



ORIGINAL ARTICLE

Breastfeeding and infant sleep patterns: an Australian population studyMegan Galbally,¹ Andrew J Lewis,³ Kerri McEgan,² Katherine Scalzo³ and FM Amirul Islam⁴¹Perinatal Mental Health Unit and ²Lactation Department, Mercy Hospital for Women, ³School of Psychology and ⁴School of Health and Social Development, Deakin University, Melbourne, Victoria, Australia

Objective: Our purpose was to determine if babies breastfed at 6 months of age were more likely to wake at night and less likely to sleep alone than formula-fed babies.

Patients and Methods: Data were drawn from the first wave of The Longitudinal Study of Australian Children, an ongoing, nationally representative study of the growth and development of Australia's children. The 4507 participants met the criteria for this study. The measures examined infant sleep problems as the outcome and breastfeeding at 6 months of age as the exposure in addition to the demographic data, maternal mental health, infant birthweight and gestational age at delivery.

Results: After adjustment for covariates, reports by mothers of infants that breastfed at 6 months of age suggested infants were 66% more likely to wake during the night and 72% more likely to report difficulty sleeping alone. However, breastfeeding had a strongly protective effect on wheezing, coughing, snoring and breathing problems, and it was not associated with restless sleep or problems getting to sleep for the infant.

Conclusions: Breastfeeding was found to be associated with increased night waking and this is consistent with other studies. There are biological reasons why this might be required to ensure breastfeeding continues to 6 months and beyond. The current low rates of sustained breastfeeding in many Western countries needs to be reconsidered in relation to parental and public health practices promoting prolonged nocturnal infant sleep patterns.

Key words: breastfeeding; breastfeeding duration; infant; sleep problems.

What is already known on this topic

- 1 In many countries breastfeeding rates at 6 months remain low.
- 2 Breastfeeding for 6 months or longer is associated with a wide range of beneficial health outcomes.
- 3 The association between infant sleep patterns and breastfeeding appears related but requires exploration.

What this paper adds

- 1 Breastfeeding at 6 months is associated with infants waking during the night and having difficulty sleeping alone.
- 2 Breastfeeding is not associated with infants having difficulty falling asleep or having restless sleep.
- 3 Further research into infant sleep patterns and infant sleep interventions need also to take into account breastfeeding.

Several areas of research suggest that breastfeeding and infant sleep patterns are closely related processes.^{1–8} Most studies have confirmed that breastfed babies are more likely to continue to wake in the night,^{3,9} and there are a number of physiological reasons why they need to feed overnight and indeed may need to do so to ensure ongoing breastfeeding. For example, the composition of breast milk requires greater frequency of feeds for infant growth, and the production of breast milk requires

frequent stimulation to ensure supply.¹⁰ Breastfeeding results in altered sleep architecture for both mother and infant, and this pattern of sleep architecture may protect against changes in maternal sleep patterns in the postpartum.^{2,4}

The World Health Organisation, American Academy of Paediatrics and the National Health and Medical Research Council are unanimous in recommending exclusive breastfeeding for most infants until 6 months and partial breastfeeding beyond.^{11–13} More recently, the Surgeon General in the USA has published a call to action to increase breastfeeding rates in the USA outlining economic, psychosocial and health benefits for the nation.¹⁴ Breastfeeding has been associated with a wide range of beneficial health effects,^{12,15,16} and the UK-based Infant Feeding Survey found that the majority of mothers were aware of the health benefits breastfeeding provides for mothers and babies.¹⁷

Yet the rate of breastfeeding at 6 months of age continues to be low across the USA, UK and Australia. In these countries,

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respectively, only 43%,¹⁴ 25%¹⁷ and 49%¹⁸ are partially breastfed at 6 months. The UK Infant Feeding Survey in 2005 found less than 1% of mothers were exclusively breastfeeding at 6 months of age.¹⁷ These current low rates of sustained breastfeeding need to be considered in relation to parental and public health practices that promote prolonged nocturnal infant sleep. Expectations for some are that infants should sleep 8 hours a night by 6 months of age,^{19,20} and if this is not occurring then a range of interventions are available to parents. However, few of the interventions promoted discuss breastfeeding in relation to sleep expectations for infants.

Given that breastfed infants will need to wake frequently through the night in order to maintain their own nutritional requirements as well as continue to maintain mother's milk supply, we predicted that mothers breastfeeding at 6 months would be more likely to report night waking and infants less willing to sleep alone. However, given the widespread health benefits of breastfeeding, we also predicted that breastfeeding would be associated with a range of sleep-related benefits for the infant including reduced breathing problems and unsettled behaviours. We were able to test these predictions in a large normative population cohort and control for a number of potentially confounding factors.

Patients and Methods

Study design and sample

Data were drawn from the first wave of The Longitudinal Study of Australian Children (LSAC), an ongoing, nationally representative study of the growth and development of Australia's children. The sampling design and method have been detailed in a previous technical paper.²¹

LSAC used a two-stage cluster sampling design with Australian postcodes (stratified by state of residence and urban vs. rural status) as primary sampling units. Secondary sampling units were infants born between March 2003 and February 2004, who were enrolled in the Australian Medicare database. Some very remote postcodes were excluded from this process.

Random selection of infants within each postcode produced a cohort aged between 3 and 19 months, with all birth months represented. Of those selected infants who were able to be contacted, 5107 took part in the first wave of LSAC in 2004 (64.2% response rate). This sample was generally representative of all Australian infants, although those with two-parent households and highly educated parents were over-represented, and single-parent and non-English speaking families were slightly under-represented.²¹

Procedures

Data were collected from the child's primary care giver via face-to-face interview with a trained researcher. The 98.6% of primary care givers were the child's mother.²¹ After each interview, both primary and secondary care givers completed a self-report questionnaire. The study was approved by the Australian Institute of Family Studies Ethics Committee, and a parent provided written informed consent for every participant.

Inclusion criteria for the current analysis

The sample for this analysis was limited to infants for whom the primary care giver was the child's biological mother and who had complete data for breastfeeding at 6 months of age. The inclusion criteria was met in 4507 primary care givers and hence the sample size of this particular study.

Measures

Predictor and outcome variables

Breastfeeding at 6 months. Mothers were asked to indicate whether the child was still receiving breast milk at 6 months of age (yes or no). Mothers' recall of breastfeeding duration has been shown to be accurate to within a few weeks, especially if recall is within 12 months.²²

Infant sleep problems. Mothers were asked 'Does your child have any of these problems on 4 or more nights a week, that is, more than half the time?' (yes or no). Problems include: wheezing or coughing, snoring/breathing, getting to sleep, sleeping alone, waking during the night and restless sleep.

Demographic and other potential confounding variables

Mothers reported on child's gender and their age in months. They also reported on their own age in years, country of birth (Australia/New Zealand vs. other), marital status (married vs. other), main language spoken at home (English vs. other), employment status (full time, part time, on maternity leave, unemployed or not in labour force), education status (did not complete high school, completed high school only, completed tertiary/postgraduate degree) and smoking history (never, past or current). Social disadvantage was measured using the census-based Socio-Economic Indexes for Areas.²³ This index of relative socio-economic disadvantage areas is based on postcode of residence and has a national mean of 1000 (SD (standard deviation) 100), with higher values indicating a greater neighbourhood advantage.

Birthweight for age z-score. Birthweight was derived from Maternal and Child Health Child Health Record key stage growth data in 67% of cases. In the remaining cases, birthweight was based on self-report. A standardised score was calculated and used in analyses.

Maternal mental health. Mental health was assessed using the Kessler-6 (K6), a validated six-item screening tool to identify psychological distress, in particular symptoms of anxiety and depression.²⁴ Each item is assessed on a five-point (0–4) rating scale, with higher scores indicating greater distress. Responses to the six items are summed to give a total score between 0 and 24. The K6 was a point in time measure in the 3–19 months after birth.

Number of weeks gestation. Mothers were asked 'After how many weeks of pregnancy was child born?' and provided a numerical response which range from 22 to 42 weeks gestation.

Statistical analysis

Infant sleeping problems were analysed as binary outcomes (e.g. wheezing or coughing problem absent as '0' and present as '1'). Comparisons were made on the demographic characteristics based on two selected sleeping problems, wheezing or coughing and waking during night by using independent sample *t*-tests for continuous and normally distributed data (e.g. age), Mann–Whitney *U*-tests for continuous and skewed data (e.g. maternal health) or chi-square tests for categorical (e.g. marital status). We used logistic regression models to estimate odds ratio (OR) for the binary outcome variables, wheezing or coughing, snoring or breathing, sleeping alone, waking during night and restless sleep in association with breastfeeding at 6 months. In order to determine independent associations between breastfeeding and infant sleep outcomes, after controlling for the presence of other sleep problems, we ran the first model for each of the outcome variables adjusted for the remaining outcome variables. The second model was adjusted for variables in the first model plus indigenous community, ethnicity, maternal age, marital status, education, smoking status, employment

and disadvantage index. The third model was adjusted for model 2 plus maternal health, and model 4 was adjusted for model 3 plus gestational age and baby's birthweight in *z*-score. Models are presented as ORs, with 95% confidence intervals (CIs). Logistic regression analyses were weighted for non-response and account for unequal probabilities of selection into the sample. All analyses were performed in SPSS version 18 (SPSS Inc, Chicago, IL, USA).

Results

Participant characteristics including children's gender, child and maternal age in relation to absence or presence of wheezing or coughing and waking during night are shown in Table 1. Mothers who are Aboriginal or Torres Straight Islanders (4.1% vs. 12.6%), with less education (16% vs. 28%, less than high school education), full-time employment (10.9% vs. 14.6%) are more likely to report their children have wheezing or coughing problem. Mothers of male children (49.5% vs. 53.6%) and Australian-born mothers (80.1% vs. 82.5%) are more likely to

Table 1 Participant characteristics by breastfeeding status at 6 months of age (*n* = 4507)

Characteristic	Wheezing or coughing		Waking during night	
	No (<i>n</i> = 4293)	Yes (<i>n</i> = 214)	No (<i>n</i> = 2643)	Yes (<i>n</i> = 1864)
Child				
Age in months, mean (SD)	9.32 (2.18)	9.14 (2.20)	9.42 (2.22)	9.15 (2.10)*
Gender (males), <i>n</i> (%)	2194 (51.1)	114 (53.3)	1308 (49.5)	1000 (53.6)*
Aboriginal/Torres Straight status, <i>n</i> (%)	177 (4.1)	27 (12.6)*	129 (4.9)	75 (4.0)
Maternal				
Age in years, mean (SD)	31.11 (5.44)	29.40 (5.78)*	30.86 (5.51)	31.26 (5.40)*
Born in Australia/ New Zealand, <i>n</i> (%)	3473 (80.9)	182 (85.0)	2118 (80.1)	1537 (82.5)*
English as first language, <i>n</i> (%)	3672 (85.5)	180 (84.1)	2227 (84.3)	1625 (87.2)*
Married, <i>n</i> (%)	3167 (73.8)	141 (65.9)*	1955 (74.0)	1353 (72.6)
Education				
Did not complete high school, <i>n</i> (%)	685 (16.0)	60 (28.0)*	473 (17.9)	272 (14.6)*
Completed high school only, <i>n</i> (%)	631 (14.7)	34 (15.9)	390 (14.8)	275 (14.8)
Completed tertiary education, <i>n</i> (%)	2977 (69.3)	120 (56.1)	1780 (67.3)	1317 (70.7)
Employment				
Employed full-time, <i>n</i> (%)	468 (10.9)	31 (14.6)	284 (10.8)	215 (11.6)
Employed part-time, <i>n</i> (%)	1326 (31.0)	62 (29.1)	815 (30.9)	573 (30.8)
Employed, but on maternity leave, <i>n</i> (%)	362 (8.5)	7 (3.3)	206 (7.8)	163 (8.8)
Unemployed and looking for work, <i>n</i> (%)	140 (3.3)	11 (5.2)	97 (3.7)	54 (2.9)
Not in the labour force, <i>n</i> (%)	1988 (46.4)	102 (47.9)*	1236 (46.9)	854 (45.9)
Smoking status				
Never smoked	2021 (56.0)	73 (44.0)*	1218 (55.4)	876 (55.5)
Current smoker	749 (20.7)	47 (28.3)	475 (21.6)	321 (20.3)
Past smoker	840 (23.3)	46 (27.7)	504 (22.9)	382 (24.2)
Gestational age, in weeks	39.13 (2.01)	38.82 (2.25)*	39.07 (2.10)	39.18 (1.90)
Baby's birthweight, <i>z</i> -score	-0.038 (1.05)	-0.178 (1.83)	-0.074 (1.06)	-0.003 (1.05)
Disadvantage index (SEIFA), mean (SD)	1009 (60)	1003 (62)	1008 (60)	1010 (61)
Mental health, median (IQR)†	2 (4)	3 (4)*	2 (4)	3 (4)*

**P* < 0.05 for comparison of means by using *t*-tests, median by using Mann–Whitney *U*-tests and proportions by using chi-square tests according to the data types. †Median (interquartile range (IQR)) for skewed data. ‡The IQR for the Kessler-6 was 4 with a range of scores from 0 to 24. SEIFA, Socio-Economic Indexes for Areas.

Table 2 Logistic regression of breastfeeding at 6 months as a function of infant sleep problems

Breastfeeding	Sleep problems					
	Absent	Present	Model 1: OR (95% CI)*	Model 2: OR (95% CI)†	Model 3: OR (95% CI)‡	Model 4: OR (95% CI)§
Wheezing or coughing						
No	1912 (42.4)	137 (3.0)	1.0 (ref)	1.0 (ref)	1.0	1.0
Yes	2381 (52.8)	77 (1.7)	0.50 (0.38, 0.69)	0.60 (0.43, 0.84)	0.62 (0.44, 0.88)	0.65 (0.45, 0.92)
Snoring/breathing						
No	1921 (42.5)	134 (3.0)	1.0	1.0	1.0	1.0
Yes	2390 (53.0)	68 (1.5)	0.44 (0.32, 0.59)	0.55 (0.38, 0.79)	0.56 (0.39, 0.81)	0.59 (0.41, 0.87)
Getting to sleep						
No	1863 (41.3)	186 (4.1)	1.0	1.0	1.0	1.0
Yes	2198 (48.8)	260 (5.8)	0.97 (0.78, 1.21)	0.98 (0.76, 1.27)	0.99 (0.76, 1.28)	0.98 (0.75, 1.27)
Sleeping alone						
No	1887 (41.9)	162 (3.6)	1.0	1.0	1.0	1.0
Yes	2134 (47.3)	324 (7.2)	1.68 (1.36, 2.08)	1.66 (1.29, 2.14)	1.73 (1.34, 2.24)	1.72 (1.33, 2.24)
Waking during night						
No	1352 (30.0)	697 (15.5)	1.0	1.0	1.0	1.0
Yes	1291 (28.6)	1167 (25.9)	1.81 (1.59, 2.07)	1.67 (1.44, 1.91)	1.68 (1.46, 1.95)	1.66 (1.43, 1.92)
Restless sleep						
No	1788 (39.7)	261 (5.8)	1.0	1.0	1.0	1.0
Yes	2175 (48.3)	283 (6.3)	0.69 (0.57, 0.84)	0.72 (0.58, 0.90)	0.74 (0.59, 0.93)	0.74 (0.59, 0.93)

*Model 1: Odds ratio (OR) (95% confidence interval (CI)) adjusted for each of the outcome variables by the rest of the outcome variables. †Model 2: Adjusted for Model 1 plus indigenous community, ethnicity, maternal age, marital status, education, employment, smoking status. ‡Model 3: Adjusted for Model 2 plus mental health. §Model 4: Adjusted for Model 3 plus gestational age and baby's birthweight.

report their children have night waking compared with the mothers with female children or born overseas. Mothers of children with wheezing or coughing problem are more likely to be younger (mean (SD) age 31.11 (5.44) vs. 29.40 (5.78)), but mothers of children with night waking are more likely to be older (mean (SD) age 30.86 (5.51) vs. 31.26 (5.40)).

Without adjustment for any confounding variables in logistic regression models (Table 2), breastfeeding revealed a protective effect on wheezing or coughing, snoring or breathing and restless sleep and risk of sleeping alone. After adjustment for indigenous community, ethnicity, maternal age, smoking status, marital status, education and employment, breastfeeding still had a significantly protective effect on wheezing or coughing (OR (95% CI): 0.6 (0.43, 0.84)), snoring or breathing problem (OR (95% CI): 0.55 (0.38, 0.79)) and restless sleep (OR (95% CI): 0.72 (0.58, 0.90)) but significant risk for sleeping alone (OR (95% CI): 1.66(1.29, 2.14)) and waking during night (OR (95% CI): 1.67(1.44, 1.91)). Breastfeeding did not show any association with getting to sleep. After additional adjustment for maternal mental health (model 3) and baby's birthweight and gestational age (model 4) this did not alter the significance of the previous findings.

Discussion

This study found that breastfeeding at 6 months of age is associated with increased likelihood of night waking and the infant not sleeping alone but not for other nocturnal unsettled behaviours. This was found to be significant after confounding variables such

as ethnicity; maternal employment, maternal smoking and age were controlled. This study also found that breastfeeding was protective for wheezing, coughing, snoring and other breathing problems. When further adjustment was undertaken for maternal mental health and infant gestational age and birthweight, the relationship between breastfeeding and infant waking during the night was reduced but not markedly so. Adjustment for the same set of covariates showed a slightly stronger relationship between breastfeeding and not sleeping alone. Overall, this comprehensive set of adjustments shows a robust relationship between breastfeeding and infant sleep outcomes.

This current finding of increased night waking in breastfed infants confirms findings in several smaller studies.^{1,3,6,9} One explanation for the increased night waking in breastfed infants is that these infants require more frequent feeds necessitating waking for feeds through the night. Although the number of night feeds was not measured, this is the most compelling explanation especially given infants woke more frequently at night but were not more unsettled nor did they have more difficulty getting off to sleep. Although sleep associations is another explanation, there are other compelling biological reasons why breastfed infants require night feeds that will be discussed.

Night feeds persist in breastfed infants because of the composition of breast milk that differs considerably from formula. Human breast milk is unique in composition and designed to meet the needs of human infants.²⁵ The milk composition is low in fat and protein and high in carbohydrate in particular lactose.^{25,26} Other species, for example, lions, whose milk is higher in fat and protein can feed at 6 h intervals or longer, but human

milk requires feed intervals of 2–4 h.²⁵ The proteins contained within breast milk have both antimicrobial and prebiotic activity and assist with the development of healthy intestinal flora. Hence, human breast milk not only provides nutrition for the infant but also facilitates digestion.²⁷ This unique composition results in breast milk being relatively more digestible for the infant. The unique nutrient and composition profile result in a requirement for more frequent feeds to ensure satiety and optimal growth for the infant.

Night feeds and more frequent waking in the night also persists due to the physiological aspects of the production of breast milk that relies on a demand–supply feedback system. The volume of milk produced by the mother is entirely regulated by infant demand.^{9,10,28} Therefore, if the infant has increased requirements for milk intake resulting from normal growth, this requires stimulation through extra feeding to increase the production and hence meet the increased demand.¹¹ In a longitudinal, prospective study of infants exclusively breastfed to 6 months of age, the vast majority woke in the night, half the sample showed a stable number of feeds across the study and a quarter decreased the interval between feeds around 3–4 months of age.⁹ The median interval for breastfeeding over 24 h was 4.23 h at 2 weeks of age and 4.47 h at 6 months of age.⁹ Interference with the demand–supply system through discouraging nocturnal feeds or substitution of some breastfeeds for formula feeds may have a detrimental impact on sustained breastfeeding through creating problems with supply.^{28–30}

There are now available numerous interventions designed to encourage longer durations of infant sleep at night at increasingly younger ages. The expectation among many parents and professionals alike that infants should sleep through the night has led to an array of interventions from self-help books to prescribed sedation, behavioural interventions and residential programmes that are all aimed at increasing infant sleep duration.^{31–33} However, within this context, there is a failure to consider the interaction between infant sleep and breastfeeding. A recent paper by Henderson, for example, argued that infants should be capable of sleeping 8 h by 6 months of age.²⁰ There was no discussion of breastfeeding or the impact that encouraging long nocturnal sleeps may have on sustained breastfeeding rates. Similarly, a systematic review of infant sleep interventions did not discuss breastfeeding.³¹ One study of an infant sleep intervention did report on breastfeeding rates for the sample.²⁹ Their sample had a breastfeeding rate of 81.8% prior to the sleep intervention; this then fell to 53.6% at follow-up following the intervention 16 weeks later.²⁹ As this study had no control group, it is difficult to know if this was due to normal attrition from breastfeeding across this time period or due to the intervention. However, it is interesting to also note that in this sample the rate of co-sleeping went from 70.1% to 26.1%.²⁹ Studies have found a link between co-sleeping and ongoing breastfeeding.^{1,6,34–36} Public health organisations in Australia, such as SIDS and Kids, recommend room sharing but not bed sharing for mothers and infants.

Breastfeeding is protective against a range of health outcomes including lower respiratory tract infections (LRTIs) and childhood asthma.¹⁶ This study found that breastfeeding was protective for wheezing, coughing, snoring and other respiratory symptoms at night. These reported symptoms are consistent

with sleep-disordered breathing in infants, which has been associated with a range of medical problems including cardiovascular and behavioural disturbance.^{37,38} Breastfeeding has previously been shown to be protective for sleep-disordered breathing.³⁸ The symptoms reported in this study may also represent a vulnerability to childhood asthma, LRTIs or sleep apnoea, all of which can have serious health implications for children.³⁹ In the USA, LRTIs and childhood asthma were identified as the third and fourth causes of excess deaths as a result of low breastfeeding rates.³⁹

Given the large normative population sample, this study was able to control for factors such as maternal depression, maternal employment, gestational age at birth and birthweight and other demographic confounding variables. The limitations of this study include the lack of clarification of the reason for the night waking. It would be useful to know if this was for feeding in the breastfed infants or for other reasons. There is also a lack of clarity around the extent of breastfeeding (exclusive or partial). There was no diagnosis available for the reported symptoms of nocturnal wheezing, snoring, coughing and other breathing problems. It was not clarified if these symptoms resulted from sleep-disordered breathing or reflected an increased vulnerability of non-breast-fed infants to lower respiratory tract illnesses and childhood asthma.

Conclusion

Findings from the current study suggest that normal sleep/wake cycles for infants who are breastfed to 6 months of age will be associated with frequent night waking. In order to maximise the health benefits to both mother and infant of breastfeeding, professionals and parents need to adopt more realistic expectations of infant sleep patterns informed by the biology of infant sleep architecture and breast milk production and composition. Future studies that examine interventions for sleep in infancy and toddlerhood should systematically report the impact this may have on breastfeeding rates and duration for these children. When investigating sleep concerns in infants and toddlers, studies should try to define more precisely the specific nature of the concern (e.g. night waking compared with difficulty getting to sleep or unsettled sleep) and its relationship to other aspects of the infant's routine such as breastfeeding.

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References

- 1 Ball HL. Breastfeeding, bed sharing, and infant sleep. *Birth* 2003; **30**: 181–8.

- 2 Blyton DM, Sullivan CE, Edwards N. Lactation is associated with an increase in slow-wave sleep in women. *J. Sleep Res.* 2002; **11**: 297–303.
- 3 Wright P, Macleod HA, Cooper MJ. Waking at night: the effect of early feeding experience. *Child Care Health Dev.* 1983; **9**: 309–19.
- 4 Butte NF, Jensen CL, Moon JONK, Glaze DG, Frost JD Jr. Sleep organization and energy expenditure of breast-fed and formula-fed infants. *Pediatr. Res.* 1992; **32**: 514–9.
- 5 Quillin SIM, Glenn LL. Interaction between feeding method and co-sleeping on maternal newborn sleep. *J. Obstet. Gynecol. Neonatal Nurs.* 2004; **33**: 580–8.
- 6 Elias MF, Nicolson NA, Bora C, Johnston J. Sleep/wake patterns of breast-fed infants in the first 2 years of life. *Pediatrics* 1986; **77**: 322–9.
- 7 Montgomery-Downs HE, Clawges HM, Santy EE. Infant feeding methods and maternal sleep and daytime functioning. *Pediatrics* 2010; **126**: e1562–8.
- 8 Rosen LA. Infant sleep and feeding. *J. Obstet. Gynecol. Neonatal Nurs.* 2008; **37**: 706–14.
- 9 Hörnell A, Aarts C, Kylberg E, Hofvander Y, Gebre-edhu M. Breastfeeding patterns in exclusively breastfed infants: a longitudinal prospective study in Uppsala, Sweden. *Acta Paediatr.* 1999; **88**: 203–11.
- 10 Neville MC. Anatomy and physiology of lactation. *Pediatr. Clin. North Am.* 2001; **48**: 13–34.
- 11 Eidelman AI, Lawrence M, Gartner LM, Morton J. American Academy of Pediatrics policy statement: breastfeeding and the use of human milk. *Pediatrics* 2005; **115**: 496–506.
- 12 NHMRC. *Dietary Guidelines for Children and Adolescents in Australia Incorporating the Infant Feeding Guidelines for Health Workers.* Canberra: National Health and Medical Research Council, 2003.
- 13 WHO. *Infant and Young Child Nutrition. Global Strategy on Infant and Young Child Feeding.* Geneva: World Health Organization, 2002.
- 14 U.S. Department of Health and Human Services. *The Surgeon General's Call to Action to Support Breastfeeding.* Washington: Department of Health and Human Services, Office of the Surgeon General, 2011.
- 15 Kramer MS, Aboud F, Mironova E et al. Breastfeeding and child cognitive development: new evidence from a large randomized trial. *Arch. Gen. Psychiatry* 2008; **65**: 578–84.
- 16 Ip S, Chung M, Raman G et al. Breastfeeding and maternal and infant health outcomes in developed countries. *Evid. Rep. Technol. Assess.* 2007; **153**: 1.
- 17 Bolling K, Grant C, Hamlyn B, Thornton A. *Infant Feeding Survey 2005.* London: The Information Centre for Health and Social Care, 2007.
- 18 Donath SM, Amir LH. Breastfeeding and the introduction of solids in Australian infants: data from the 2001 National Health Survey. *Aust. N. Z. J. Public Health* 2005; **29**: 171–5.
- 19 Henderson JMT, France KG, Owens JL, Blampied NM. Sleeping through the night: the consolidation of self-regulated sleep across the first year of life. *Pediatrics* 2010; **126**: e1081–7.
- 20 Henderson JMT, France KG, Blampied NM. The consolidation of infants' nocturnal sleep across the first year of life. *Sleep Med. Rev.* 2011; **15**: 211–20.
- 21 Soloff C, Lawrence D, Johnstone R. *LSAC Technical Paper No. 1: Sample Design.* Melbourne, Vic.: AIFS, 2005.
- 22 Gillespie B. Recall of age of weaning and other breastfeeding variables. *Int. Breastfeed. J.* 2006; **1**: 4.
- 23 Trewin D. *Socio-Economic Indexes for Areas: Australia, 2001.* Canberra: Australian Bureau of Statistics, 2003.
- 24 Kessler RC, Barker PR, Colpe LJ et al. Screening for serious mental illness in the general population. *Arch. Gen. Psychiatry* 2003; **60**: 184–9.
- 25 McKenna J, Thoman EB, Anders TF, Sadeh A, Schechtran UL, Glotzbach SF. Infant-parent co-sleeping in an evolutionary perspective: implications for understanding infant sleep development and the sudden infant death syndrome. *Sleep* 1993; **16**: 263.
- 26 James D, Dobson B. Position of the American Dietetic Association: promoting and supporting breastfeeding. *J. Am. Diet. Assoc.* 2005; **105**: 810.
- 27 Lönnerdal B. Nutritional and physiologic significance of human milk proteins. *Am. J. Clin. Nutr.* 2003; **77**: 1537S.
- 28 Hörnell A, Hofvander Y, Kylberg E. Solids and formula: association with pattern and duration of breastfeeding. *Pediatrics* 2001; **107**: e38.
- 29 Hall W, Saunders R, Clauson M, Carty EM, Janssen PA. Effects of an intervention aimed at reducing night waking and signaling in 6-to 12-month-old infants. *Behav. Sleep Med.* 2006; **4**: 242–61.
- 30 Baxter J, Cooklin AR, Smith J. Which mothers wean their babies prematurely from full breastfeeding? An Australian cohort study. *Acta Paediatr.* 2009; **98**: 1274–7.
- 31 Ramchandani P, Wiggs L, Webb V, Stores G. A systematic review of treatments for settling problems and night waking in young children. *BMJ* 2000; **320**: 209–13.
- 32 Rickert VI, Johnson CM. Reducing nocturnal awakening and crying episodes in infants and young children: a comparison between scheduled awakenings and systematic ignoring. *Pediatrics* 1988; **81**: 203–12.
- 33 Hall T. *Save Our Sleep: A Parent's Guide Towards Happy, Sleeping Babies from Birth to Two Years.* Sydney: Pan Macmillan Australia, 2006.
- 34 McKenna JJ, Mosko SS, Richard CA. Bedsharing promotes breastfeeding. *Pediatrics* 1997; **100**: 214–9.
- 35 Ball H. Reasons to bed-share: why parents sleep with their infants. *J. Reprod. Infant Psychol.* 2002; **20**: 207–22.
- 36 Blair P, Ball H. The prevalence and characteristics associated with parent–infant bed-sharing in England. *Arch. Dis. Child.* 2004; **89**: 1106–10.
- 37 Kelmanson IA. Snoring, noisy breathing in sleep and daytime behaviour in 2–4-month-old infants. *Eur. J. Pediatr.* 2000; **159**: 734–9.
- 38 Montgomery-Downs HE, Crabtree VML, Capdevila OS, Gozal D. Infant-feeding methods and childhood sleep-disordered breathing. *Pediatrics* 2007; **120**: 1030–5.
- 39 Bartick M, Reinhold A. The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis. *Pediatrics* 2010; **125**: e1048–1056.

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