenance of signalling behaviours rather than a generalised disturbance.

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Table 1

Descriptive figures for infant crying and sleeping behaviours in each study at 5–6 and 12 weeks of age

	COSI		CCS	
5–6 weeks age		N		N
Mean (SD) total minutes of fuss/crying per 24 h	104.71 (63.17)	352	100.59 (61.94)	199
% Infants with fuss/crying total ≥3 h per 24 h	12.2%	352	10.1%	199
% Infants with unsoothable crying bouts	NA	NA	39.7	199
12 weeks age				
Mean (SD) total minutes of fuss/crying per 24 h	63.00 (42.08)	316	65.48 (51.04)	193
% Infants with fuss/crying total ≥3 h per 24 h	1.6	316	3.1	193
% Infants with unsoothable crying bouts	NA	NA	24.4	193
Mean (SD) no. nights infants slept for ≥5 h	5.19 (2.27)	305	4.42 (2.56)	181

CCS, cross-cultural study.

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Table 2

Relationships between the crying measures at 5–6 weeks and night waking at 12 weeks of age

	COSI			CCS		
			N			N
1. Spearman's correlations between total minutes of fuss/crying per 24 h at 5–6 weeks and no. nights infants slept ≥5 h at 12 weeks of age.	r=−0.142	p=0.013*	305	r=0.046	p=0.537	181
2. Mann–Whitney comparison of infants with fuss/crying total (a) ≥3 h/24 h (b) <3 h/24 h at 5–6 weeks on mean (SD) no. nights infants slept ≥5 h at 12 weeks of age.	4.71 (2.90) nights 5.25 (2.33) nights	U=4778.5 p=0.533	38 267	5.44 (2.23) nights 4.31 (2.58) nights	U=1114.0 p=0.086	18 163
3. Mann–Whitney comparison of infants with (a) unsoothable cry bouts (b) no unsoothable cry bouts at 5–6 weeks on mean (SD) no. nights infants slept ≥5 h at 12 weeks of age.	NA	NA	NA	4.26 (2.53) nights 4.53 (2.58) nights	U=3583.5 p=0.311	72 109

*p<0.05.

CCS, cross-cultural study.