Breastfeeding, maternal depressive mood and room sharing as predictors of sleep fragmentation in 12-week-old infants: a longitudinal study

Valerie Simard*, Jessica Lara-Carrasco, Tyna Paquette and Tore Nielsen

Department of Psychology, Université de Sherbrooke, Longueuil, Quebec, Canada; Department of Psychology, Université de Montréal, Montreal, Quebec, Canada; Hôpital du Sacré-Cœur de Montréal, Centre d’étude du sommeil, Montreal, Quebec, Canada; Department of Psychiatry, Université de Montréal, Montreal, Quebec, Canada

(Received 9 June 2010; final version received 2 August 2010)

Sleep fragmentation in infancy can burden a family by disrupting the sleep of all its members. However, there has been no longitudinal prospective investigation of the determinants of infant sleep fragmentation. We undertook such an investigation. New mothers (N = 106) completed questionnaires and were administered structured telephone interviews at three, six and 12 weeks postpartum. Pre- and postnatal maternal adjustment and sleep-related parental practices were evaluated as potential predictors of infants’ sleep fragmentation. Risk factors for infants sleeping less than six consecutive hours per night at 12 weeks were found to be mother’s depressed mood (OR = 1.55, p < .01), breastfeeding (OR = 6.40, p < .01) and room sharing (OR = 2.91, p < .05). The mother’s depressed mood and breastfeeding were also related to poor sleep consolidation when the latter was assessed as a continuous outcome (p < .01). This study identifies factors to target in sleep-focused interventions in families where the child’s sleep has become a problem.

Keywords: sleep consolidation; infancy; postpartum depression; breastfeeding; cosleeping; room sharing

Introduction

Because infants spend more time sleeping than engaging in any other activity, sleep may be the brain’s single most important activity during early childhood (Dahl, 1996). During the first year of life, there is a developmental progression consisting of a decrease in total sleep duration over the 24-hour period, major reductions in diurnal sleep and establishment of a clear day–night differentiation during the first four months of life (Armstrong, Quinn, & Dadds, 1994). Additionally, nocturnal sleep fragmentation decreases during the first year of life, with infants sleeping undisturbed for longer time periods as they grow older. Specifically, from the age of three weeks to three months, the longest nocturnal sleep period duration increases from 3.5 to 6 hours (Anders, Halpern, & Hua, 1992). By the age of 12 weeks, 75% of infants sleep undisturbed for at least six consecutive hours (Adams, Jones, Esmail, & Mitchell, 2004).
Sleep problems affect 20–30% of children at least once during childhood (Owens, 2007) and are risk factors for both physical health problems such as overweight (Taveras, Rifas-Shiman, Oken, Gunderson, & Gillman, 2008) and emotional problems through childhood to adulthood (Breslau, Roth, Rosenthal, & Andreski, 1996; Gregory & O’Connor, 2002). Sleep problems tend to be maintained across the preschool years (Simard, Nielsen, Tremblay, Boivin, & Montplaisir, 2008a, 2008b) and their occurrence during infancy is the strongest predictor of preschool sleep difficulties (Simard et al., 2008b). Therefore, there is a clear need to identify risk factors for signs of sleep problems that are observed early in infancy. The main goal of this study was to identify such risk factors (measured at the age of zero to six weeks) of later sleep fragmentation (measured at 12 weeks). Two types of predictors were considered: maternal psychological factors and parental sleep-related practices.

**Maternal psychological factors**

Of all potential indicators of maternal mental health problems, the most studied in relation to early infant sleep problems is postnatal depression. This condition affects 10–15% of mothers in the first postpartum year (O’Hara & Swain, 1996; Skouteris, Wertheim, Rallis, Milgrom, & Paxton, 2009) and is widely considered to adversely affect the child’s emotional development (Hay, Pawlby, Angold, Harold, & Sharp, 2003; Moehler et al., 2007). There is also increasing evidence that a child’s sleep problems in the first year of life are closely related to poor maternal well-being (Zuckerman, Stevenson, & Bailey, 1987) and to depression more specifically (Anders et al., 1992; Armstrong, Van Haeringen, Dadds, & Cash, 1998; Dennis & Ross, 2005; Hiscock & Wake, 2001; Karraker & Young, 2007). However, most of these studies focus on the child’s sleep behaviours after a clear day–night differentiation has been established, i.e., at the age of three months (Nishihara, Horiuchi, Eto, & Uchida, 2002). The present study examines predictors of poor sleep at the age of zero to six weeks, before sleep consolidation is clearly established. Other forms of postnatal maternal distress, such as feeling anxious or stressed, have not yet been studied in relation to infant sleep consolidation and are included as predictors in the present study.

Maternal psychopathology during the prenatal period may also have a negative influence on infants’ sleep behaviours, since such psychopathology affects a number of physiological (Field, Diego, & Hernandez-Reif, 2006) and emotional (O’Connor, Heron, Golding, Beveridge, & Glover, 2002) components of child development. Prenatal maternal depression is associated with less time spent in deep sleep (Field et al., 2007), while prenatal psychological distress predicts night wakings at the age of six to 12 months (Baird, Hill, Kendrick, & Inskip, 2009). To our knowledge, the present study is the first to investigate whether prenatal maternal psychopathology is associated with sleep fragmentation in the very first months of life.

Maternal history of primary insomnia is another factor suspected to contribute to poor sleep early in infancy. Insomnia is the most common sleep disorder, with chronic insomnia affecting up to 20% of the adult population (Dauvilliers et al., 2005) and showing a familial aggregation (Dauvilliers et al., 2005; Drake, Scofield, & Roth, 2008) that may be partly attributed to genetic factors (Drake et al., 2008). Moreover, insomnia onset at a young age has been found for familial insomnia (Dauvilliers et al., 2005; Hauri & Olmstead, 1980) with a preferential maternal transmission (Dauvilliers et al., 2005). Thus, we hypothesised that maternal history of insomnia would predict
infant sleep fragmentation, which might be considered a sign of protodyssomnia, an early manifestation of insomnia.

Sleep regulation in infancy might also be determined by familial relational factors, more specifically by relational insecurity of the mother. In line with this hypothesis, maternal separation anxiety was found to be associated with the child’s night wakings at 10 and 12 months (Scher, 2008; Scher & Blumberg, 1999). Similarly, more sleep problems were found among the children of mothers showing an insecure (dismissing or preoccupied), as opposed to a secure-autonomous, attachment when interviewed about past relationships (Benoit, Zeanah, Boucher, & Minde, 1992). This suggests that a parent’s insecure attachment to his/her own parental figures leads to sleep problems in the child. However, this has never been tested in very young infants. In the present study, the mother’s perception of bonding with her own parental figures, thought to be related to maternal sensitivity, was measured and examined in relation to early sleep regulation.

**Parental practices**

Breastfeeding is widely recognised to have numerous benefits to infant health (Heinig & Dewey, 1996) and is usually recommended as the first choice method for feeding infants aged zero to six months (American Academy of Pediatrics, 2005; World Health Organization, 2001). However, it is also an important predictor of sleep fragmentation in five-month-old infants (Touchette et al., 2005) and of sleep dysregulation in the first three years of life (Sadeh, Mindell, Luedke, & Wiegand, 2009). The association between breastfeeding and poor sleep in both parents and infants might be partly attributed to the well-known relationship between breastfeeding and cosleeping (Goldberg & Keller, 2007). Cosleeping, defined as sharing the parent’s bed or room for part or all of the night, is associated with lighter infant sleep, more night wakings (Adair, Bauchner, Philipp, Levenson, & Zuckerman, 1991; Mao, Brunham, Goodlin-Jones, Gaylor, & Anders, 2004; Mosko, Richard, & McKenna, 1997) and the persistence of sleep problems from one to two years of age (Morrell & Steele, 2003). However, few studies have examined sleep outcomes of cosleeping before the age of three months. Anders et al. (1992) reported that three-month-old infants who were put to bed awake were more likely than those put to bed already asleep to self-comfort after later nocturnal awakenings, hence suggesting a detrimental effect of parent–child proximity at bedtime.

Based on the literature reviewed above, we hypothesised that sleep fragmentation in 12-week-old infants would be predicted by: (1) postpartum distress of the mother, defined as feeling depressed, anxious and stressed from zero to six weeks; (2) prenatal psychological distress of the mother; (3) pre-pregnancy maternal insomnia; (4) maternal perception of having received poor parenting; and (5) parental practices involving parent–child proximity at night (breastfeeding, feeding the child in bed and room sharing). Two alternative indicators of sleep consolidation were investigated in the study: sleeping less or more than six consecutive hours at night (categorical outcome) and number of consecutive hours of sleep at night (continuous outcome).

**Methods**

**Participants**

The sample consisted of 106 new mothers aged 18–45 years ($M = 30.5 \pm 5.2$ years), each of whom had given birth in the Hôpital du Sacré-Coeur de Montréal (Montreal,
Canada) within the last 24 hours and had agreed to take part in a study on the sleep and dream experiences of new mothers. Each of these mothers completed questionnaires within 48 hours of giving birth and were later contacted by telephone at home to complete structured interviews at three, six and 12 weeks postpartum. All mothers were selected based on the following inclusion criteria: (1) no active neurological, psychiatric or major sleep disorder; (2) not currently taking medication known to influence sleep; (3) no evidence of substance abuse during pregnancy; and (4) comprehension of English or French.

Most mothers in the final sample were Caucasians (98.1%), born in Canada (96.2%), and spoke French as their first language (96.2%). Half of the mothers were living in common law relationships (51.4%), while 39.1% were married and 9.5% were single. With regard to education level, 42.9% had a university degree, 28.6% had a college diploma, 22.9% had a high school diploma and 5.7% did not complete high school. Most (63.5%) families earned more than $50,000, whereas 10.6% earned less than $20,000 annually.

**Measures**

**Interviews**

The same structured interview was conducted at three, six and 12 weeks postpartum. Interviews covered the period since the child’s birth (Week 3 interview) or their last contact with a research assistant (Weeks 6 and 12 interviews). Responses to all questions were tape-recorded and typed into a database by one of three interviewers. Each interview included 71 questions, nine of which were assessed in the present analyses (see Table 1).

<table>
<thead>
<tr>
<th>Item</th>
<th>Type of variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many hours does he/she sleep consecutively during the night?</td>
<td>Continuous</td>
</tr>
<tr>
<td>Does he/she sleep through the night?</td>
<td>Dichotomous (yes/no)</td>
</tr>
<tr>
<td>How many hours does your baby sleep on average in a 24-hour period?</td>
<td>Continuous</td>
</tr>
<tr>
<td>How often do you feed your baby in your bed?</td>
<td>Continuous (times/week)</td>
</tr>
<tr>
<td>Are you breastfeeding?</td>
<td>Dichotomous (yes/no)</td>
</tr>
<tr>
<td>How stressed have you been feeling about the new responsibilities of being a mother?</td>
<td>11-point scale (0 – not at all to 10 – extremely)</td>
</tr>
<tr>
<td>How anxious have you been feeling since coming home from the hospital (or the last interview)?</td>
<td>11-point scale (0 – not at all to 10 – extremely)</td>
</tr>
<tr>
<td>Have you been feeling depressed since coming home from the hospital (or the last interview)?</td>
<td>11-point scale (0 – not at all to 10 – extremely)</td>
</tr>
<tr>
<td>Where does your baby sleep?</td>
<td>Categorical (In your room, In baby’s room without monitor, In baby’s room with monitor)</td>
</tr>
</tbody>
</table>


Questionnaires

**General information questionnaire.** This instrument assesses 11 sociodemographic items, including mother’s age, education and familial income levels, number of children, marital status, language spoken at home, infant’s birth weight, etc.

**Sleep Disorders Questionnaire – Abbreviated (SDQ-A).** This 81-item instrument was adapted from the Sleep Disorders Questionnaire (Douglass et al., 1994) and assesses the presence of sleep disorders symptoms using five-point rating scales (1 = never, 2 = rarely, 3 = sometimes, 4 = usually, 5 = always). Only the 12 items assessing insomnia were used in this study. These items target diverse aspects of insomnia, such as lack of sleep (e.g. *I get too little sleep at night, I wake up often during the night*), and ruminations and worries at night (e.g. *At bedtime, I worry about things; My sleep is disturbed by thoughts racing through my head*).

**Parental Bonding Instrument (PBI).** This widely used questionnaire measures the adult’s perception of bonding with parental figures for the age of 16 and earlier (Parker, Tupling, & Brown, 1979). It includes 25 items, each rated on a four-point scale from *very like* to *very unlike*, and yields scores on two subscales: affection and protection. The questionnaire is completed once for each parental figure.

**Symptom Checklist-90-Revised (SCL-90-R).** This 90-item instrument assesses psychopathology with nine validated clinical subscales: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism (Derogatis, 1977). Additionally, a Global Severity Index (GSI) derived from these subscales provides information about general psychopathology level. The questionnaire was used to probe psychological distress only during the last month of pregnancy. The SCL-90-R has good internal consistency in the present study (Cronbach’s alpha = .95).

**Results**

**Data reduction**

To reduce the number of predictors and minimise multicollinearity, the following variables were combined and averaged: mother-reported stress and anxiety levels at three and six weeks postpartum (*rs* between .59 and .72, *p* < .01), and depressive symptoms level at three and six weeks (*r* = .41, *p* < .01). Most of the SCL-90-R subscales were highly inter-correlated (*rs* between .33 and .82, *p* < .01). Thus, only the GSI was used in the analyses.

**Preliminary analyses**

Preliminary analyses were undertaken to identify potential sociodemographic covariates of the study dependent variables (consecutive hours of sleep at 12 weeks), i.e., child’s gender, mother’s parity, marital status, age, education level and family yearly income. Children differed significantly as a function of mother’s parity, with children of multipara mothers sleeping fewer hours in a row (*M* = 6.5 ± 2.2 hours) than children of primipara mothers (*M* = 7.4 ± 2.2 hours; *t*[104] = 2.09, *p* < .05). Only parity was
identified as a possible confounder, and was therefore included as a covariate in subsequent analyses.

Longitudinal progression of sleep consolidation from the age of three to 12 weeks

The longitudinal progression from three to 12 weeks of children with consolidated sleep (‘sleeping at least or less than six consecutive hours’) at night is displayed in Figure 1. Only a small proportion of children was already sleeping six hours in a row at three weeks (8.5%), and 100% of this number continued to do so at six and 12 weeks. Among the majority (91.5%) of infants who slept less than six hours at three weeks, most (76.3%) still had short nocturnal sleep periods at six weeks. However, at 12 weeks the tendency towards consolidated sleep was stronger than the tendency towards non-consolidated sleep among infants who were previously sleeping less than six hours (62.2% vs. 37.8%). At 12 weeks, the majority (70.8%) of infants slept at least six consecutive hours nightly.

Predictors of sleeping less than six hours in a row at 12 weeks

Binary logistic regression analyses were conducted, with a forced entry of the covariate (parity) in a first step, followed by the inclusion of all predictors of interest using a forward-stepwise likelihood ratio method, in a second step. The inclusion of the covariate significantly added to a constant-only model ($\chi^2[1, N = 106] = 4.36, p < .05$); however, parity was no longer a significant predictor in the final model (see Table 2).

Figure 1. Evolution of children sleeping less than or at least six consecutive hours at night at three, six and 12 weeks of age.
Three predictors achieved entry in the final model ($\chi^2[4, N = 106] = 23.68, p < .01$). The order of stepwise entry of these predictors was: (1) maternal depressive symptoms (from zero to six weeks) (improvement $\chi^2[1, N = 106] = 5.54, p < .01$), (2) breastfeeding during Weeks 3–6 (improvement $\chi^2[1, N = 106] = 9.59, p < .01$), and (3) sleeping in mother’s room during Weeks 3–6 (improvement $\chi^2[1, N = 106] = 4.19, p < .05$). All these predictors remained significant in the final model (see Table 2).

Predictors of number of consecutive hours of nocturnal sleep at 12 weeks

Multiple regression analyses were performed on sleep consolidation as a continuous outcome (number of consecutive hours of nighttime sleep) at the age of 12 weeks as for the previous model. Mother’s parity was entered in a forced first step then all other predictors were entered in a stepwise fashion. As for the previous analysis, breastfeeding during Weeks 3–6 ($\Delta R^2 = 0.12, \Delta F(1,98) = 13.44, p < .01$) and the mother feeling depressed during Weeks 3–6 ($\Delta R^2 = 0.08, \Delta F(1,97) = 9.57, p < .01$) were significant predictors of poor sleep consolidation at 12 weeks (see Table 3). Unexpectedly, being a primipara mother was associated with more consecutive hours of nighttime sleep ($\Delta R^2 = 0.05, \Delta F(1,99) = 5.25, p < .05$). Parity remained a significant predictor in the final model (see Table 3). Room sharing was not a significant predictor of sleep consolidation assessed as a continuous variable.

Post-hoc analyses: association between room sharing and breastfeeding

At three weeks, 60.0% of children were sleeping in mother’s room, whereas 40.0% were sleeping in their own room and 75.5% were breastfed, as opposed to 24.5% who were formula-fed. Similarly, at six weeks, most (69.5%) children were breastfed. However, 47.6% children were sleeping in their own room. Chi-square analyses were undertaken to investigate whether mother–infant room sharing and breastfeeding were inter-related. At three weeks, the proportion of room sharing was higher among

---

### Table 2. Final logistic regression model for predicting sleeping less than six consecutive hours at night at 12 weeks.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>%Ref&lt;sup&gt;a&lt;/sup&gt;</th>
<th>%Cat&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Wald statistic</th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primipara mother&lt;sup&gt;c&lt;/sup&gt;</td>
<td>50.67%</td>
<td>32.26%</td>
<td>2.79</td>
<td>0.38 (0.13–1.18)</td>
</tr>
<tr>
<td>Mother’s report of feeling depressed from zero to six weeks</td>
<td>2.03 (1.79)</td>
<td>2.71 (1.62)</td>
<td>7.19**</td>
<td>1.55 (1.13–2.13)</td>
</tr>
<tr>
<td>Breastfeeding at six weeks&lt;sup&gt;d&lt;/sup&gt;</td>
<td>64.00%</td>
<td>83.33%</td>
<td>7.37**</td>
<td>6.40 (1.68–24.48)</td>
</tr>
<tr>
<td>Sleeping in mother’s bedroom at six weeks&lt;sup&gt;e&lt;/sup&gt;</td>
<td>38.36%</td>
<td>70.00%</td>
<td>4.08*</td>
<td>2.91 (1.03–8.18)</td>
</tr>
</tbody>
</table>

<sup>*p < .05; **p < .01.</sup>

<sup>a</sup>Percentage within the group of children sleeping at least six hours in a row at night (reference category).

<sup>b</sup>Percentage within the group of children sleeping less than six hours in a row at night.

<sup>c</sup>The reference category was being a multipara mother.

<sup>d</sup>The reference category was bottle-feeding.

<sup>e</sup>The reference category was the infant sleeping in his/her own room.
bottle-feeding (76.9%) than among breastfeeding (54.4%) mothers ($\chi^2[1, n = 105] = 4.12, p < .05$). However, this difference was not significant at six weeks ($\chi^2[1, n = 102] = 0.03, \text{ns}$). Finally, there was no interaction effect between breastfeeding and room sharing in predicting impaired sleep consolidation at 12 weeks, using either dichotomous or continuous measures.

**Discussion**

We examined the longitudinal progression of an infant’s sleep consolidation during the immediate postpartum period and identified predictors of failing to reach this developmental milestone by the age of 12 weeks. While relatively few infants slept at least six consecutive hours at night (8.5%) at three weeks of age, there was a dramatic increase in sleep consolidation between six (30.2%) and 12 (70.8%) weeks. This pattern of developmental change is consistent with the view of sleep maturation as a discontinuous process, with the most acute changes in sleeping through the night occurring seven weeks after birth (Fukuda & Ishihara, 1997). Consistent with a previous report (Adams et al., 2004; Anders et al., 1992), most children in the present study had consolidated sleep by the time they reached 12 weeks of age, which supports the idea that synchronisation between the homeostatic and circadian processes, thought to be reflected in the absence of awakenings over a six-hour period at night, is attained between the age of six and 12 months (Jenni & LeBourgeois, 2006).

Nonetheless, a considerable number of families (25–30%) were still dealing with non-consolidated sleep when the child was 12 weeks old. The present study revealed two postpartum factors that may explain this developmental delay: breastfeeding during Weeks 3–6 and the mother’s depressive affect. These factors reliably predicted impaired sleep consolidation at 12 weeks whether assessed as a dichotomous or a continuous measure and independent of sociodemographic factors. Mother–infant room sharing also predicted poor sleep consolidation only for the dichotomous measure while multipara status predicted poor sleep consolidation only for the continuous measure. Altogether, the findings support the idea that maternal-related cues and behaviours are prominent determinants of sleep regulation from infancy (Nishihara et al., 2002) throughout the preschool years (Touchette et al., 2005).

**Maternal practices: breastfeeding and room sharing**

As hypothesised on the basis of previous findings (Sadeh et al., 2009; Touchette et al., 2005), breastfeeding predicted delayed sleep consolidation in 12-week-old...
infants. After controlling for sociodemographic factors (parity), the risk of delayed sleep consolidation at the age of 12 weeks was more than eight times higher if the child had been breastfed from the age of three to six weeks. Consistent with this finding, a recent case study found that nocturnal awakenings are closely related to the need for milk intake in breastfed infants younger than four months of age (Oda et al., 2008). This does not mean that, in order to improve infant’s sleep, breastfeeding should be avoided, since the practice has numerous benefits to the child’s health (Heinig & Dewey, 1996). There is clinical evidence that the optimal delay between a child’s expression of a need (e.g. hunger) and a caregiver’s response to it is short in the very first weeks of life (American Academy of Pediatrics, 2005). However, lengthening the delay between the infant’s nighttime crying and breastfeeding by introducing alternatives to feeding as a first response to the crying (e.g. diapering, walking the infant, patting) results in a reduced frequency of night waking and reduced likelihood of seeking help for crying and sleeping (Pinilla & Birch, 1993; St James-Roberts, Sleep, Morris, Owen, & Gillham, 2001). That such procedures are not associated with weight loss suggests that crying does not automatically imply a need for immediate feeding.

Mother–infant room sharing can also interfere with the development of self-soothing strategies. Indeed, such a sleep arrangement promotes a faster response by the mother to the child’s cries, and hence may interfere with sleep consolidation through processes similar to those related to breastfeeding. Consistent with this, we found that room sharing predicted the subsequent absence of sleep consolidation in 12-week-olds. Specifically, 12-week-olds who at six weeks had slept in their mother’s bedroom were over two times more at risk of sleeping less than six consecutive hours at night than were 12-week-olds who had slept in their own room with or without a monitor. These findings support the considerable body of evidence for a link between cosleeping and sleep problems during childhood (Adair et al., 1991; Adams et al., 2004; Anders et al., 1992; Mao et al., 2004; Morell & Steele, 2003; Mosko et al., 1997). However, we found that cosleeping was not a predictor of sleep consolidation when measured in a continuous fashion.

Despite the well-known relationship between cosleeping and breastfeeding (Goldberg & Keller, 2007) and the fact that both practices are thought to interfere with sleep through similar processes relating to enhanced proximity with the child, they were not interrelated at the age of six weeks in the present study. Moreover, there was a larger proportion of cosleepers among bottlefed (76.9%) than among breastfed (54.4%) infants at the age of three weeks. This unexpected finding is at odds with previous research suggesting that breastfeeding and cosleeping are mutually supportive (Ball, 2003). One possible explanation is that mothers who bottle-feed do so knowingly counter to the recommendations of public health policies and paediatricians, and are thereby more inclined to compensate their lack of proximity with the child through sharing of the same room. Finally, in the present study, there was no interaction between practices in predicting sleep consolidation. Thus, in the first three months of life, room sharing and breastfeeding each appear to have a unique contribution to delayed sleep consolidation.

In the present results, mother’s parity was unexpectedly related to infant sleep fragmentation. While multipara status was found to predict poor sleep consolidation, this was not reliably so for the continuous dependent measure. One possible explanation for this finding is that primipara mothers benefit from a greater involvement of fathers in nocturnal care of infants and thus incorrectly judge them to have slept more
hours. Alternatively, it may be that the infants of multipara mothers are disturbed more by the presence of other children in the household – and possibly even in the same bedroom, although this factor was not evaluated in the present study.

**Depressive affect of the mother**

As expected, the mother’s postnatal depressive affect was found to predict disrupted sleep consolidation at the age of 12 weeks. A maternal depressed mood from zero to six weeks postpartum increased the child’s subsequent risk for sleeping less than six consecutive hours at night by a factor of 1.55 for each elevation of 1 on an 11-point scale. Moreover, postpartum depressed mood was associated with fewer consecutive hours of nocturnal sleep. That the mother’s postnatal anxiety and stress did not contribute to this effect is in line with literature that emphasises the deleterious effects of maternal depressive mood on the child’s sleep and with evidence that maternal stress does not predict the persistence of sleep difficulties in children at the age of three years beyond what is predicted by depression (Zuckerman et al., 1987). Researchers have noted difficulties in clarifying the causal nature of associations between maternal depression and infant sleep difficulties (Armstrong et al., 1998; Hiscock & Wake, 2001; Ross, Murray, & Steiner, 2005) but two main pathways have been proposed. The first is that the child’s sleep disruption contributes to maternal depression by augmenting sleep deprivation in the mother (Ross et al., 2005; Warren, Howe, Simmens, & Dahl, 2006). This explanation is consistent with evidence that:

1. chronic sleep deprivation is a risk factor for the onset of depression in the general population (Boivin et al., 1997) and in new mothers in particular (Dennis & Ross, 2005; Goyal, Gay, & Lee, 2007), and
2. reducing an infant’s sleep problems improves maternal mood (Armstrong et al., 1998; Hiscock & Wake, 2002).

The second suggested pathway is that maternal depressive symptoms contribute to infant sleep problems through maladaptive parenting behaviours that negatively affect the infant’s sleep. Thus, children of depressed mothers may be more prone to sleep disorders as a reaction to their mothers’ inappropriate practices in situations of bedtime resistance or night waking (Stoleru, Nottelmann, Belmont, & Ronsaville, 1997). Results from two longitudinal studies support this notion by showing that maternal depressive symptoms predicted persistence (Zuckerman et al., 1987) and even worsening (Warren et al., 2006) sleep problems among children up to three years of age, while children’s sleep disturbances were unlikely to contribute to maternal depressive symptoms.

Finally, Karraker and Young (2007) proposed a model in which the two suggested causal pathways between child sleep disruption and mother depressive symptoms operate simultaneously. Tired and depressed mothers of wakeful infants purportedly engage in parenting practices that prolong or increase the child’s night waking, thereby increasing their own exhaustion and depression, and so on cyclically. In line with this model, a greater frequency of night wakings in the infants of depressed mothers could be an indicator of less sensitive caregiving (Mills-Koonce, Gariepy, Sutton, & Cox, 2008) and an early marker for the development of insecure child–mother attachment (De Wolff & van Ijzendoorn, 1997). However, since depressed mothers underestimate their own sleep quality (Dorheim, Bondevik, Eberhard-Gran, & Bjorvatn, 2009), they may also overemphasise sleep difficulties in their child. For instance, mothers experiencing depressive affects retrospectively report difficulties with their infant learning to sleep through the night (Germo, Goldberg, & Keller,
Alternatively, by sleeping less during the night, they may be more aware of their infant’s night awakenings than are non-depressed mothers (Hiscock & Wake, 2001; Karraker & Young, 2007).

Prenatal maternal factors
Contrary to our hypotheses, neither maternal prenatal psychopathology nor maternal history of insomnia before pregnancy predicted disrupted sleep consolidation in the child. One explanation for these unexpected findings is that completion of the questionnaires measuring psychopathology and insomnia within 48 hours of giving birth distanced mothers psychologically from their past difficulties and led to underestimation of them. Childbirth is a landmark event that evokes both positive and negative psychological reactions, and for some women transition to motherhood may be a period of heightened cognitive–emotional sensitivity during which they are totally focused on the infant’s needs, a state designated by Winnicott (1965) as ‘primary maternal preoccupation’. Such a change may render women psychologically unavailable to respond accurately to questions about former internal states.

The quality of a mother’s bonding with her own parental figures also did not predict sleep fragmentation at the age of 12 weeks as expected. This hypothesis (Jefferis & Oliver, 2006) was based on the notion of transgenerational transmission of anxiety (DiBartolo & Helt, 2007), as expressed here in the child’s difficulty in separating from the caregiver at night. Given the complexity of these concepts and the lack of studies on the topic, it is possible that the instrument used in the present study (PBI) does not adequately capture the type of maternal relational insecurity that interferes with the child’s sleep.

Clinical implications
Our finding of a time window from 6 to 12 weeks of age that is critical to sleep consolidation may inform the development and evaluation of much-needed intervention programmes. Because it is still not known definitively if sleep fragmentation has detrimental or beneficial effects on infant development, sleep interventions should for the time being be applied only in families where the infant’s sleep fragmentation is a burden, interfering with the quality of parent–child interactions. Until this issue is resolved, findings from the present study suggest that intervention programmes could target the factors of room sharing, breastfeeding and depressive mood among families with infant sleep problems. Nonetheless, caution should be exercised with respect to room sharing and breastfeeding in particular. Both factors are associated with sleep difficulties, but both have also been reported to impart benefits to the child’s health and development. Breastfeeding should clearly not be avoided, but provided to the child in a way that is minimally disruptive to the infant’s sleep (for a discussion, see Pinilla & Birch, 1993 and St James-Roberts et al., 2001). With respect to cosleeping, the latter has been reported repeatedly to predict poor sleep during childhood and the same may be true for the very first weeks of life. However, cosleeping could also be a protective factor against SIDS (McKenna & McDade, 2005). Also, as previously suggested (Germo et al., 2009), some families may hold personal or cultural beliefs that emphasise a later onset of sleeping through the night and which may thereby be associated with less distress and less need for professional help.
Acknowledgements
This research was supported by grants received from the Social Sciences and Humanities Research Council of Canada (SSHRC), the Canadian Institutes of Health Research (CIHR) and the Natural Sciences and Engineering Research Council of Canada (NSERC).

Notes on contributors
Valerie Simard is a clinical child psychologist and a professor in the Department of Psychology at the Université de Sherbrooke. Her research interests include child development, sleep, parent–child relationships and attachment.

Jessica Lara-Carrasco is a doctoral student in the Department of Psychology at the Université de Montréal who is currently conducting research in the Dream and Nightmare Laboratory at the Sleep Research Center of Hôpital du Sacré-Coeur de Montréal. Her research interests include functions of dreams, sleep and maternal adjustment.

Tyna Paquette is the research coordinator of the Dream and Nightmare Laboratory at the Sleep Research Center of Hôpital du Sacré-Coeur de Montréal. Her research interests include physiology of normal and disordered dreaming.

Tore Nielsen is a psychologist, professor of psychiatry at the Université de Montréal, and director of the Dream & Nightmare Laboratory at the Hôpital du Sacré-Coeur de Montréal where he conducts research on nightmare physiology and the neuroscience of dreaming.

References


