

# Benefits and Harms Associated With the Practice of Bed Sharing

## A Systematic Review

Tanya Horsley, PhD; Tammy Clifford, PhD; Nicholas Barrowman, PhD; Susan Bennett, MB, ChB, FRCP; Fatemeh Yazdi, MSc; Margaret Sampson, MLIS; David Moher, PhD; Orvie Dingwall, MLIS; Howard Schachter, PhD; Aurore Côté, MD

**Objective:** To examine evidence of benefits and harms to children associated with bed sharing, factors (eg, smoking) altering bed sharing risk, and effective strategies for reducing harms associated with bed sharing.

**Data Sources:** MEDLINE, CINAHL, Healthstar, PsycINFO, the Cochrane Library, Turning Research Into Practice, and Allied and Alternative Medicine databases between January 1993 and January 2005.

**Study Selection:** Published, English-language records investigating the practice of bed sharing (defined as a child sharing a sleep surface with another individual) and associated benefits and harms in children 0 to 2 years of age.

**Data Extraction:** Any reported benefits or harms (risk factors) associated with the practice of bed sharing.

**Data Synthesis:** Forty observational studies met our inclusion criteria. Evidence consistently suggests that there

may be an association between bed sharing and sudden infant death syndrome (SIDS) among smokers (however defined), but the evidence is not as consistent among nonsmokers. This does not mean that no association between bed sharing and SIDS exists among nonsmokers, but that existing data do not convincingly establish such an association. Data also suggest that bed sharing may be more strongly associated with SIDS in younger infants. A positive association between bed sharing and breastfeeding was identified. Current data could not establish causality. It is possible that women who are most likely to practice prolonged breastfeeding also prefer to bed share.

**Conclusion:** Well-designed, hypothesis-driven prospective cohort studies are warranted to improve our understanding of the mechanisms underlying the relationship between bed sharing, its benefits, and its harms.

*Arch Pediatr Adolesc Med.* 2007;161:237-245

**B**ED SHARING, THE PRACTICE of adults sleeping on the same surface as children, is a controversial routine about which health care professionals are often asked to advise parents. Bed sharing involving parents and young infants appears to be an increasingly common practice in society, even though there are few detailed reports regarding its true prevalence.<sup>1,2</sup>

*For editorial comment  
see page 305*

In the 1990s, great interest in reexamining the practice of bed sharing began after reports from New Zealand linked bed sharing and sudden infant death syndrome (SIDS).<sup>3,4</sup> Since then there has been a growing body of research on the possible benefits of bed sharing and also the

harms, namely the association with SIDS. However, the benefits and harms of bed sharing continue to be debated extensively, without resolution. The American Academy of Pediatrics issued a statement in 1997 advising of the risk of bed sharing under particular circumstances (eg, soft sleep surfaces; situations with a caregiver who smoked or used alcohol or drugs).<sup>5</sup> The most recent policy statement of the American Academy of Pediatrics is similar, but it also acknowledges that the topic of bed sharing remains highly controversial.<sup>6</sup> Other health authorities have also issued statements on bed sharing and recommended that the safest place for infants to sleep is in a standard crib, in the parents' room.<sup>7,8</sup> These official positions have not, however, been based on a thorough review of the literature.

This systematic review was undertaken to provide health care profession-

Author Affiliations are listed at the end of this article.

als with a thorough review of evidence (eg, case-control and prospective cohort studies) on the harms and benefits of bed sharing. Our objectives were to identify and synthesize evidence of the following: (1) benefits and harms to children associated with bed sharing, (2) factors (eg, smoking) altering bed-sharing risk, and (3) effective strategies for reducing harms associated with bed sharing.

## METHODS

The MEDLINE, CINAHL, Healthstar, PsycINFO, the Cochrane Library, Turning Research Into Practice, and Allied and Alternative Medicine databases were searched for records published in any language between January 1993 and January 2005. Published and unpublished studies of any design were considered. Bed sharing was defined as the practice of sharing a sleep surface between adults and young children. Any report investigating the practice of bed sharing and associated benefits and harms, in children 0 to 2 years of age, was included.

### STUDY SELECTION

All records identified by our searches were uploaded to a systematic review management software program. Records were screened in duplicate by means of titles and abstracts. Each potentially relevant record was marked and the full-text reports were obtained. Each record was screened independently to achieve consensus by 2 reviewers, and disagreements were resolved through discussion.

### DATA EXTRACTION

Data pertaining to study design, population demographics, study characteristics, risk factors, and exposure (eg, description of bed-sharing environment) were extracted by one reviewer and verified by another for all relevant reports.

Relevant studies failing to use a contemporaneous comparison (eg, case series or retrospective cohort) were excluded from any analysis. Although it is feasible to provide data from studies without a comparison, analytical “solutions” to such designs do not currently exist. Even though there is no randomization, cohort and case-control studies offer some control over the influence of bias because they incorporate a comparison group and can also adjust for known or suspected confounders in the statistical analysis.

The Newcastle-Ottawa Scale<sup>9</sup> was used for quality assessment for prospective cohort and case-control study designs by 1 reviewer (T.A.). For prospective cohort studies, items include assessment of selection (representativeness of samples, ascertainment of exposure, and demonstration that the outcome of interest was not present at the start of study), comparability (control for important factors by either matching and/or adjusting for confounders in the analysis), and outcomes (independent blind assessment, sufficient length of follow-up for outcomes to occur, and adequacy of follow-up). Case-control studies assess items related to selection (adequacy of case definition, representativeness of cases, and selection and definition of controls), comparability (on the basis of design or analysis), and exposure (ascertainment of exposure, method of ascertainment for cases and controls, and nonresponse rate).

Quality assessment was determined solely by what was reported in each study. No attempt was made to contact authors for missing information. Companion reports (subsequent publications using the same sample population) were used to supplement missing data when required.

## REPRESENTING INTERACTIONS

Suppose  $OR_{b(smoker)}$  is the odds ratio (OR) for the association between SIDS and bed sharing among smokers, and  $OR_{b(nonsmoker)}$  is the OR for the association between SIDS and bed sharing among nonsmokers. These 2 ORs are directly interpretable estimates of the association between SIDS and bed sharing in the 2 groups (smokers and nonsmokers). The interaction between bed sharing and smoking can be represented by the ratio  $OR_{b(smoker)}/OR_{b(nonsmoker)}$ . A test of the statistical significance of this interaction can be based on whether this ratio is significantly different from 1. An alternative representation is shown in the following  $2 \times 2$  table:

Smoking	Bed Sharing	
	Yes	No
Yes	$OR_{sb}$	$OR_s$
No	$OR_b$	1

Note that the reference category in this table is infants who were exposed to neither bed sharing nor smoking, for whom the OR is defined to be 1. The association between SIDS and bed sharing together with smoking (relative to neither bed sharing nor smoking) is  $OR_{sb}$ , the association between SIDS and bed sharing in the absence of smoking is  $OR_b$ , and the association between SIDS and smoking in the absence of bed sharing is  $OR_s$ . These ORs are related to  $OR_{b(smoker)}$  and  $OR_{b(nonsmoker)}$  defined in the preceding paragraph, as follows:  $OR_{b(smoker)} = OR_{sb}/OR_s$  and  $OR_{b(nonsmoker)} = OR_b$ . Thus,  $OR_b$  is directly interpretable as the OR for the association between SIDS and bed sharing among nonsmokers, but  $OR_{sb}$  and  $OR_s$  are not directly interpretable in terms of the association between SIDS and bed sharing. Therefore, the interaction ratio can be expressed as  $OR_{b(smoker)}/OR_{b(nonsmoker)} = OR_{sb}/(OR_s \times OR_b)$ . In other words, the interaction represents the synergistic effect of smoking together with bed sharing compared with the independent effects of bed sharing and of smoking.

### ANALYSIS

Characteristics of the studies, including design, population, and risk factors, were tabulated. Quantitative estimates of the association between bed sharing and harms were extracted by a statistician using a standardized extraction form. The ORs and 95% confidence intervals for bed sharing as a risk factor were extracted. Adjusted ORs were chosen in preference to unadjusted ORs because of concerns about confounding within case-control studies.

## RESULTS

Initial searches identified a total of 1218 records from bibliographic sources. After duplicate publications were excluded, titles and abstracts were evaluated; nonrelevant and non-English publications were excluded. A total of 323 articles were retrieved for relevance assessment for which we used the full text of each study. Eighty-three topic-relevant reports were identified for inclusion. We further excluded 43 reports from formal synthesis because they were noncomparison studies (eg, case series). In total, 40 reports (30 case-control design and 10 prospective cohort design) met our final inclusion criteria and constitute the body of evidence for this review (**Figure**).

### QUALITY ASSESSMENT

Many of the reports included companion (or subsequent) publications, and thus quality assessment was con-

ducted with the Newcastle-Ottawa Scale only for the publications that were deemed to be the “primary” publication (eg, containing the most relevant information per question). Companion publications were used to supplement data when necessary. We identified 16 case-control studies in 30 publications<sup>3,4,10-37</sup> and 8 prospective cohorts in 10 publications<sup>38-47</sup> (**Table 1** and **Table 2**). Comparability (a category of the scoring scale) was heterogeneous within these studies. Of the case-control studies, only 11 of the 17 publications met all criteria for maximum scoring for this category (2 points) at this level.<sup>10,12,14-18,21,23-25</sup> The remaining studies received only 1 point.<sup>3,11,13,19,20,22</sup> This means that the cases and controls who were studied were not necessarily sufficiently similar to reduce the likelihood of bias influencing the study results. Put another way, these studies did not plan a priori to match their cases with their controls on certain variables of interest (ie, age or sex), nor did they adjust for these variables in their statistical analysis (eg, control for confounding). The exposure assessment category was consistently the lowest-rated section within the included studies.

Unlike the case-control studies, the prospective cohort studies fared best in the outcome evaluation (5 of 10 receiving the maximum 3 stars<sup>38-40,42,44</sup>) but performed poorly within the selection category (4 of 10 receiving the maximum 4 stars<sup>41,42,45,47</sup>). This raises concerns that, if the populations being examined are inadequately selected or are subject to bias, it is difficult to be confident that the outcomes reported are true representations of the cohorts examined.

### HARMS AND RISK FACTORS ASSOCIATED WITH BED SHARING

The consistency across studies of associations between bed sharing and harms or benefits was examined. We decided early in the process that no attempt would be made to pool estimates of the association between bed sharing and harms or benefits across studies. This was motivated by a number of concerns. Differences in how confounding was controlled would make pooling of estimates questionable. Inconsistencies in how interactions were examined and reported (eg, incomplete data) were also problematic. For example, when an individual study did not find an interaction to be statistically significant, further detail on the interaction was typically not provided. From the perspective of potential pooling, this selective reporting posed a problem akin to publication bias, in which statistically nonsignificant results may not be available. Pooling only the available results could lead to bias. Finally, varying definitions of exposure and overlapping data sets make pooling problematic.

The included studies reported on a total of 17 different data sets for 19 publications (all case-control studies) (**Table 3**). The studies were conducted in 10 countries (England, Germany, Ireland, Japan, New Zealand, Norway, Russia, Scotland, the Netherlands, and the United States). In addition, 1 study grouped data from 20 regions of Europe and included data from other included publications. Most of the studies included infants aged up to 1 year. The majority of populations included in these

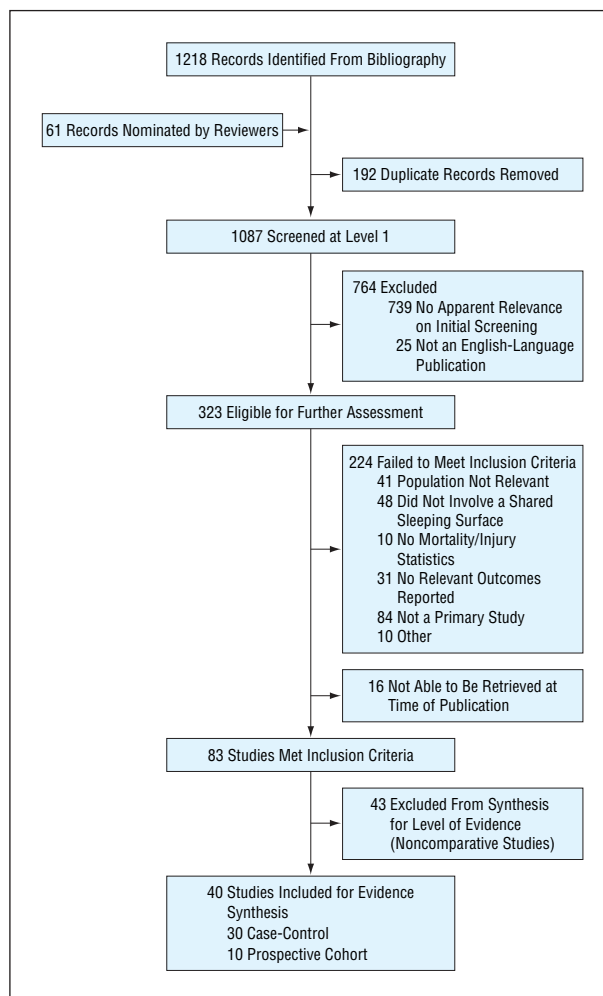


Figure. Study inclusion and exclusion flow diagram.

studies were white. One study reported data collected solely on indigenous people (Northern Plains Indians) in the United States,<sup>16</sup> and 1 other study examined a predominantly African American population.<sup>15</sup> The New Zealand data sets were collected to reflect adequate representation for Maoris and Pacific Islanders.

The studies we reviewed were consistently aimed at identifying the prevalence of known or potential risk factors for SIDS. Seven publications<sup>4,11,15,18,20,22,28</sup> were more specifically aimed at investigating bed sharing and SIDS, although the studies were not originally designed as such. Two publications did not report data on bed sharing, although the data were collected.<sup>14,25</sup> One reported data solely for the cases,<sup>22</sup> and another reported only the prevalence of bed sharing in cases and controls without any further analysis.<sup>19</sup>

Definitions of sleeping location (bed sharing or non-bed sharing) were heterogeneous. Nevertheless, the studies can be classified broadly into 2 subgroups: those reporting routine sleep location (5 studies)<sup>10,12,16-18</sup> and those reporting bed sharing on a particular night (last sleep for cases and reference sleep for controls) (5 studies).<sup>13,15,19,21,23</sup> Three studies<sup>4,11,20</sup> reported data on both routine bed sharing and bed sharing on a particular night. For 3 studies, the definition of sleep location was not clearly reported<sup>14</sup> or no data were available.<sup>22,25</sup>

**Table 1. Quality Assessment of Case-Control Studies\***

Source	No. of Cases/Controls	Selection	Comparability	Exposure
Arnestad et al, <sup>10</sup> 2001	174/375	4	2	1
Blair et al, <sup>11</sup> 1999	325/1300	4	1	1
Brooke et al, <sup>12</sup> 1997	147/276	4	2	1
Carpenter et al, <sup>13</sup> 2004	745/2411	3	1	1
Findeisen et al, <sup>14</sup> 2004	373/1118	4	2	1
Hauck et al, <sup>15</sup> 2003	260/260	4	2	2
Iyasu et al, <sup>16</sup> 2002	33/66	4	2	2
Kelmanson, <sup>17</sup> 1993	48/48	4	2	1
Klonoff-Cohen and Edelstein, <sup>18</sup> 1995	200/200	4	2	1
L'Hoir et al, <sup>19</sup> 1998	73/146	4	1	1
McGarvey et al, <sup>20</sup> 2003	203/622	4	1	1
Mitchell et al, <sup>3</sup> 1992	393/1592	4	1	1
Mitchell et al, <sup>21</sup> 1997	79/679	4	2	2
Mukai et al, <sup>22</sup> 1999	56/230	4	1	...†
Schellscheidt et al, <sup>23</sup> 1997	78/156	4	2	1
Schluter et al, <sup>24</sup> 1998‡	393/1592	4	2	1
Tappin et al, <sup>25</sup> 2002	131/278	4	2	1

\*There is currently no standard guideline published for interpreting star ratings for the Newcastle-Ottawa Scale. However, based on previous experience, we determined that studies meeting the following criteria, a score of 3 to 4 for selection, 2 for comparability, and 2 to 3 for exposure, were considered to be of "good" quality. Recognizing the limitations of this method, each study was considered individually for further interpretation.

†No points could be awarded.

‡Although the data in this publication came from the New Zealand Cot Death Study (as did the data in Mitchell et al<sup>3</sup>), additional information was presented.

**Table 2. Quality Assessment of Prospective Cohort Studies\***

Source	Selection	Comparability	Outcome
Baddock et al, <sup>38</sup> 2004	3	2	3
Ball, <sup>48</sup> 2002	4	2	2
Lozoff et al, <sup>39</sup> 1996	3	1	3
Mao et al, <sup>40</sup> 2004	2	1	3
McCoy et al, <sup>41</sup> 2004	4	2	1
Mitchell et al, <sup>42</sup> 1996	4	2	3
Okami et al, <sup>43</sup> 2002	3	2	2
Richard and Mosko, <sup>46</sup> 2004	1	1	2
Thomas and Burr, <sup>44</sup> 2002	1	2	3
Vogel et al, <sup>45</sup> 1999	4	2	2

\*There is currently no standard guideline published for interpreting star ratings for the Newcastle-Ottawa Scale. However, based on previous experience, we determined that studies meeting the following criteria, a score of 3 to 4 for selection, 2 for comparability, and 2 to 3 for outcome, were considered to be of "good" quality. Recognizing the limitations of this method, each study was considered individually for further interpretation.

Overall, there were 11 publications reporting on different data sets for which ORs (and 95% confidence intervals) were provided for bed sharing data.\* The results were grouped as follows: 5 studies reported a nonsignificant OR, 1 after univariate analysis only<sup>16</sup> and 4 after multivariate analysis.<sup>10-12,18</sup> Four of these used *routine practice* as their definition of bed sharing.<sup>10,12,16,18</sup> One study<sup>15</sup> reported a nonsignificant OR when parents were bed sharing (last sleep) but a significant OR for any bed sharing (with anyone including siblings). Five studies reported a significant OR for bed sharing, which ranged from 2.02 (Mitchell et al<sup>3</sup>) to 16.47 (McGarvey et al<sup>20</sup>), and 4 of these 5 studies defined bed sharing in terms of last sleep or reference sleep.<sup>3,13,20,23</sup>

\*References 3, 10-13, 15, 16, 18, 20, 21, 23.

## INTERACTIONS

For the outcome of SIDS, the most frequently investigated interaction with bed sharing was smoking (most commonly by the mother either during pregnancy or postpartum). For the purpose of reporting interactions, we have listed the primary publication (which was defined as the publication containing the most relevant data for our report) (**Table 4**).

A total of 10 publications provided data on interactions for smoking,<sup>3,10-13,15,16,18,20,21</sup> but complete data were available in only 4<sup>3,11,13,21</sup> (Table 4). Owing to varying definitions of exposure (eg, maternal smoking during pregnancy or postpartum), a total of 15 interactions were summarized. Reported interaction ratios were all greater than 1 (range, 1.60-29.23), suggesting that the association between bed sharing and SIDS is greater among smokers than nonsmokers. Of the 15 publications reporting interaction ratios, 6 interactions (in 5 reports) were statistically significant,<sup>3,10,12,13,20</sup> 6 (in 4 reports) were not statistically significant,<sup>3,15,16,18</sup> and 3 (in 2 reports) were not clear.<sup>11,21</sup> Interaction ratios were not available for a number of studies,<sup>12,15,16,18</sup> primarily those in which the interaction was reported to be statistically nonsignificant, and thus the ratios may be substantially lower in these cases. Because of the way results were reported in the studies, the confidence interval was not consistently available for the OR among smokers. In total, 6 such confidence intervals (in 4 reports) were not available.<sup>3,11,13,21</sup> Two confidence intervals (in 1 report) were available for the OR among smokers, and both were statistically significant.<sup>3</sup> Of 8 ORs (in 4 reports) among nonsmokers,<sup>3,11,13,21</sup> only one<sup>3</sup> was statistically significant.

A large number of other factors (20, not including smoking) were also reported, and the data are pre-

**Table 3. Distribution of Studies by Country and Number of Original Data Sets Represented**

Country	Data Set 1	Data Set 2	Data Set 3	Total No. of Data Sets
United States	Hauck et al, <sup>15</sup> 2003	Klonoff-Cohen and Edelstein, <sup>18</sup> 1995	Iyasu et al, <sup>16</sup> 2002	3
Germany	Findeisen et al, <sup>14</sup> 2004	Schellscheidt et al, <sup>23</sup> 1997		2
New Zealand	Scragg et al, <sup>4</sup> 1993, and Mitchell et al, <sup>3</sup> 1992*	Mitchell et al, <sup>21</sup> 1997		2
Scotland	Brooke et al, <sup>12</sup> 1997	Tappin et al, <sup>25</sup> 2002		2
England	Fleming et al, <sup>28</sup> 1996, and Blair et al, <sup>11</sup> 1999*	Mitchell et al, <sup>42</sup> 1996		2
Ireland	McGarvey et al, <sup>20</sup> 2003			1
Japan	Mukai et al, <sup>22</sup> 1999			1
Russia	Kelmanson, <sup>17</sup> 1993			1
The Netherlands	L'Hoir et al, <sup>19</sup> 1998			1
Norway	Arnestad et al, <sup>10</sup> 2001			1
Europe	Carpenter et al, <sup>13</sup> 2004			1
<b>Total</b>				<b>17</b>

\*Two publications are referenced because the data in each study were complementary, although they were derived from the same data set.

**Table 4. Interactions Between Smoking and Bed Sharing as a Risk Factor for SIDS**

Source	Smoking	Bed Sharing	No. of Cases/ Controls	OR*		Interaction Ratio	Significance
				OR <sub>b(smoker)</sub>	OR <sub>b(nonsmoker)</sub>		
Mitchell et al, <sup>21</sup> 1997	Maternal smoking at first contact	First contact	79/679	2.98† (5.01/1.68)	0.55 (0.17-1.78)	5.42‡ (5.01/[0.55 × 1.68])	NC
	Maternal smoking at 2 mo of age	2 mo of age	38/588	3.51† (5.02/1.43)	1.03 (0.21-5.06)	3.41‡ (5.02/[1.03 × 1.43])	NC
Carpenter et al, <sup>13</sup> 2004	Maternal smoking during pregnancy	All night with an adult on last occasion	745/2411	7.28-11.64§	1.56 (0.91-2.68)	4.67-7.46§	S (P value NR)
Arnestad et al, <sup>10</sup> 2001	Maternal smoking during pregnancy	At time of death	174/375	NR	NR	8.63 (1.87-39.85)	S (P<.01)
Mitchell et al, <sup>3</sup> 1992	Mother smoked in last 2 wk	Last 2 wk	393/1592	2.77† (3.94/1.42)	1.73 (1.11-2.7)	1.60‡ (3.94/[1.73 × 1.42])	NS (P = .10)
	Mother smoked in last 2 wk	Last sleep	391/1584	2.94† (4.55/1.55)	0.98 (0.44-2.18)	3.00‡ (4.55/[0.98 × 1.55])	.02
Mitchell et al, <sup>3</sup> 1992¶	Maternal smoking	For the nominated sleep/death and usually bed shared	370/1550	2.81 (1.93-4.09)	0.38 (0.14-1.05)	7.39# (2.81/0.38)	NC
	Maternal smoking	For the nominated sleep/death and usually slept alone	370/1550	10.09 (2.16-47.06)	1.24 (0.15-10.17)	8.14# (10.09/1.24)	NC
Iyasu et al, <sup>16</sup> 2002	Maternal smoking	Usual	33/66	NR	NR	NR	NS (P = .10)
Klonoff-Cohen and Edelstein, <sup>18</sup> 1995	Passive smoking (mother, father, live-in adult, or daycare provider)	Routine	200/200	NR	NR	NR	NS (P value NR)
Brooke et al, <sup>12</sup> 1997	Maternal smoking	Routine	147/276	NR	NR	NR**	S (P<.005)
McGarvey et al, <sup>20</sup> 2003	Maternal smoking during pregnancy	Last sleep period	203/622	NR	NR	29.23 (2.69-316.78)	S (P value NR)
Blair et al, <sup>11</sup> 1999	≥1 Parent smokes (at time of interview)	Found bed sharing	325/1300	2.31† (12.35/5.34)	1.08 (0.45-2.58)	2.14‡ (12.35/[5.31 × 1.08])	NC
Hauck et al, <sup>15</sup> 2003	Maternal smoking during pregnancy	Reference sleep	260/260	NR	NR	NR	NS (P value NR)
	Maternal smoking postpartum	Reference sleep	260/260	NR	NR	NR	NS (P value NR)

Abbreviations: NC, not clear; NR, not reported and not estimable; NS, not significant; OR, odds ratio; OR<sub>b(nonsmoker)</sub>, OR for the association between sudden infant death syndrome (SIDS) and bed sharing among nonsmokers; OR<sub>b(smoker)</sub>, OR for the association between sudden SIDS and bed sharing among smokers; S, significant.

\*Confidence intervals were generally not available owing to reporting; where available, they are reported as 95% confidence intervals.

†Calculated as OR<sub>sb</sub>/OR<sub>s</sub>. (See "Representing Interactions" subsection in the "Methods" section for an explanation of OR<sub>b</sub>, OR<sub>s</sub>, and OR<sub>sb</sub>.)

‡Calculated as OR<sub>sb</sub>/(OR<sub>s</sub> × OR<sub>b</sub>).

§The authors reported a value of OR<sub>s</sub> with smoking defined as fewer than 10 cigarettes a day, as well as a value of OR<sub>s</sub> with smoking defined as more than 10 cigarettes a day (note that this apparently excludes the case of 10 cigarettes a day). We computed values of OR<sub>b(smoker)</sub> using each of the values of OR.

¶Results from Scragg et al.<sup>4</sup>

||Results from Schluter et al.<sup>37</sup>

#Calculated as OR<sub>b(smoker)</sub>/OR<sub>b(nonsmoker)</sub>.

\*\*Although no estimate of the interaction ratio is provided nor can be calculated, the authors' description indicates that it is greater than 1.

sented in **Table 5**. For 18 factors, only 1 estimated interaction was available; for 2 factors, an estimate was available in 3 different publications for a total of 24 in-

teractions. Of these 24 interactions, 6 were statistically significant,<sup>11,13,20,31</sup> 16 were not statistically significant,<sup>3,4,10,16,18,20,24</sup> and 2 were unclear.<sup>11,13</sup> Of the 6 esti-

**Table 5. Additional Factors Investigated for Interactions With Bed Sharing as a Risk Factor for SIDS**

Factor	Total No. of Studies	Significance		
		Yes (Direction)	Unclear	No
Maternal alcohol consumption	4		Carpenter et al, <sup>13</sup> 2004	Iyasu et al, <sup>16</sup> 2002 Klonoff-Cohen and Edelstein, <sup>18</sup> 1995 Scragg et al, <sup>4</sup> 1993 Klonoff-Cohen and Edelstein, <sup>18</sup> 1995
Maternal recreational drug consumption	1			
Age of infant	3	Carpenter et al, <sup>13</sup> 2004 (decrease) Blair et al, <sup>11</sup> 1999 (decrease) McGarvey et al, <sup>20</sup> 2003 (decrease)		
Birth weight	1			Arnestad et al, <sup>10</sup> 2001
Death during daytime sleep	1	Williams et al, <sup>31</sup> 2002 (decrease)		
Death on weekend	1			Mitchell et al, <sup>3</sup> 1992
Death away from home	1			Schluter et al, <sup>24</sup> 1998
≥2 Layers of clothing	1			Iyasu et al, <sup>16</sup> 2002
≥2 Layers of covers	1			Iyasu et al, <sup>16</sup> 2002
Use of duvets	1			McGarvey et al, <sup>20</sup> 2003
Tog value of bedding ≥10*	1			McGarvey et al, <sup>20</sup> 2003
Pillows used	1			McGarvey et al, <sup>20</sup> 2003
Found prone	1			McGarvey et al, <sup>20</sup> 2003
Absence of routine soother use	1			McGarvey et al, <sup>20</sup> 2003
Breastfeeding initiated at birth	1	McGarvey et al, <sup>20</sup> 2003 (decrease)		
History of illness since birth	1	McGarvey et al, <sup>20</sup> 2003 (increase)		
Symptoms in 48 h before death	1			McGarvey et al, <sup>20</sup> 2003
Social disadvantage	1			McGarvey et al, <sup>20</sup> 2003
Surface softness	1			McGarvey et al, <sup>20</sup> 2003
Sofa sharing	1		Blair et al, <sup>11</sup> 1999	

Abbreviation: SIDS, sudden infant death syndrome.

\*Tog value represents the thermal insulating property of the bedding. The value expresses the difference between heat underneath the duvet and the heat that escapes through the top. The more dense the duvet, the less heat that escapes and thus a higher tog value.

mated interactions that were statistically significant, it is of interest that 3 of them<sup>11,13,20</sup> were for age of infant and were all in the same direction, namely, indicating a decreased association between bed sharing and SIDS with increasing age. The other 3 statistically significant interactions were as follows: daytime<sup>31</sup> (indicating a decreased association between bed sharing and SIDS during daytime sleeping), breastfeeding initiated at birth<sup>20</sup> (indicating a decreased association between bed sharing and SIDS for mothers who initiated breastfeeding at birth), and history of illness since birth<sup>20</sup> (indicating an increased association between bed sharing and SIDS for infants who had a history of illness since birth). For the interaction between history of illness since birth and bed sharing, the authors of the report comment that this raises the question of whether some infants are taken into the parental bed specifically because of illness, and they speculate that it may be the illness rather than bed sharing per se that is associated with death.

### BENEFITS OF BED SHARING

We focused our investigations on 3 purported child-related benefits of bed sharing: breastfeeding, parent-child bonding, and sleep-related issues. Our searches identified a total of 4 studies (in 5 publications) that examined the effect of bed sharing on the practice of breastfeeding.<sup>41,43,45,47,48</sup> All were prospective cohort studies and were published between 1999 and 2004. They were con-

ducted in England,<sup>47</sup> the United States,<sup>41,43</sup> and New Zealand<sup>45</sup> and reported on various follow-up intervals including 3 months,<sup>47</sup> 6 months,<sup>41</sup> 12 months,<sup>45</sup> and the longest interval, 18 years.<sup>43</sup> The ethnicities of the study populations were similar, with white subjects being preponderant, while 1 study included black non-Hispanic, Hispanic, and Asian participants.<sup>41</sup>

Breastfeeding was most likely to be defined in general terms, eg, any breastfeeding<sup>43,45</sup>; however, 1 study did define it as "present if it occurred within the previous 24 hours."<sup>41</sup> A subset of studies examined bed sharing and its influence on the duration of breastfeeding in mother-infant pairs.<sup>43,45,47</sup>

These studies suggest a positive association between bed sharing and breastfeeding (ie, increased duration of breastfeeding); however, the data cannot clarify the issue of causality (eg, whether bed sharing promotes breastfeeding and/or whether breastfeeding promotes bed sharing). It is possible that these data reflect the propensity for women who are most likely to practice prolonged breastfeeding to also prefer to bed share.

### BONDING

Our searches did not identify relevant studies, with a contemporaneous comparison, examining the effect of bed sharing in relation to bonding. The association between attachment and bed sharing has not been studied, to our knowledge.

## BED SHARING AND SLEEP-RELATED ISSUES

Our searches identified 5 studies that examined bed sharing and sleep-related issues.<sup>38-40,43,46</sup> Four studies<sup>38-40,43</sup> examined infant sleep-wake patterns or problems (ie, night awakenings) and 2 examined infant sleep physiology.<sup>39,46</sup>

The 3 studies that examined infant sleep-wake patterns<sup>38-40</sup> were published between 1996 and 2004 and represented populations with varied socioeconomic status (SES) from the United States<sup>39,40</sup> and New Zealand.<sup>38</sup> All were case-control in design and included infants aged 5 weeks to 48 months. All studies showed that infants who bed share have an increased number of awakenings when compared with solitary-sleeping infants; however, 2 of the studies<sup>38,40</sup> showed that individual awakenings were shorter in the bed sharers than in the solitary sleepers. It is interesting that in 1 study<sup>39</sup> the proportion of bed-sharing children with night awakening occurring 3 or more times per week was approximately double that of the non-bed-sharing children. The difference was significant for lower-SES whites (75% vs 29%;  $P = .006$ ) and higher-SES African Americans (46% vs 21%;  $P = .008$ ), but among higher-SES whites it was not statistically significant, perhaps because of small numbers of regular bed sharers in this group (50% vs 25%;  $P = .2$ ).

### STRATEGIES TO REDUCE HARMS

No primary studies (that included a comparison) examining strategies to reduce child-related harms associated with bed sharing were identified through our literature search.

### COMMENT

Our review highlights 3 general difficulties with the studies: (1) few of the studies specifically investigated the risks or benefits of bed sharing; (2) definitions used for bed sharing, especially in the harm studies, were too heterogeneous to compare across studies; and (3) incomplete reporting of interactions hampered synthesis.

Studies we reviewed concerning the harms associated with bed sharing were, for the most part, derived from population-based case-control studies undertaken in the mid-1990s. The objective of most included studies was not to evaluate the risks and/or harms of bed sharing directly, but rather to study a variety of potential risk factors for SIDS. Typically, in the larger national-based studies, comprehensive questionnaires were administered to parents whose children succumbed to sudden unexpected death and to parents of matched controls. Embedded within these questionnaires were items soliciting information on bed sharing. After completion of data collection in these large epidemiologic studies, multiple articles—each relying on the same data set, but focusing on a different aspect of a risk factor—were published. More specifically, much of the data analyses was exploratory, with bed sharing being just one of many variables examined as possible risk factors. It is extremely difficult to draw conclusions from these reports because

they were, more often than not, intended to generate, rather than test, hypotheses by exploring a multitude of potential risk factors and by performing multiple tests of statistical significance. The definition of risk exposure (bed sharing) varied considerably between studies, as did the definition of smoking status. Any attempt to compare results across these studies was therefore extremely difficult.

When there is significant interaction between a risk factor and SIDS (eg, smoking), an association between bed sharing and SIDS might not be meaningful unless the specific factor is taken into account. While the investigation of interactions was one of our primary objectives, it was difficult to glean the information because reports of interactions frequently lacked sufficient detail for our purposes.

### FINDINGS RELATED TO HARMS OF BED SHARING

The evidence does suggest that there may be an association between bed sharing and SIDS among smokers (however smoking status is defined) but that this association may not be present among nonsmokers. This does not mean that no association between bed sharing and SIDS exists among nonsmokers, but simply that existing evidence does not convincingly establish such an association. The evidence also suggests that bed sharing may be more strongly associated with SIDS for younger infants. It should be noted that, for the 3 reports<sup>11,13,20</sup> that showed this association, a portion of the data of 2 of them<sup>11,20</sup> were included in the third.<sup>13</sup> This finding for younger infants is also supported by recent publications by Tappin et al<sup>49</sup> from Scotland and McGarvey et al<sup>50</sup> from Ireland that reported increased risk of SIDS for bed-sharing infants younger than 11 and 10 weeks, respectively (these 2 studies were published beyond our search dates for the systematic review). This latest study from Ireland<sup>50</sup> is an 8-year study (1994-2001) and is composed of some data (1994-1998) from an earlier publication by the same authors.<sup>20</sup>

Our findings concerning infants of nonsmoking parents and younger infants need to be qualified. Differences between study designs, data and reporting, and the limited attention paid to the control of confounders, in some studies, preclude the drawing of definitive conclusions.

### FINDINGS RELATED TO BENEFITS OF BED SHARING

Evidence suggests that there is a positive association between bed sharing and an increase in the rate and duration of breastfeeding; however, the data cannot clarify the issue of causality. It is possible that the data reflect the propensity for women who are most likely to practice prolonged breastfeeding to also prefer to bed share.

The evidence also suggests that infants who bed share have an increased number of awakenings during the evening as compared with solitary-sleeping infants. Although speculative, it has been suggested that these awakenings are potentially protective against SIDS, which may relate to the infants' ability to rouse.<sup>38-40</sup>

## STRENGTHS AND LIMITATIONS OF OUR REVIEW

The primary strength of our systematic review is that it provides a thorough review of the evidence as a starting point for those wishing to develop clinical practice guidelines. This is important because most recommendations and guidelines for bed sharing are based on nonsystematic samples of evidence. Our review also summarizes data from studies that included a contemporaneous comparison group. In studies without a comparison, there is no adequate way to assess the influence of bias. In such circumstances, it is pragmatic and scientifically prudent to limit systematic reviews to primary studies that have a comparison group.

Our review was limited to English-language literature. Although this is not an atypical practice for systematic reviews, there may be published, relevant non-English reports available that were not identified in our report. Second, our reporting and assessment of each study were limited to published data because no attempts were made to contact authors for additional information or missing data.

Finally, the scope of the review does not focus on risk factors independently associated with the benefits or harms of bed sharing. For some risk factors, there may have been a statistically significant association between the risk factor and SIDS, in which case the adjustment could have a substantial effect. However, for the same risk factor, the association between bed sharing and SIDS may not vary with the risk factor, in which case there would not be a significant interaction between the risk factor and bed sharing as a risk factor for SIDS. Failure to find a significant interaction with bed sharing does not preclude the existence of a statistically significant association between a risk factor and SIDS.

## RECOMMENDATIONS FOR FUTURE STUDIES

The issue of bed sharing and sudden death demands re-evaluation, with hypothesis-driven studies using a prospective design and a standardized definition of bed sharing. Most of the studies we reviewed were undertaken more than a decade ago. The prevalence of bed sharing may have changed as a result of public health statements, guideline recommendations, or societal factors. Because an increasing proportion of deaths attributed to SIDS occur in families with low SES,<sup>51,52</sup> efforts are needed to include data from these families in future studies. The exact sleep environment of those families, as well as other potential confounders, remains unknown. Without these data, it is impossible to determine primary risk factors associated with harms.<sup>53</sup>

In addition, the validity of smoking exposure was not verified in any of the studies despite knowledge that smoking is underreported.<sup>54-56</sup> Because exposure to smoking has such a strong association with SIDS,<sup>57</sup> it is extremely important to include biological markers to verify smoking exposure in future studies.<sup>58</sup> Smoking exposure of the infant from other smokers in the household may be significant as well, even if the mother is a non-

smoker. Evidence suggests that the risk of SIDS has been shown to increase with the number of smokers in the household.<sup>53</sup> This should also be taken into account in future studies.

**Accepted for Publication:** October 4, 2006.

**Author Affiliations:** Departments of Pediatrics and Epidemiology and Community Medicine, University of Ottawa and Department of Pediatrics, the Children's Hospital of Eastern Ontario (CHEO), Ottawa (Drs Horsley, Clifford, Bennett, Moher, and Schachter); Chalmers Research Group at the CHEO Research Institute, Ottawa, Ontario (Drs Horsley, Barrowman, and Moher and Mss Yazdi and Sampson); Department of Psychiatry, University of Ottawa (Dr Bennett); Canadian Patient Safety Institute, Edmonton, Alberta (Ms Dingwall); Respiratory Medicine Division, Montreal Children's Hospital, McGill University, Montreal, Quebec (Dr Côté); Department of Epidemiology and Community Medicine, University of Ottawa (Drs Clifford and Moher); and Canadian Coordinating Office Health Technology Assessment, Ottawa (Dr Clifford).

**Correspondence:** Tanya Horsley, PhD, Chalmers Research Group at the CHEO Research Institute, 401 Smyth Rd, Room 238, Ottawa, Ontario, Canada K1H 8L1 (thorsley@rcpsc.edu).

**Author Contributions:** *Study concept and design:* Horsley, Clifford, Sampson, Moher, Schachter, and Côté. *Acquisition of data:* Horsley, Clifford, Yazdi, Dingwall, and Côté. *Analysis and interpretation of data:* Horsley, Clifford, Barrowman, Bennett, Moher, and Côté. *Drafting of the manuscript:* Horsley, Bennett, Yazdi, Sampson, Dingwall, and Côté. *Critical revision of the manuscript for important intellectual content:* Horsley, Clifford, Barrowman, Bennett, Sampson, Moher, Dingwall, Schachter, and Côté. *Statistical analysis:* Clifford and Barrowman. *Obtained funding:* Moher, Schachter, and Côté. *Administrative, technical, and material support:* Horsley, Clifford, Bennett, Yazdi, and Dingwall. *Study supervision:* Horsley, Schachter, and Côté. *Search expertise:* Sampson and Dingwall.

**Financial Disclosure:** None reported.

**Funding/Support:** This study was supported by the City of Toronto, Toronto Public Health.

**Disclaimer:** The views expressed herein do not necessarily represent the views of Toronto Public Health.

**Acknowledgment:** We thank Raymond Daniel for his contribution to bibliographic database management and article acquisition.

## REFERENCES

1. Blair PS, Ball HL. The prevalence and characteristics associated with parent-infant bed-sharing in England. *Arch Dis Child.* 2004;89:1106-1110.
2. Willinger M, Ko CW, Hoffman HJ, Kessler RC, Corwin MJ; National Infant Sleep Position Study. Trends in infant bed sharing in the United States, 1993-2000: the National Infant Sleep Position Study. *Arch Pediatr Adolesc Med.* 2003;157:43-49.
3. Mitchell EA, Taylor BJ, Ford RP, et al. Four modifiable and other major risk factors for cot death: the New Zealand study. *J Paediatr Child Health.* 1992;28(suppl 1):S3-S8.
4. Scragg R, Mitchell EA, Taylor BJ, et al; New Zealand Cot Death Study Group. Bed sharing, smoking, and alcohol in the sudden infant death syndrome. *BMJ.* 1993;307:1312-1318.
5. American Academy of Pediatrics Task Force on Infant Positioning and SIDS. Does bed sharing affect the risk of SIDS? *Pediatrics.* 1997;100:272.
6. American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome.



- The changing concept of sudden infant death syndrome: diagnostic coding shifts, controversies regarding the sleeping environment, and new variables to consider in reducing risk. *Pediatrics*. 2005;116:1245-1255.
7. Leduc D, Côté A, Woods S; Community Paediatrics Committee of the Canadian Paediatric Society. Recommendations for safe sleeping environments for infants and children. *Paediatr Child Health*. 2004;9:659-663.
  8. UK Department of Health. Reduce the risk of cot death. Available at: <http://www.dh.gov.uk/assetRoot/04/12/36/26/04123626.pdf>.
  9. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Tugwell P. The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomised studies in meta-analyses. Presented at: Third Symposium on Systematic Reviews: Beyond Basics; July 2000; Oxford, England.
  10. Arnestad M, Andersen M, Vege A, Rognum TO. Changes in the epidemiological pattern of sudden infant death syndrome in southeast Norway, 1984-1998: implications for future prevention and research. *Arch Dis Child*. 2001;85:108-115.
  11. Blair PS, Fleming PJ, Smith IJ, et al; CESDI SUDI Research Group. Babies sleeping with parents: case-control study of factors influencing the risk of the sudden infant death syndrome. *BMJ*. 1999;319:1457-1461.
  12. Brooke H, Gibson A, Tappin D, Brown H. Case-control study of sudden infant death syndrome in Scotland, 1992-5. *BMJ*. 1997;314:1516-1520.
  13. Carpenter RG, Irgens LM, Blair PS, et al. Sudden unexplained infant death in 20 regions in Europe: case control study. *Lancet*. 2004;363:185-191.
  14. Findeisen M, Vennemann M, Brinkmann B, et al. German study on sudden infant death (GeSID): design, epidemiological and pathological profile. *Int J Legal Med*. 2004;118:163-169.
  15. Hauck FR, Herman SM, Donovan M, et al. Sleep environment and the risk of sudden infant death syndrome in an urban population: the Chicago Infant Mortality Study. *Pediatrics*. 2003;111:1207-1214.
  16. Iyasu S, Randall LL, Welty TK, et al. Risk factors for sudden infant death syndrome among Northern Plains Indians [published correction appears in *JAMA*. 2003;289:303]. *JAMA*. 2002;288:2717-2723.
  17. Kelmanson IA. An assessment of the microsocial environment of children diagnosed as "sudden infant death" using the "process" inventory. *Eur J Pediatr*. 1993;152:686-690.
  18. Klonoff-Cohen H, Edelstein SL. Bed sharing and the sudden infant death syndrome. *BMJ*. 1995;311:1269-1272.
  19. L'Hoir MP, Engelberts AC, van Well GT, et al. Case-control study of current validity of previously described risk factors for SIDS in the Netherlands. *Arch Dis Child*. 1998;79:386-393.
  20. McGarvey C, McDonnell M, Chong A, O'Regan M, Matthews T. Factors relating to the infant's last sleep environment in sudden infant death syndrome in the Republic of Ireland. *Arch Dis Child*. 2003;88:1058-1064.
  21. Mitchell EA, Tuohy PG, Brunt JM, et al. Risk factors for sudden infant death syndrome following the prevention campaign in New Zealand: a prospective study. *Pediatrics*. 1997;100:835-840.
  22. Mukai T, Tamaki N, Sato Y, et al. Sleeping environments as risk factors of sudden infant death syndrome in Japan. *Leg Med (Tokyo)*. 1999;1:18-24.
  23. Schellscheidt J, Ott A, Jorch G. Epidemiological features of sudden infant death after a German intervention campaign in 1992. *Eur J Pediatr*. 1997;156:655-660.
  24. Schluter PJ, Ford RP, Mitchell EA, Taylor BJ. Residential mobility and sudden infant death syndrome. *J Paediatr Child Health*. 1998;34:432-437.
  25. Tappin D, Brooke H, Ecob R, Gibson A. Used infant mattresses and sudden infant death syndrome in Scotland: case-control study. *BMJ*. 2002;325:1007-1009.
  26. Mitchell EA, Stewart AW, Scragg R, et al. Ethnic differences in mortality from sudden infant death syndrome in New Zealand. *BMJ*. 1993;306:13-16.
  27. Hauck FR, Moore CM, Herman SM, et al. The contribution of prone sleeping position to the racial disparity in sudden infant death syndrome: the Chicago Infant Mortality Study. *Pediatrics*. 2002;110:772-780.
  28. Fleming PJ, Blair PS, Bacon C, et al; Confidential Enquiry Into Stillbirths and Deaths Regional Coordinators and Researchers. Environment of infants during sleep and risk of the sudden infant death syndrome: results of 1993-5 case-control study for confidential inquiry into stillbirths and deaths in infancy. *BMJ*. 1996;313:191-195.
  29. Scragg R, Stewart AW, Mitchell EA, Ford RP, Thompson JM. Public health policy on bed sharing and smoking in the sudden infant death syndrome. *N Z Med J*. 1995;108:218-222.
  30. Matthews T, McDonnell M, McGarvey C, Loftus G, O'Regan M. A multivariate "time based" analysis of SIDS risk factors. *Arch Dis Child*. 2004;89:267-271.
  31. Williams SM, Mitchell EA, Taylor BJ. Are risk factors for sudden infant death syndrome different at night? *Arch Dis Child*. 2002;87:274-278.
  32. McDonnell M, Mehanni M, McGarvey C, Oregan M, Matthews TG. Smoking: the major risk factor for SIDS in Irish infants. *Ir Med J*. 2002;95:111-113.
  33. Becroft DM, Thompson JM, Mitchell EA. Nasal and intrapulmonary haemorrhage in sudden infant death syndrome. *Arch Dis Child*. 2001;85:116-120.
  34. Mitchell EA, Thompson JM, Ford RP, Taylor BJ; New Zealand Cot Death Study Group. Sheepskin bedding and the sudden infant death syndrome. *J Pediatr*. 1998;133:701-704.
  35. Williams SM, Mitchell EA, Scragg R; New Zealand National Cot Death Study Group. Why is sudden infant death syndrome more common at weekends? *Arch Dis Child*. 1997;77:415-419.
  36. Scragg RK, Mitchell EA, Stewart AW, et al; New Zealand Cot Death Study Group. Infant room-sharing and prone sleep position in sudden infant death syndrome. *Lancet*. 1996;347:7-12.
  37. Schluter P, Ford R, Mitchell E, Taylor B. Novel events and sudden infant death syndrome. *Ambul Child Health*. 2000;6:24-25.
  38. Baddock SA, Galland BC, Beckers MG, Taylor BJ, Bolton DP. Bed-sharing and the infant's thermal environment in the home setting. *Arch Dis Child*. 2004;89:1111-1116.
  39. Lozoff B, Askew GL, Wolf AW. Cosleeping and early childhood sleep problems: effects of ethnicity and socioeconomic status. *J Dev Behav Pediatr*. 1996;17:9-15.
  40. Mao A, Burnham MM, Goodlin-Jones BL, Gaylor EE, Anders TF. A comparison of the sleep-wake patterns of cosleeping and solitary-sleeping infants. *Child Psychiatry Hum Dev*. 2004;35:95-105.
  41. McCoy RC, Hunt CE, Lesko SM, et al. Frequency of bed sharing and its relationship to breastfeeding. *J Dev Behav Pediatr*. 2004;25:141-149.
  42. Mitchell EA, Esmail A, Jones DR, Clements M. Do differences in the prevalence of risk factors explain the higher mortality from sudden infant death syndrome in New Zealand compared with the UK? *N Z Med J*. 1996;109:352-355.
  43. Okami P, Weisner T, Olmstead R. Outcome correlates of parent-child bedsharing: an eighteen-year longitudinal study. *J Dev Behav Pediatr*. 2002;23:244-253.
  44. Thomas KA, Burr R. Preterm infant temperature circadian rhythm: possible effect of parental cosleeping. *Biol Res Nurs*. 2002;3:150-159.
  45. Vogel A, Hutchison BL, Mitchell EA. Factors associated with the duration of breastfeeding. *Acta Paediatr*. 1999;88:1320-1326.
  46. Richard CA, Mosko SS. Mother-infant bedsharing is associated with an increase in infant heart rate. *Sleep*. 2004;27:507-511.
  47. Ball HL. Breastfeeding, bed-sharing, and infant sleep. *Birth*. 2003;30:181-188.
  48. Ball HL. Reasons to bed-share: why parents sleep with their infants. *J Reprod Infant Psychol*. 2002;20:207-221.
  49. Tappin D, Ecob R, Brooke H. Bedsharing, roomsharing, and sudden infant death syndrome in Scotland: a case-control study. *J Pediatr*. 2005;147:32-37.
  50. McGarvey C, McDonnell M, Hamilton K, O'Regan M, Matthews T. An 8 year study of risk factors for SIDS: bed-sharing versus non-bed-sharing. *Arch Dis Child*. 2006;91:318-323.
  51. Blair PS, Sidebotham P, Berry PJ, Evans M, Fleming PJ. Major epidemiological changes in sudden infant death syndrome: a 20-year population-based study in the UK. *Lancet*. 2006;367:314-319.
  52. Spencer N, Logan S. Sudden unexpected death in infancy and socioeconomic status: a systematic review. *J Epidemiol Community Health*. 2004;58:366-373.
  53. Blair P. Sudden infant death syndrome epidemiology and bed sharing. *Paediatr Child Health*. 2006;11(suppl A):29A-31A.
  54. McMartin KI, Platt MS, Hackman R, et al. Lung tissue concentrations of nicotine in sudden infant death syndrome (SIDS). *J Pediatr*. 2002;140:205-209.
  55. Ford RP, Tappin DM, Schluter PJ, Wild CJ. Smoking during pregnancy: how reliable are maternal self reports in New Zealand? *J Epidemiol Community Health*. 1997;51:246-251.
  56. Russell T, Crawford M, Woodby L. Measurements for active cigarette smoke exposure in prevalence and cessation studies: why simply asking pregnant women isn't enough. *Nicotine Tob Res*. 2004;6(suppl 2):S141-S151.
  57. Mitchell EA, Milerad J. Smoking and sudden infant death syndrome. In: *Tobacco Free Initiative: International Consultation on Environmental Tobacco Smoke (ETS) and Child Health*. Geneva, Switzerland: World Health Organization; 1999: 105-129.
  58. Blair PS, Fleming PJ, Bensley D, et al; Confidential Enquiry Into Stillbirths and Deaths Regional Coordinators and Researchers. Smoking and the sudden infant death syndrome: results from 1993-5 case-control study for confidential inquiry into stillbirths and deaths in infancy. *BMJ*. 1996;313:195-198.

"Children are one third of our population  
and all of our future."

—Anonymous