The Social Ecology of Infant Sleep: Maternal Depression, Bedtime and Nighttime Parenting, and Infant Sleep Disruption

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Infant sleep disruption, parenting stress, and behavior problems

- Sleep disruptions in childhood associated with behavior problems and emotion dysregulation (Bates et al., 2009; DeLeon & Karraker, 2007; Meltzer & Mindell, 2006; Sadeh et al., 2002)

- Sleep disruption in infancy (frequent, “signaled” night waking) associated with parent and family stress (Dahl & El Sheikh, 2007; Hiscock & Wake, 2001; Junko & Yoshiko, 2007; Loutzenhiser & Sevigny, 2008; Lozoff et al., 1985; Mindell et al., 2006; Thome & Skuldottir, 2004)

- Sleep problems can develop during first year of life and tend to be stable over time (Dahl, 1998; Zuckerman et al., 1987)

- Infant night waking associated with maternal depression (Bayer, Hiscock, Hampton, & Wake, 2007; Messer & Richards, 1993; Warren, Howe, Simmens, & Dahl, 2006)
Mechanisms underlying link between maternal depression and infant night waking

- Biological vulnerabilities
  - (e.g., higher pregnancy and perinatal cortisol and norepinephrine levels in depressed mothers - Armitage et al., 2009; Field et al., 2007)

- Parenting at bedtime/nighttime?
Parenting and infant sleep
What is known?

- Not much:

- More frequent signaled infant night waking associated with:
  - Close, prolonged parent-infant contact
  - Parental presence (bedtime, during the night)
  - Unstructured bedtime routines
  - (Anders et al., 1992; Burnham et al., Burke et al., 2004; Mao et al., 2004; Mindell et al., 2007)
  - Until recently, focus was almost exclusively on parenting practices at bedtime/nighttime
  - Information about practices almost always provided by parents (mothers)
Parenting practices vs. emotional climate at bedtime

- **Parenting practices** (what parents do)
- **Emotional quality of parenting** (how parents do what they do). Not examined, until recently.
Project SIESTA

(Study of Infants’ Emergent Sleep Trajectories)

• Study of parenting, infant sleep, parent-infant relationships, and infant development

• SIESTA I
  • Cross-sectional study of infants and parents at 1, 3, 6, 12, 24 months

• SIESTA II (w/ co-Is Cole, Stifter, Rovine, Paul, Anders)
  • NICHD-funded longitudinal study, with assessment occasions: 1, 3, 6, 9, 12, 18, 24 months
Thanks to:

- Co-investigators: Tom Anders, Pamela Cole, Cindy Stifter, Mike Rovine, Ian Paul

- SIESTA I: Molly Countermine, Gail Mayer, Melanie Henderson, Stacey Cohen, Dan Coladonato, and Penn State’s Children, Youth, and Family Consortium

- SIESTA II: Gail Mayer, Molly Countermine, Bo-Ram Kim, Beth Hunt, Brian Crosby, Corey Whitesell, Lauren Philbrook, Hye-Young Rhee, Mina Shimizu, Brandon McDaniel, Cori Reed, Alexia Hozella, Alix Dusel, Katie Pollom, Samantha Kramer, Stephanie Bekelja, + many undergraduates
## SIESTA I: Age/gender breakdown (N = 45)

<table>
<thead>
<tr>
<th>Cohort</th>
<th>N</th>
<th>M</th>
<th>Range</th>
<th>SD</th>
<th>No. of girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month</td>
<td>9</td>
<td>5.0 wks</td>
<td>4.0-6.0 wks</td>
<td>1.0 wks</td>
<td>5</td>
</tr>
<tr>
<td>3 mos.</td>
<td>8</td>
<td>2.9 mos</td>
<td>2.5-3.0 mos</td>
<td>.19 mos</td>
<td>3</td>
</tr>
<tr>
<td>6 mos.</td>
<td>8</td>
<td>6.2 mos</td>
<td>5.0-7.0 mos</td>
<td>.65 mos</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>12.3 mos</td>
<td>10.0-14.0 mos</td>
<td>1.06 mos</td>
<td>7</td>
</tr>
<tr>
<td>24</td>
<td>8</td>
<td>25.3 mos</td>
<td>24.0-27.0 mos</td>
<td>1.10 mos</td>
<td>4</td>
</tr>
</tbody>
</table>
SIESTA I sample characteristics:

- Mothers 22 – 42 years of age

- All high school graduates; 36% with college degree, 27% with a master’s degree, 2.2% completing a Ph.D. degree.

- 44 mothers were married or living with a partner

- 43.5% of the mothers were employed at least part-time

- Yearly family income from $11,000 to $200,000 per year, $61,323, SD = 36,151

- 90.9% White, 2.3% African American, 6.8% Asian
• Each family visited 3 times during one week

• Parents completed an infant sleep diary each day for 7 consecutive days

• Parents completed a battery of questionnaires about perceptions of their infants’ sleep, perceptions of themselves as parents, depressive/anxiety symptoms, choices/attitudes about infant sleep arrangements, infant temperament

• Continuous digital video recordings made of bedtimes and night wakings (8-12 hour continuous recordings)

• Mothers wore actigraph watches on same night as video recording
Video-recording

--Video recording done evening of Day 6, commencing when the parents began to put their infants to bed and continued throughout the night until the infant awoke the following morning.

--Telexper DVR-X4/80 digital video recorder.

--Channel Vision (CV-5005-W) night-vision cameras, with small TV monitor.

--Channel Vision (CV-5104MIC) microphones.

--Two infrared illuminators (CS-IR200) used.

--2-to-3 cameras used for all families (1 above crib/bed, 1 focused on the doorway and rest of room, and, if necessary, 1 in separate room if parents took infant there).
Observations of parent-infant interactions at bedtime

- Parent instructed to turn video cameras on (switch on surge strip) when bedtime commenced.

- End of bedtime defined by 10 consecutive 30-second intervals of the infant being asleep (i.e., 5 minutes of continuous infant sleep).

- Video data were coded by two coders, blind to other data on the families.
Parenting practices vs. emotional quality during infant bedtime

- Very little known about parenting at bedtime, and its developmental significance for children (bedtime heralds longest separation from parents of the day)

- SIESTA I and II looking at both practices, and emotional quality of parenting, with infants at bedtime

- Parenting practices recorded were:
  - Close contact (holding, cuddling)
  - Casual contact (touching)
  - Quiet activities (book reading, quiet play)
  - Nursing

Coded with interval sampling (30 second bins), divided by the total # bedtime intervals
Emotional availability at bedtime – why study it?

- Deep sleep requires the ability to relinquish consciousness and vigilance. Requires that one “feel safe” in one’s sleep environment (Dahl and El Sheikh, 2007)

- **Feeling safe**, in infancy and childhood, depends greatly on quality of relationship with caregivers, caregivers ability to promote feelings of safety and security in their offspring (attachment theory).

- A parent’s emotional availability to an infant during bedtime expected to promote infant feelings of safety and security in these contexts, and in turn, sleep quality.
Emotional availability scales (Biringen, 2000)

- **Sensitivity** - to infant emotional /behavioral cues. Parent demonstrates awareness of cues, interprets them accurately, and responds contingently and appropriately.

- **Structuring** - parent creates safe, sleep-promoting environment—preparing infant for bed; positive, quiet, soothing bedtime routines. Gently guides infant toward sleep.

- **Non-intrusiveness** - parent respects child’s autonomy, choices. Does not initiate new interactions when child is drowsy, ready for sleep.

- **Non-hostility** - parent shows no overt or covert anger, irritability toward child.
Results

- Infant age group correlated with sleep disruption (totaled across 7 consecutive days, from infant sleep diary):
  - Total night wakings: $r(41) = -0.48$, $p = .001$
  - Total time awake: $r(41) = -0.70$, $p < .001$

- Infant age statistically controlled in all subsequent analyses
<table>
<thead>
<tr>
<th></th>
<th># times mother returned to inf. at bedtime</th>
<th>Total # night wakings&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>&lt;sup&gt;r&lt;/sup&gt; (&lt;df&gt;)</td>
<td>&lt;sup&gt;r&lt;/sup&gt; (&lt;df&gt;)</td>
</tr>
<tr>
<td>Close contact</td>
<td>.12 (32), ns</td>
<td>.26 (36), ns</td>
</tr>
<tr>
<td>Casual contact</td>
<td>-.01 (32), ns</td>
<td>.09 (36), ns</td>
</tr>
<tr>
<td>Quiet activities</td>
<td>.11 (32), ns</td>
<td>-.14 (36), ns</td>
</tr>
<tr>
<td>Nursing</td>
<td>.43* (32)</td>
<td>.11 (36), ns</td>
</tr>
</tbody>
</table>

<sup>a</sup>Summed across 7 consecutive days, from infant sleep diary

<sup>*</sup> <i>p < .05</i>
<table>
<thead>
<tr>
<th></th>
<th>Mothers’ perception of infant sleep difficulty $^b$</th>
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<tbody>
<tr>
<td># minutes inf. awake at night $^a$</td>
<td>$r$ (df)</td>
</tr>
<tr>
<td></td>
<td>$r$ (df)</td>
</tr>
<tr>
<td>Close contact</td>
<td>.18 (36), ns</td>
</tr>
<tr>
<td>Casual contact</td>
<td>.16 (36), ns</td>
</tr>
<tr>
<td>Quiet activities</td>
<td>-.12 (36), ns</td>
</tr>
<tr>
<td>Nursing</td>
<td>.17 (36), ns</td>
</tr>
</tbody>
</table>

$^a$Summed across 7 consecutive days, from infant sleep diary  
$^b$0 = no; 1 = yes, mild; 2 = yes, moderate; 3 = yes, severe.
emotional availability and infant sleep disruption

- # times mother returned to inf. At bedtime
- Total # night wakings

<table>
<thead>
<tr>
<th></th>
<th>Mothers’ EA</th>
<th>Total # night wakings</th>
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<tbody>
<tr>
<td></td>
<td>-.44* (31)</td>
<td>-.44* (32)</td>
</tr>
</tbody>
</table>

- aSummed across 7 consecutive days, from infant sleep diary
- * $p < .05$
# Emotional availability and infant sleep disruption

## # minutes infant awake at night\(^a\)

<table>
<thead>
<tr>
<th>Mothers’ EA (standardized Composite)</th>
<th>( r ) (df)</th>
<th>( r ) (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers’ EA</td>
<td>-.16 (32)</td>
<td>-.56** (32)</td>
</tr>
</tbody>
</table>

\(^a\) Summed across 7 consecutive days, from infant sleep diary

\(^b\) 0 = no; 1 = yes, mild; 2 = yes, moderate; 3 = yes, severe

**\(p<.05\)**
• No linkages between parenting practices
  • and emotional availability
  • (all non-significant)
Conclusions

- Maternal bedtime practices largely unrelated to infant sleep disruption

- By contrast, maternal EA at bedtime significantly and negatively correlated with infant sleep quality, and with mothers’ perceptions about whether their infant had a sleep problem

What about maternal depression?

- In SIESTA I, 10 mothers reported depressive symptoms above clinical cutoff score of 13 (SCL-90).
- Mean, full sample = 9.13 ($SD = 7.04$)

- Not significantly correlated with maternal EA in SIESTA I, partial $r (32) = -.24$, ns, but...

- Mothers’ depressive symptoms were associated with infant sleep disruption (standardized composite of infant night waking + # minutes awake throughout the night (partial $r(41) = .40$, $p = .008$.)
Maternal depression and cognitions about infant night waking

- Maternal Cognitions about Infant Sleep (Morrell, 1999)
- PCA yielded two factors, internally reliable:
  - Worry about infants’ physical/emotional needs at night
  - Helplessness/loss of control
Worry about infants’ physical/emotional needs

- My child will feel abandoned if I don’t respond immediately to his/her cries at night.
- My child might go hungry if I don’t give him/her a feed at night.
- It is all right to allow my child to cry at night (reverse scored)
- I should be getting up during the night to check that my child is still all right.
- If I try to resist my child’s demands at night, then he/she will get even more upset.
- If I say no to my child’s demands at night, then it means I’m a bad mother.
- I should respond right away when my child wakes crying at night.
- I am able to resist my child’s demands when he/she wakes at night (reverse scored)
- If I give up feeding at night, then he/she will never sleep.
Helplessness/loss of control

- When my child cries at night, I think I might lose control and harm him/her.

- When my child cries at night, I can find myself thinking I wish I had never had a child.

- When my child doesn’t sleep at night, I doubt my competence as a parent.
• Maternal depressive symptoms and

• Mothers’ worries about infant physical/emotional needs: partial $r(39) = .42, p = .007$

• Mothers’ feelings of helplessness/loss of control: partial $r(41) = .46, p = .002$
Mothers’ worry about infant phys/emot needs was significantly associated w/
- Mothers’ presence with infant during the night
- Infant sleep disruption

Mothers’ feelings of helplessness/loss of control not associated w/ maternal behavior or infant sleep disruption.
Dysfunctional cognitions, maternal presence at night, and infant sleep

- Mediated path was significant, $p < .05$ (MacKinnon, 2008).
Mediated path not significant, $p<.05$ (MacKinnon, 2008).
Informal observations:

- Mothers with elevated depressive symptoms more likely to be
  - hyper-vigilant during the night (e.g., to respond to non-distressed vocalizations)
  - to awaken infant without clear reason (to bring infant to parent’s bed)
  - to be less able to set bedtime limits.

In comparison to non-depressed mothers
Study of parenting, infant sleep, and infant development across the first 2 years post partum (Target N = 150 families)

Families studied at 1, 3, 6, 9, 12, 18, and 24 months post partum. At each age point:

- Video-recordings of parenting at bedtime and throughout the night made for one full night at each age point.
- Actigraphy (infants, mothers, fathers) recorded 7 consecutive days
- Parent and infant sleep diaries recorded 7 consecutive days
- Infant, mother, father salivary cortisol obtained across one full night
- Questionnaire battery for parents: Psychiatric symptoms, marital adjustment, co-parenting, etc.
SIESTA II Outcomes

- Quality of infant and parent sleep (from actigraphy and sleep diaries)
- Parental adaptation (general, and to infant sleep behavior)
- Infant and parent stress reactivity
- Daytime mother-infant interaction
- Infants’ emotion regulation
- Infant information processing
- Quality of attachment
- Infant behavior competencies
- Infant behavior problems
Maternal depressive symptoms, marital adjustment and bedsharing (1 month)

<table>
<thead>
<tr>
<th></th>
<th>Bedsharing (n=67)</th>
<th>EA (n=45)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>$r$</td>
<td>$r$</td>
</tr>
<tr>
<td>Depressive Symptoms</td>
<td>-.01</td>
<td>-.02</td>
</tr>
<tr>
<td>Marital Adjustment</td>
<td>-.29*</td>
<td>.08</td>
</tr>
<tr>
<td>(1 mos)</td>
<td></td>
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</tr>
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</table>

* $p < .05$
Maternal depressive symptoms, marital adjustment and bedsharing (3 months)

<table>
<thead>
<tr>
<th>Bedsharing (n=47)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressive Symptoms</td>
<td>.15</td>
</tr>
<tr>
<td>Marital Adjustment (1 mos)</td>
<td>-.45**</td>
</tr>
</tbody>
</table>

** p < .05
Maternal depressive symptoms (1, 3, & 6 mos.), marital adjustment (1 mos.), and bedsharing at 6 months

<table>
<thead>
<tr>
<th></th>
<th>Bedsharing (6 mos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressive Symptoms (1 mos)</td>
<td>( r = 0.18 )</td>
</tr>
<tr>
<td>Depressive Symptoms (3 mos)</td>
<td>( r = 0.29^* )</td>
</tr>
<tr>
<td>Depressive Symptoms (6 mos)</td>
<td>( r = 0.39^{**} )</td>
</tr>
<tr>
<td>Marital Adjustment (1 mos)</td>
<td>( r = -0.43^{**} )</td>
</tr>
</tbody>
</table>

* \( p < .05 \)  ** \( p < .01 \)
Figure 1. Mothers’ depressive symptoms across the first 6 months post partum and infant sleep arrangements

Maternal depressive symptoms

- Separate room
- Same room, different bed
- Same bed

Infant Age

1 month 3 months 6 months
Conclusions

- Moms w/ elevated depressive symptoms, and perhaps particularly mothers who are maritally distressed, behave differently with their infants at night
  - More likely to bedshare, by 6 months post partum
  - More likely to interrupt infant sleep
  - More likely to intervene when intervention is not needed (e.g., to non-distressed infant vocalizations)
  - More likely to have difficulty setting proper limits at bedtime
- Depression-based maternal cognitions (excessive worry about infant physical/emotional well-being causally implicated)
• Association between mothers’ depressive symptoms and feelings of helplessness/loss of control with infant during the night
• Depressed mothers of infants with sleeping problems appear to be important group for intervention
  • Spousal/partner support
  • Sleep training intervention for infants (but not CIO, or graduated extinction)
  • Mothers’ depression (perhaps specifically focused on mothers’ cognitions about infant sleep)