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Bedsharing and Maternal Smoking in a Population-Based Survey of New Mothers

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ABSTRACT. *Objective.* **Sudden infant death syndrome (SIDS) remains the number 1 cause of postneonatal infant death. Prone infant sleep position and maternal smoking have been established as risk factors for SIDS mortality. Some studies have found that bedsharing is associated with SIDS, but, to date, there is only strong evidence for a risk among infants of smoking mothers and some evidence of a risk among young infants of nonsmoking mothers. Despite the lack of convincing scientific evidence, bedsharing with nonsmoking mothers remains controversial. In some states, nonsmoking mothers are currently being told that they should not bedshare with their infants, and mothers of infants who died of SIDS are told that they caused the death of their infant because they bedshared. The objective of this study was to explore the relationship between maternal smoking and bedsharing among Oregon mothers to explore whether smoking mothers, in contrast to nonsmoking mothers, are getting the message that they should not bedshare.**

Methods. **Oregon Pregnancy Risk Assessment Monitoring System surveys a stratified random sample, drawn from birth certificates, of women after a live birth. Hispanic and non-Hispanic black, non-Hispanic Asian/Pacific Islander and non-Hispanic American Indian/Alaskan Native women, and non-Hispanic white women with low birth weight infants are oversampled to ensure sufficient numbers for stratified analysis. The sample then was weighted to reflect Oregon's population. In 1998–1999, 1867 women completed the survey (73.5% weighted response). The median time from birth to completion of the survey was 4 months. Women were asked whether they shared a bed with their infant "always," "almost always," "sometimes," or "never." Frequent bedsharing was defined as "always" or "almost always"; infrequent was defined as "sometimes" or "never."**

Results. **Of all new mothers, 35.2% reported bedsharing frequently (always: 20.5%; almost always: 14.7%) and 64.8% infrequently (sometimes: 41.4%; never: 23.4%). Bedsharing among postpartum smoking mothers was 18.8% always, 12.6% almost always, 45.1% sometimes, and 23.6% never; this was not statistically different from among nonsmoking mothers. Results for prenatal smokers were similar. When stratified by race/ethnicity, there was no association between smoking and bedsharing in any racial or ethnic group. In univariable and multivariable logistic regression, there were no statistical differences in frequent or any bedsharing among either prenatal or postpartum smoking mothers compared with nonsmokers; the adjusted odds ratio for postpartum smokers who frequently bedshared was 0.73 (95% confidence interval [CI]: 0.42–1.25) and for any bedsharing was 1.05 (95% CI: 0.57–1.94). Results for prenatal smoking were similar. This is the first US population-based study to look at the prevalence of bedsharing among smoking and nonsmoking mothers. Bedsharing is common in Oregon, with 35.2% of mothers in Oregon reporting frequently bedsharing and an additional 41.4% sometimes bedsharing. There was no significant association between smoking and bedsharing for either prenatal or postpartum smokers among any racial or ethnic group. Smoking mothers were as likely to bedshare as nonsmoking mothers. The frequency of bedsharing in Oregon was similar to estimates from other sources. Our study has the advantage of being a population-based sample drawn from birth certificates, weighted for nonresponse.**

Conclusions. **Although a number of case series have raised concerns about the safety of mother–infant bedsharing, even among nonsmoking mothers, this has not yet been confirmed by careful, controlled studies. There have been 9 large-scale case-control studies of the relationship between bedsharing and SIDS. Three case-control studies did not stratify by maternal smoking status, but found no increased risk for SIDS. Six case control studies reported results stratified by maternal smoking status: 1 study, while asserting an association, provided an unexplained range of univariable odds ratios without CIs; 3 found no increased risk for older infants of nonsmoking mothers; and 2 found a risk only for infants <8–11 weeks of age. Despite the preponderance of evidence that bedsharing by nonsmoking mothers does not increase the risk for SIDS among older infants, the recent specter of bedsharing as a cause of SIDS, based on uncontrolled case series and medical examiners' anecdotal experience, has led some medical examiners to label a death "suffocation" or "overlay asphyxiation" simply because the infant was bedsharing at the time of death. This "diagnostic drift" may greatly complicate future studies of the relationship between bedsharing and SIDS. Epidemiologic evidence shows that there is little or no increased risk for SIDS among infants of nonsmoking mothers but increased risk among infants of smoking mothers and younger infants of nonsmoking mothers. It seems prudent to discourage bedsharing among all infants <3 months old. Young infants brought to bed to be breastfed should be returned to a crib when finished. It would be worthwhile for other researchers to reanalyze their previous data to evaluate the consistency of the interaction of young infant age and bedsharing. Large controlled studies that include infants who are identified**

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as dying from SIDS, asphyxia, suffocation, and sudden unexplained infant death, analyzed separately and in combination, are needed to resolve this and other issues involving bedsharing, including the problem of diagnostic drift. Recommendations must be based on solid scientific evidence, which, to date, does not support the rejection of all bedsharing between nonsmoking mothers and their infants. Cribs should be available for those who want to use them. Nonsmoking mothers should not be pressured to abstain from bedsharing with their older infants; they should be provided with accurate, up-to-date scientific information. Infants also should not cosleep with nonparents. In Oregon, if not elsewhere, the message that smoking mothers should not bedshare is not being disseminated effectively. Because it is not known whether the risk caused by smoking is associated with prenatal smoking, postpartum smoking, or both, bedsharing among either prenatal or postpartum smokers should be strongly discouraged. Much more public and private effort must be made to inform smoking mothers, in culturally competent ways, of the very significant risks of mixing bedsharing and smoking. Public health practitioners need to find new ways to inform mothers and providers that smoking mothers should not bedshare and that putting an infant of a nonsmoking mother to sleep in an adult bed should be delayed until 3 months of age. *Pediatrics* 2005;116:e530–e542. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2005-0354; *SIDS, infant mortality, bedsharing, public health, tobacco, smoking.*

ABBREVIATIONS. SIDS, sudden infant death syndrome; PRAMS, Pregnancy Risk Assessment Monitoring Survey; DHS, Department of Human Services; OR, odds ratio; CI, confidence interval; aOR, adjusted OR.

Sudden infant death syndrome (SIDS), with an infant mortality rate of 0.57 per 1000 liveborn infants per year, remains the leading cause of postneonatal infant mortality, accounting for 22.7% of all postneonatal deaths in 2002.[1] In Oregon, the SIDS rate has been consistently higher than the national average and in 2002 was 0.69 per 1000 liveborn infants[2]; in general, there seems to be a nationwide gradient from east to west and south to north. Between 1997 and 2001, there were 187 SIDS deaths in Oregon, 11% of which occurred among Hispanic infants (rate 0.61 per 1000 liveborn infants), 4% among black infants (rate: 1.69), 4% among American Indians/Alaskan Native infants (rate: 2.16), and 78% among white infants (rate 0.77); there were too few Asian/Pacific Islander deaths for an accurate rate. It should be noted that, in Oregon, black mothers choose prone infant sleep position twice as often as white mothers (unpublished data).

Prone infant sleep position, identified as a major risk factor for SIDS, became the focus of widespread efforts to reduce its prevalence. The nationwide "Back to Sleep" campaign, launched in 1994, led to a dramatic fall in the prevalence of prone sleep position, from 70% in 1992 to 17% in 1998,[3] with a concomitant halving of the US SIDS death rate.[4] With the success of this campaign, those concerned with infant mortality have looked for other potentially modifiable SIDS risk factors.

In this context, much attention has focused on bedsharing, the practice of putting an infant to sleep with others, in other than a crib. It most commonly refers to the sharing of a bed between mother and infant. The practice of bedsharing, although common, is controversial in the public health community. Some consider it a significant risk factor for SIDS and argue for its wholesale elimination.[5–7] Others disagree, finding little or no scientific evidence for an association with SIDS, except among smoking mothers.[8–11] Bedsharing has been associated with longer duration of breastfeeding,[12,13] and some promote it for this reason.[14] The American Academy of Pediatrics has recommended that care be taken if mothers choose to bedshare; bedsharing mothers should not smoke, and arrangements that might lead to entrapment, the use of soft sleep surfaces of sofas or chairs, and intoxication or substances that impair arousal all should be avoided.[4,15] The goal of this study was to measure bedsharing and maternal smoking rates among Oregon women using a population-based cross-sectional sample.

METHODS

Surveillance Sample Design

Oregon Pregnancy Risk Assessment Monitoring System (PRAMS) is an ongoing public health surveillance project of the Oregon Office of Family Health. It relies on a stratified random sample of women drawn from recently filed birth certificates, generally when the infant was 2 months of age. Oregon PRAMS began in November 1998. The questionnaire asks a number of questions about the woman's prenatal, perinatal, and postnatal experiences, attitudes, and practices. The sample is weighted to account for sample design (oversampling of strata), nonresponders, and noncoverage. Oregon PRAMS methods appear elsewhere.[16]

Random sampling was by strata, with oversampling of mothers who were Hispanic, non-Hispanic American Indian/Alaskan Native, non-Hispanic Asian/Pacific Islander, and non-Hispanic black and of mothers with infants <2500 g, to ensure reliable estimates for these groups (see Appendix A). This analysis is based on the first 12 months of the survey, November 1998 to October 1999. A total of 2919 women were selected to be surveyed. A total of 1867 women completed the survey (73.5% response after weighting for stratified oversampling). Fifty-three women reported that their infants were no longer alive and/or no longer living with them; they were excluded from the analysis, per survey protocol. In addition, 38 women failed to indicate whether their infants were alive and living with them; they were excluded as well. There remained 1776 women were eligible for analysis. Of these, 1756 women provided responses to the bedsharing question (99% of those eligible) and were included in the analysis. The median time from birth to completion of the survey is 4 months.

Categorization of Variables

Mothers were asked, "How often does your new infant sleep in the same bed with you? (check only one): always, almost always, sometimes, never." All choices were used in cross-tabulation analysis. Bedsharing was analyzed 2 ways using logistic regression. First, any bedsharing (always, almost always, or sometimes), as the outcome variable, was compared with never bedsharing. Second, frequent bedsharing (always or almost always), as the outcome variable, was compared with infrequent bedsharing (sometimes or never). For the adjusted analysis, maternal and infant characteristics that previously were found to be associated with bedsharing within this population were added to the smoking variables.

Data Analysis

SUDAAN 8.01 was used to account for the complex sample design involving a stratified weighted sample. All data presented are weighted, except where noted. Variable significance, using the

weighed data, was estimated using either the χ^2 test statistic (cross-tabs) or the Wald-F test statistic (logistic regression), with the level of significance at $P < .05$.

The Oregon PRAMS survey and analyses were conducted in accordance with prevailing ethical principles. PRAMS is an ongoing surveillance system for monitoring mother–child health events and identification of the determinants of health outcomes for the purposes of improving maternal and child health in Oregon. ("CDC also determined that state grantees that undertake PRAMS are not engaged in research and do not have to get approval through their own IRBs. . . ."[17] For a longer discussion of the distinction between public health practice and research, please see the full report sponsored by the Council of State and Territorial Epidemiologists.) Oregon PRAMS was also determined by Oregon's Department of Human Services (DHS) Health Services to be exempt from institutional review board review. Individual consent for participation in the survey was obtained at the time of the survey. Individual surveys were linked with birth certificate information, and the data set then was de-identified by staff at the DHS Health Services and a subset of the full data set was made available for this analysis. Only authorized DHS Health Services staff would be able to re-identify respondents. DHS is a Health Insurance Portability and Accountability Act of 1996–compliant covered entity.

RESULTS

Bedsharing between mother and infant is common in Oregon. Of the respondents, 20.5% reported always bedsharing, 14.7% almost always, 41.4% sometimes, and only 23.4% never.

Population Characteristics

The characteristics of smoking mothers and nonsmoking mothers and bedsharing and nonbedsharing mothers and their infants were compared. There were significant differences in maternal race/ethnicity, age, education, parity, and socioeconomic status (Tables 1 and 2). Multivariable analysis accounted for these factors.

The distribution of bedsharing frequencies was not statistically different between prenatal smoking mothers and nonsmoking mothers; similar results were seen for postpartum smoking status (Table 3). When stratified by race/ethnicity, again, there were no significant differences for any racial or ethnic group, although sample sizes were too small to analyze prenatal smoking, and to analyze postpartum smoking, "always" and "almost always" responses were combined (Table 4).

Smoking and Bedsharing

In univariable logistic regression, prenatally smoking mothers were as likely to bedshare frequently as nonsmoking mothers, with an odds ratio (OR) of 1.03 (95% confidence interval [CI]: 0.64–1.68). The same was true of postpartum smokers, with an OR of 0.81 (95% CI: 0.54–1.23; Table 5).

In multivariable regression, smoking status was adjusted for race/ethnicity; mother's age, education, and marital status; breastfeeding status; income; enrollment in the Special Supplemental Nutrition Program for Women, Infants, and Children; health insurance; and county of residence. Prenatal smoking (adjusted OR [aOR]: 1.24; 95% CI: 0.60–2.54) and postpartum smoking (aOR: 1.05; 95% CI: 0.57–1.94) remained unassociated with bedsharing (Table 4). When the outcome was frequent bedsharing, the results were similar (prenatal smoking aOR: 0.90; 95% CI: 0.50–1.64; postpartum smoking aOR: 0.73; 95% CI: 0.42–1.25; Table 6). All told, 16% of the infants in the sample bedshared at least sometimes with mothers who smoked during and/or after pregnancy, and 7% did so frequently.

DISCUSSION

This is the first US population-based study to examine the prevalence of bedsharing among smoking and nonsmoking mothers. Bedsharing is common, with 35.2% of mothers in Oregon reporting frequently bedsharing and an additional 41.4% sometimes bedsharing; only 23.4% reporting never bedsharing. Smokers were as likely to bedshare as nonsmokers.

Oregon PRAMS specifically asked whether the mother shared a bed with her infant. Certain sleep surfaces (eg, couches, chairs) have been associated with SIDS risk.[18,19] These circumstances were unlikely to have been counted as "bedsharing" in this analysis. Infants who sleep primarily with someone other than their parents are at increased risk for SIDS.[18] The survey did not specifically address this; infants who sleep only with other children are unlikely to have been counted, and infants who sleep with mothers and other children might be included. Overall, this study can provide a fairly unclouded population-based estimate of bedsharing between Oregon mothers and infants in adult beds.

The frequency of bedsharing in Oregon is comparable to but higher than that of the National Infant Sleep Position Study, a nationwide telephone sample conducted at roughly the same time.[20] Their sample overrepresented white mothers and underrepresented mothers with low education and young age, unlike this population-based sample drawn from birth certificates. They found that 19.4% frequently ("always" and "more than half the time"), 27.6% sometimes ("less than half the time"), and 52.7% never bedshared. They did not ask about smoking. Our study has the advantage of a population-based sample drawn from birth certificates. Bedsharing may also be more common in Oregon than elsewhere. This may be attributable in part to the relatively large Hispanic population in Oregon, with its higher bedsharing prevalence. Other cultural factors may be in play, as well.

A study among infants who attended community-based infant health clinics in the county of Värmland, Sweden, found that 22.8% of 3-month-olds "regularly" bedshared. They, too, found no association between maternal smoking and bedsharing.[21]

Case Series: Raising Questions but No Answers

A number of case series have been published reporting the proportion of SIDS victims found bedsharing (Table 7). These studies have been drawn from death certificates and either relied on death scene and medical examiners' investigations[5,6,22–27] or used the US Consumer Products Safety Commission's Death Certificate data sets.[5,6,28] These often lacked critical information (eg, mother's smoking status) and, by their very nature, had no comparison control group drawn from the same population(s).

TABLE 1. Characteristics of Smoking Mothers Compared With Nonsmoking Mothers and Their Infants

Maternal and Infant Characteristics	*n**	Frequency of Characteristic (Weighted)	Proportion of Sample Prenatal Smokers, %†	χ^2 *P* Value	Proportion of Sample Postpartum Smokers, %†	χ^2 *P* Value
Total sample	1844	*n* = 44 482†	13.2		20.5	
Race						
Hispanic	425	14.7	3.8		7.0	
Black‡	206	2.0	13.1		22.7	
Asian/Pacific Islander‡	305	4.7	5.9	<.0001	6.6	<.0001
American Indian/Alaskan Native‡	213	1.5	20.9		27.0	
White‡	683	77.1	15.2		23.8	
Mother's age						
13–19 y	288	12.4	18.8		29.9	
20–25 y	588	33.0	16.8	.0441	28.2	<.0001
26–30 y	484	28.0	20.7		15.8	
31–48 y	484	26.7	19.5		11.7	
Mother's education						
<12 y	463	19.5	22.4	<.0001	33.5	<.0001
12 y	618	35.7	16.2		28.7	
>12 y	748	44.9	6.9		8.7	
Marital status						
Married/separated	1197	70.8	8.3	<.0001	12.9	<.0001
Single/divorced	647	29.2	25.0		39.1	
Breastfeed at 4 wk						
>4 wk	1252	75.6	10.7	.0182	15.7	.0001
≤4 wk	426	24.4	19.0		32.6	
Income						
<$15 000	609	26.6	24.4		34.0	
$15 000–29 999	498	28.9	14.0	<.0001	21.7	<.0001
$30 000–49 999	320	24.7	8.7		14.5	
≥$50 000	315	19.8	3.4		5.9	
Parity						
First child	812	43.7	11.7		17.7	
Second child	568	31.2	10.7	.1635	23.0	.1791
Third child	284	15.9	20.8		26.5	
≥Fourth child	178	9.2	15.2		15.8	
County of residence						
Urban	484	20.4	15.8		19.8	
Mixed	954	56.7	10.3	.0587	17.1	.0150
Rural/frontier	406	23.0	17.8		29.7	
Kotelchuck Adequacy of Prenatal Care Index						
Inadequate	298	14.6	21.2		25.9	
Intermediate	369	19.5	9.1	.1217	19.1	.5327
Adequate	704	41.3	12.8		18.7	
Adequate plus	441	24.7	11.5		21.5	
Insurance now						
OHP	609	26.1	26.0	<.0001	37.7	<.0001
Not OHP	1207	73.9	8.8		14.6	
WIC enrollment						
Yes	962	50.6	18.1	.0008	29.4	<.0001
No	710	49.4	8.8		13.9	
Infant Age						
≤3 mo	602	39.6	14.2	.7043	22.7	.4454
>3 mo	1182	60.4	13.1		20.2	
Infant birth weight						
≥1500 g	1777	99.0	13.1	.9599	20.5	.5079
<1500 g	67	1.0	13.4		24.1	
"Usual" infant sleep position						
Back	1056	67.0	12.9		19.3	
Side	542	23.9	14.5	.4955	22.1	.7545
Stomach	146	9.1	8.8		20.8	

OHP indicates Oregon Health Plan; WIC, Special Supplemental Program for Women, Infants, and Children.
* Unweighted.
† Weighted.
‡ Non-Hispanic.

This is particularly important as bedsharing prevalence varies significantly by race/ethnicity, income, and geography. Studies that attempted to control for SIDS victims' "last night" of bedsharing by using published estimates of bedsharing in the population at large, unmatched as to infant age and timing of bedsharing, are very likely to suffer misclassification bias. Although useful for hypothesis generation, such studies cannot really establish an association, let alone causality. Although not strong evidence against an association, 2 ecologic studies, one in Hong Kong[29] and a second, better designed study in Birmingham, England[30], found no association between bedsharing and SIDS rates (Table 8).

TABLE 2. Characteristics of Bedsharing Versus Nonbedsharing Mothers and Their Infants

Maternal and Infant Characteristics	*n**	Frequency of Characteristic (Weighted)	Proportion of Subsample Bedsharing Always and Almost Always, %†	Proportion of Subsample Bedsharing Sometimes, %†	Proportion of Subsample Bedsharing Never, %†	χ^2 *P* Value
Total sample	1756	*n* = 42 846†	35.2	41.4	23.4	
Race						
Hispanic	417	14.7	56.2	31.2	12.6	
Black‡	201	2.0	63.6	27.4	9.0	
Asian/Pacific Islander‡	296	4.7	44.6	39.5	15.9	<.0001
American Indian/ Alaskan Native‡	200	1.4	41.3	38.8	19.9	
White‡	642	77.2	29.8	43.9	26.3	
Mother's age						
13–19 y	274	12.2	52.2	39.9	8.0	
20–25 y	557	33.2	34.6	43.6	21.9	<.0001
26–30 y	462	27.5	33.5	41.6	24.9	
31–48 y	463	27.0	30.1	39.3	30.6	
Mother's education						
<12 y	430	19.1	51.6	33.3	15.2	
12 y	583	35.5	36.2	40.8	23.0	<.0001
>12 y	729	45.4	27.8	45.4	26.9	
Marital status						
Married/separated	1149	70.9	30.2	42.3	27.6	<.0001
Single/divorced	607	29.1	47.4	39.5	13.1	
Breastfeed at 4 wk						
>4 wk	1255	75.4	38.6	43.1	18.3	<.0001
≤4 wk	430	24.6	23.0	40.1	37.0	
Income						
<$15 000	574	26.2	45.9	35.9	18.3	
$15 000–29 999	484	29.7	42.5	41.4	16.2	<.0001
$30 000–49 999	305	24.3	26.9	49.9	23.3	
≥$50 000	300	19.9	20.5	40.9	38.6	
Parity						
First child	779	43.8	37.7	42.6	19.8	
Second child	539	30.9	31.3	41.0	27.7	.2861
Third child	269	16.1	35.4	36.6	28.0	
≥Fourth child	167	9.2	34.8	47.0	18.2	
County of residence						
Urban	468	21.0	39.5	42.3	18.2	
Mixed	905	56.1	33.2	40.9	25.9	.3589
Rural/frontier	383	22.8	36.2	41.9	21.9	
Kotelchuck Adequacy of Prenatal Care Index						
Inadequate	282	14.5	39.2	41.9	18.8	
Intermediate	354	19.1	25.6	48.7	25.7	.0095
Adequate	671	41.6	33.4	44.1	22.4	
Adequate plus	421	24.8	41.9	31.8	26.3	
Insurance now						
OHP	572	25.9	43.3	38.3	18.5	.0138
Not OHP	1158	74.1	31.8	42.9	25.4	
WIC enrollment						
Yes	910	50.4	46.4	38.9	14.8	<.0001
No	685	49.6	25.5	43.7	30.8	
Infant Age						
≤3 mo	574	39.9	37.3	42.1	20.6	.4912
>3 mo	1123	60.1	34.2	41.5	24.3	
Infant birth weight						
≥1500 g	1711	99.3	35.4	41.4	23.3	.0049
<1500 g	45	0.7	13.8	51.0	35.2	
"Usual" infant sleep position						
Back	1047	67.0	34.0	40.7	25.3	
Side	537	24.0	42.7	42.3	15.0	.0025
Stomach	144	9.0	23.4	42.7	34.0	

* Unweighted.
† Weighted.
‡ Non-Hispanic.

Case-Control Studies

Nine large case-control studies have reported the association between co-sleeping and SIDS (Table 8). Some have led to multiple publications. Three studies (1, 6, and 7) did not provide results stratified by maternal smoking status, but all found no association between bedsharing and SIDS among infants as a whole. Six did provide stratified results. Of these, 1 did not provide confidence intervals (8). Of the remaining 5, 3 found no association between SIDS and bedsharing infants of nonsmoking mothers. However, 2 studies (2 and 9) stratified the data by infant

TABLE 3. Prevalence of Bedsharing by Maternal Smoking Status

	*n**	Frequency of Bedsharing†				χ^2 *P* Value
		Always, %	Almost Always, %	Sometimes, %	Never, %	
Total	1756	20.5	14.7	41.4	23.4	
Prenatal smoking						
Yes	213	24.9	10.8	44.3	20.1	.4195
No	1524	16.0	15.3	41.1	24.0	
Postpartum smoking						
Yes	297	18.8	12.6	45.1	23.6	.7518
No	1441	20.6	15.3	40.6	23.5	

* Unweighted.
† Weighted.

TABLE 4. Prevalence of Bedsharing by Maternal Postpartum Smoking Status, Stratified by Race

	*n**	Frequency of Bedsharing†			χ^2 *P* Value
		Always or Almost Always, %	Sometimes, %	Never, %	
Total	1738	35.2	41.4	23.4	
Hispanic					
Yes	28	48.0	31.7	20.1	.4855
No	380	56.6	31.6	11.1	
Black‡					
Yes	42	64.6	22.8	12.6	.5041
No	157	63.5	28.5	8.1	
Asians/Pacific Islander‡					
Yes	20	50.0	40.5	9.5§	.5571
No	276	44.2	39.5	16.4	
American Indian/ Alaskan Native‡					
Yes	53	42.8	36.2	21.1	.8489
No	146	40.5	40.0	19.5	
White‡					
Yes	154	28.9	46.7	24.3	.7985
No	482	29.8	43.1	27.1	

* Unweighted.
† Weighted.
‡ Non-Hispanic.
§ Unweighted $n = 2$.

TABLE 5. Risk of Any Bedsharing Among Smoking Mothers

	Crude OR (95% CI)*	Adjusted OR (95% CI)*†	Wald-F *P* Value
Prenatal smoking			
Yes	1.26 (0.69–2.28)	1.24 (0.60–2.54)	.5635
No	1.00	1.00	
Postpartum smoking			
Yes	0.99 (0.61–1.61)	1.05 (0.57–1.94)	.8771
No	1.00	1.00	

* Logistic regression: comparing any bedsharing (= "outcome") with never bedsharing.
† Adjusted for race/ethnicity; mother's age, education, and marital status; breastfeeding status; income; WIC enrollment; health insurance; and county of residence.

age and found an interaction between infant age, smoking, and bedsharing with infants of nonsmoking mothers, if <8–11 weeks of age, at risk.

Scottish investigators conducted 2 population-based studies (1992–1995 and 1996–2000), with mixed results. The first found no association between SIDS and bedsharing in adjusted analysis.[31] The second found a modest risk (aOR: 3.36; 95% CI: 1.67–6.73) but did not stratify the analysis by maternal smoking status and did not distinguish between sharing a bed or sharing a chair or couch.[32] A reanalysis of the 1996–2000 data set, recently published, found an association between SIDS and bedsharing among the infants of nonsmoking mothers for infants <11 weeks (aOR: 8.01; 95% CI: 1.20–53.3), but the subsample size was small and the CI wide; there were only 15 cases and 43 controls <11 weeks old with nonsmoking mothers.[33] No association was found for older infants.

The New Zealand Cot Death Study produced several papers analyzing their 1987–1990 nationwide data set.[34–39] In addition to finding an association between SIDS and maternal smoking, an early report did find an association between SIDS and bedshar-

TABLE 6. Risk of Frequent Bedsharing Among Smoking Mothers

	Crude OR (95% CI)*	Adjusted OR (95% CI)*†	Wald-F *P* Value
Prenatal smoking			
Yes	1.03 (0.64–1.68)	0.90 (0.50–1.64)	.7408
No	1.00	1.00	
Postpartum smoking			
Yes	0.81 (0.54–1.23)	0.73 (0.42–1.25)	.2474
No	1.00	1.00	

* Logistic regression: comparing frequent (always/almost always) bedsharing (= "outcome") with infrequent (sometimes/never) bedsharing.
† Adjusted for race/ethnicity; mother's age, education, and marital status; breastfeeding status; income; WIC enrollment; health insurance; and county of residence.

ing. Results were not stratified by maternal smoking status. Additional analysis discovered that this association was seen only among Maori women and infants. Closer investigation identified maternal smoking, much higher among Maori than non-Maori women, as the risk factor. When the participants were stratified by maternal smoking status, the association between SIDS and bedsharing disappeared. Similar results were seen in a follow-up prospective case-cohort study in 1991–1993.[40] A southern California case-control study (1989–1992) did not find any association between bedsharing and SIDS in multivariable analysis; the authors stated that there was no interaction between smoking and bedsharing but did provide stratified results.[41]

The Confidential Enquiry into Stillbirths and Deaths in Infancy–Sudden Unexplained Deaths in Infancy Study (1993–1996) reported on overlapping population-based samples in England.[19,42] When the sample was stratified by maternal smoking status, no association between SIDS and bedsharing was found among nonsmokers, although sample sizes were small, but a high-risk association was found among smoking mothers. When the sample was stratified by infant age (above or below 14 weeks), bedsharing remained significant only for the younger infants (aOR: 4.65; 95% CI: 2.70–7.99), with the OR for older infants near unity. The comparison of younger and older infants was not analyzed stratified by maternal smoking status and can be considered only suggestive.

The Chicago Infant Mortality Study (1993–1996) found that bedsharing with someone other than a parent was a risk factor for SIDS, as was sleeping on a nonstandard sleep surface, but sleeping in an adult bed with a parent only was not, when adjusted for maternal smoking.[18] The authors did not report separate ORs for infants of smoking and nonsmoking mothers.

A nationwide Irish case-control study did find an increased SIDS risk for infants sleeping with adults. In their first publication, they reported that bedsharing by nonsmoking mothers was a statistically significant risk for SIDS, without controlling for other variables, including prone infant sleep position. Without explanation, they provided a range of ORs, with no CIs.[43] Their second report included a multivariable model with co-sleeping adjusted for but not stratified by maternal prenatal smoking, but with the addition of infant sleep position, they could no longer provide an OR for co-sleeping.[44]

The multinational European Concerted Action on SIDS study (1992–1996) in multivariable analysis found no significant risk for SIDS among bedsharing but nonsmoking mothers compared with nonbedsharing nonsmoking mothers; for smoking nonbedsharing mothers, the aOR was more than doubled; for smoking bedsharing mothers, the aOR was 17-fold higher.[45] When the sample was stratified by maternal smoking status, among infants of nonsmoking mothers, the OR was 2.4 (95% CI: 1.2–4.6) for "all-night" bedsharers at 2 weeks of age and lost significance by 8 weeks of age. By 20 weeks of age, the OR was <1.0. At all ages, the risk for smoking mothers was much greater than the risk for nonsmoking mothers.

Diagnostic Drift, Overlay Asphyxiation, and the Bedsharing Debate

Diagnostic drift in the diagnosis of sudden unexplained infant death has been raised as a complicating factor in the analysis of SIDS rates over time and the comparability of SIDS studies done at different times. There is reason to be concerned. The recent specter of bedsharing as a cause of SIDS, based on uncontrolled case series and medical examiners' anecdotal experience, has led some medical examiners to label a death "suffocation" or "overlay asphyxiation" simply because the infant was bedsharing at the time of death.[11]

There is some evidence of diagnostic drift. At least 3 studies (South Australia,[46] the United States nationwide,[47] and Kentucky statewide[48]) have found a large drop in the SIDS death rate, with concomitant but smaller rises in the death rates for accidental and undetermined sudden infant deaths, suggesting diagnostic drift. Studies that rely solely on SIDS death codes might be omitting true cases of SIDS, and studies that select suffocation-related death codes may be biased against bedsharing (differential misclassification). Conversely, studies of SIDS that omitted infants who were found bedsharing because they were classified as suffocation might fail to find a true association. Future studies of bedsharing will need to take this phenomenon into account in the design and analysis.

Limitations

PRAMS is a multimode survey; for nonresponders, the questionnaire is remailed and, if there is still no response, multiple attempts are made to telephone the individual. A total of 1308 responded

TABLE 7. Case Series and Similar Studies

Study	Source of Cases	No. of Cases	Control Group	Comments
1a. USPSC, 1980–1997[6]	US CPSC's Death Certificate data set	2178 "suffocation" case summaries	No	The USCPSC Death Certificate data set is not a population-based registry of infant deaths; subject to selection bias.[11] The diagnosis of death by "suffocation" may have been influenced by the sleeping surface on which the infant was found (eg, if deaths in beds were more likely to be labeled "suffocation" and deaths in cribs "SIDS"), leading to possible differential misclassification. Some infants who were found dead in an adult bed may not have been bedsharing, again leading to misclassification bias.
1b. USPSC, 1990–1997[5]	US CPSC's Death Certificate data set	515 case summaries, 394 attributed to entrapment and 121 to overlay asphyxiation	No	
1c. USPSC, 1980–1983 and 1995–1998[28]	US CPSC's Death Certificate data set	1396 infant "suffocation" deaths; 299 reported suffocated in cribs, compared with 543 found in adult bed.	National Infant Sleep Position Study data	
2a. St Louis County, 1994–1997[24]	Death scene information and medical examiners' investigations	118; 47% sharing a sleep surface, but only approximately half were in adult beds	No	Maternal smoking status not available
2b. St. Louis County, 1994–1997[25]	Death scene information and medical examiners' investigations	118; bedsharing twice as common among black SIDS cases as nonblack cases	No	More than twice as many black infants shared a sofa, rather than a bed, and nearly twice as many shared a sleep surface with a sibling. A total of 12.5% of the black victims were found on "makeshift" beds compared to none of the nonblack victims. Bedsharing among black individuals is much more common than among white individuals.
3. Upstate New York, 1991–2000[27]	Coroner autopsy files	56; 48.2% found bedsharing, but only 25% of the series were bedsharing in an adult bed	No	25% does not seem to be a large prevalence given reported bedsharing in the general population
4. Southeast Norway, 1984–1998[52]		174 SIDS cases	375 "controls"	The survey was limited by the long interval between death and questionnaire (mean: 3 y) and the shorter period of observation for cases than controls, both leading to possible recall bias.
5. Cleveland, Ohio, 1992–1996[53]	SIDS cases	84; compared age and maternal size of those who were found bedsharing and those who were not; there was a barely significant difference in mean age ($P = .048$).	NA	Hypothesized that victims of bedsharing would be younger and less vigorous and their mothers larger. Ten of the 84 cases had missing information and were assumed to be nonbedsharers; differential misclassification bias. Did not report on maternal smoking.

TABLE 7. Continued

Study	Source of Cases	No. of Cases	Control Group	Comments
6. Kentucky, 1991–2000[48]	All sudden unexpected infant deaths other than homicide in Medical Examiner files	697; 252 (36.2%) "co-sleeping" mentioned in Medical Examiner files	"Controls" drawn from 4 published studies and added together; used 24.6% as the population prevalence	Authors did not distinguish between sleeping with adults or other children and did not provide data on infants sleeping only with parents compared with those sleeping with others. A total of 120 of the 252 were "co-sleeping" on a sleep surface not designed for infants, but of these, only 67 were on adult mattresses. A total of 72% of the "co-sleepers" were found prone. Studies used to establish "population" prevalence used different designs and definitions of bedsharing, were from different countries.

CPSC indicates Consumer Products Safety Commission.

to the first mailing, 230 to the second, and 329 by telephone. Those without telephones would be underrepresented but not as badly as by a strictly telephone-based survey, as they likely would have had an opportunity to respond to the mailing. In addition, the survey was weighted for nonresponders (see Appendix) and would minimize selection bias on the basis of race/ethnicity, education, and socioeconomic status. Some residual bias is possible.

The potential for mode of administration bias exists but is unlikely to have significantly affected the results. Mode of administration (mailing vs computer-assisted telephone interview) was tested as a potential confounding variable but did not alter the results and was omitted from the final model.

The question was phrased to identify infants who sleep with their mothers on adult beds. No information was collected on the frequency of bedsharing by fathers, and we cannot exclude the presence of nonadults, a SIDS risk factor. Another limitation of our study was its inability to explore the sleep surface itself or other sleep environment conditions; use of duvets, quilts, thick pillows, and soft surfaces have been reported to increase the risk for SIDS.[18,19,42,49,50] This information would have been interesting to analyze as coexisting risks for SIDS but would not have altered the main results regarding smoking and bedsharing.

CONCLUSION

In a population-based survey of new Oregon mothers, bedsharing (mothers bringing their infant to bed with them) was common: 76.6% bedshared sometimes, including 35.2% who bedshared frequently. We found no association between smoking status (prenatal or postpartum) and bedsharing; smoking mothers were as likely to bedshare as nonsmoking mothers. In Oregon, if not elsewhere, the message that smoking mothers should not bedshare is not being disseminated effectively. As it is not known whether the risk from smoking is associated with prenatal smoking, postpartum smoking, or both, bedsharing among either prenatal or postpartum smokers should be strongly discouraged. Much more public and private effort must be made to inform smoking mothers, in culturally competent ways, of the very significant risks of mixing bedsharing and smoking.

The only 2 case-control studies to stratify the subjects by both infant age and maternal smoking status have both identified a risk for younger (<8–11 weeks of age) infants of nonsmoking mothers. No risk was found for older infants bedsharing with nonsmoking mothers. Unless and until larger studies confirm or refute these findings, they stand as the best scientific evidence to date. It would be worthwhile for other researchers to reanalyze their previous data to evaluate the consistency of the interaction of young infant age and bedsharing.

Large controlled studies, that include both infants labeled as SIDS, as asphyxia or suffocation, and as sudden unexplained infant death, analyzed separately and in combination, are needed to resolve this

TABLE 8. Risk of SIDS: Summary of Large Controlled Studies

Study (1–9)	Category	All Cases, OR (95% CI)		Smoking Mothers, OR (95% CI)	Nonsmoking Mothers, OR (95% CI)
		Smoking Versus Nonsmoking	Bedsharing Versus Nonbedsharing	Bedsharing Versus Nonbedsharing	Bedsharing Versus Nonbedsharing
1. Scotland, 1992–1995,[31] 201 cases/276 controls	Entire sample	–	2.90 (0.75–11.26)*	Did not stratify by smoking status	Did not stratify by smoking status
2a. Scotland, 1996–2000,[32] 131 cases/278 controls	Entire sample	4.39 (1.90–10.14)*	3.36 (1.67–6.73)*	Did not stratify by smoking status	Did not stratify by smoking status
2b. Scotland, 1996–2000,[33] 123 cases/263 controls	Entire sample	1.75 (0.34–9.13)*	3.49 (1.54–7.92)*	–	–
	> 11 weeks of age	–	1.07 (0.32–3.56)*	1.74 (0.40–7.62)*	0.45 (0.04–5.46)*
	< 11 weeks of age	–	10.20 (2.99–34.8)*	12.21 (2.57–58)*	8.01 (1.20–53)*
3a. NZCDS, 1987–1990,[35] 393 cases/1592 controls	Entire sample	1.79 (1.30–2.48)*	2.02 (1.35–3.04)*	–	–
3b. NZCDS, 1987–1990[38]	Maori	2.18 (1.26–3.78)*†	2.96 (1.93–4.55)*	5.5 (3.1–9.6)*	0.8 (0.3–2.3)‡
	Non-Maori	3.23 (2.04–5.08)*†	0.98 (0.55–1.72)*	4.5 (2.3–8.8)*	0.6 (0.2–1.5)‡
3c. NZDCS, 1987–1990[36]	"In the last 2 wk"	–	–	3.94 (2.47–6.27)*	1.73 (1.11–2.70)*
	"Last sleep"	–	–	4.55 (2.63–7.88)*	0.98 (0.44–2.18)*
3d. NZDCS, 1987–1990[39]	"In the last 2 wk"	–	–	2.32 (1.47–3.66)*	0.64 (0.39–1.05)*
	"Last sleep"	–	–	2.95 (1.66–5.27)*	0.30 (0.11–0.78)*
4. New Zealand, 1991–1993,[40] 127 cases/922 controls (case-cohort study)	"Initial"	5.84 (3.72–9.21)‡	1.76 (1.11–2.78)‡	5.01 (2.01–12.46)*	0.55 (0.17–1.78)*
	"Age 2 mo"	4.90 (2.65–9.06)‡	2.43 (1.24–4.69)‡	5.02 (1.05–24.05)*	1.03 (0.21–5.06)*
5a. CESDI SUDI, 1993–1995,[42] 195 cases/780 controls	Entire sample		4.38 (1.59–11.95)*	9.25 (2.51–34.02)*	2.27 (0.41–12.54)*
	Maternal prenatal smoking	1.78 (1.04–3.05)*			
	Parental postpartum smoking	3.79 (2.09–6.88)*			
5b. CESDI SUDI, 1993–1996,[31] 325 cases/1300 controls	"Put back in cot"	–	0.60 (0.33–1.08)*	–	–
	"At end of sleep"	–	1.35 (0.83–2.20)*	12.35 (7.41–20.59)‡	1.08 (0.45–2.58)‡
	"Under 14 wk of age"		4.65 (2.70–7.99)		
	"Over 14 wk of age"		1.08 (0.55–2.11)		
6. S. California, 1989–1992,[41] 200 cases/200 controls	"Daytime"	–	1.38 (0.59–3.22)*	"No interaction with smoking"	"No interaction with smoking"
	"Night"	–	1.21 (0.59–2.48)*		
7. CIMS, 1993–1996,[18] 260 cases/260 controls	Entire sample	4.3 (2.1–8.9)*§		"No interaction between bed sharing and maternal smoking either during pregnancy or postpartum"	"No interaction between bed sharing and maternal smoking either during pregnancy or postpartum"
	"With parents"		1.4 (0.7–2.8)*		
	"With others"		3.6 (1.4–9.4)*		
8a. Ireland, 1994–1998,[43] 203 cases/622 controls	Entire sample	–	16.47 (3.73–72.75)*	29.23 (2.69–316.78)*	OR 1.42–13.91‡‖
	"Usual practice"		4.31 (1.07–17.37)*		
	"Last sleep put back in cot"		1.29 (0.41–3.95)*		
	"Last sleep entire sleep"		9.28 (1.69–50.90)*		
	Infant <20 wk		16.86 (6.27–45.30)*		
	Infant ≥20 wk		2.80 (0.71–11.01)*		
8b. Ireland, 1994–1998[44]	Entire sample		41.41 (3.55–483.68)¶	–	–
	Prenatal <10 cigarettes/d	2.07 (0.30–14.41)*			
	Prenatal 10+ cigarettes/d	1.32 (0.19–8.85)*			

TABLE 8. Continued

Study (1–9)	Category	All Cases, OR (95% CI)		Smoking Mothers, OR (95% CI)	Nonsmoking Mothers, OR (95% CI)
		Smoking Versus Nonsmoking	Bedsharing Versus Nonbedsharing	Bedsharing Versus Nonbedsharing	Bedsharing Versus Nonbedsharing
9. ECAS, 1992–1996,[45] 745 cases/2411 controls	Entire sample		–	17.7 (10.3–30.3)*	1.56 (0.91–2.68)*
	<10 cigarettes/d	1.52 (1.10–2.09)*#		–	–
	>10 cigarettes/d	2.43 (1.76–3.36)*#		–	–
	Infant = 2 wk			27.0 (13.3–54.9)	2.4 (1.2–4.6)
	Infant = 26 wk			7.5 (4.3–13.2)	0.7 (0.2–1.5)**

NZCDS, New Zealand Cot Death Study; CIMS, Chicago Infant Mortality Study; CESDI SUDI, Confidential Enquiry Into Stillbirths and Deaths in Infancy–Sudden Unexplained Death in Infancy; ECAS, European Concerted Action on SIDS.
* Adjusted OR.
† Ten to 19 cigarettes per day.
‡ Crude OR.
§ Prenatal smoking.
‖ No CIs provided.
¶ Not adjusted for prone sleep position; once adjusted for prone position, OR could not be estimated because of small sample size.
\# Excluding bedsharers.
** Estimated from graph in article.

and other issues involving bedsharing, including the problem of diagnostic drift.

Recommendations must be based on solid scientific evidence. Cribs should be available for those who want to use them. Nonsmoking mothers should not be pressured to abstain from bedsharing with older infants; they should be provided with accurate, up-to-date scientific information. Although there are no studies to validate the American Academy of Pediatrics' recommendations[15] to avoid known SIDS risk factors, including soft sleep surfaces, pillows, quilts, blankets, comforters, parental use of substances that may impair arousal, and tobacco use, if parents consider bedsharing, then these are reasonable recommendations at this time. Infants also should not co-sleep with nonparents. Current epidemiologic evidence does not support the rejection of all bedsharing between nonsmoking mothers and their infants. It seems prudent to discourage bedsharing among all infants <3 months old. Young infants brought to bed to be breastfed should be returned to a crib when finished.

APPENDIX A: PRAMS METHOD

The PRAMS stratified random sample is drawn each month from the current birth certificate file. Sampling is by strata, with the following sampling proportions: 1 of every 65 non-Hispanic white women with a normal birth weight infant (≥2500 g), 1 of every 4 non-Hispanic white women with a low birth weight infant, 1 of every 10 Hispanic women, 9 of every 20 black women, half of all American Indian or Alaskan Native women, and 1 of every 4 Asian or Pacific Islander women. Most of the mothers sampled in each month had given birth 60 to 90 days before the drawing date. Women with multiple births had only a single chance to be in the sampling frame. Women are remailed a questionnaire ~3 weeks later if they have not responded. If there is still no response, then women are called beginning ~6 weeks after the initial mailing. Up to 15 attempts, on each telephone number, are made to contact a mother. The median response occurred when the infant was 4 months of age.

After all of the data were collected, the sample was weighted. Weighting is done in 3 steps, and the final weighting is a product of the 3. The first level of weighting was to account for the stratified oversampling; the weight given each respondent in a stratum is the total number of eligible mothers for the year in that stratum divided by the actual number sampled. (Given the complex study design, we believe that the response proportion weighted for oversampling is a more useful measure than the crude response proportion.) The second weighting is to adjust for nonresponse, using the variable identified by the Centers for Disease Control and Prevention as possible indicators of a mother's inclination to respond: marital status, high education, low education, parity, high age, low age, and first-trimester prenatal care. The third weighting is to account for noncoverage of women within the sampling frame.

During 1999, there were 45 193 births in Oregon, with 6902 Hispanic, 877 black, 2607 Asians/Pacific

Islander, 654 American Indians/Alaskan Native, 1813 white mothers with low birth weight infants and 32 408 white mothers with normal birth weight infants (the remainder were of unknown race).[51] For the first year of Oregon PRAMS, November 1998 through October 1999, the total weighted number of respondents was 45 110, with 6678 Hispanic, 910 black, 2079 Asians/Pacific Islander, 660 American Indians/Alaskan Native, and 1555 white mothers with low birth weight infants and 33 227 white mothers with normal birth weight infants.

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REFERENCES

1. Anderson RN, Smith BL, Division of Vital Statistics. *Deaths: Leading Causes for 2002*. Hyattsville, MD: National Center for Health Statistics; 2005:72–80. Available at: www.cdc.gov/nchs/data/nvsr/nvsr53/nvsr53_17.pdf. Accessed March 31, 2005
2. Oregon Department of Human Services Health Services, Office of Disease Prevention and Epidemiology, Center for Health Statistics. Oregon Vital Statistics Annual Report 2002, Vol 2: Mortality, Fetal and Infant Mortality, Youth Suicide Attempts, Tables 7–12. Available at: oregon.gov/DHS/ph/chs/data/arpt/02v2/chapter7/7–02.pdf. Accessed March 31, 2005
3. Willinger M, Ko CW, Hoffman HJ, Kessler RC, Corwin MJ. Factors associated with caregiver's choice of infant sleep position, 1994–1998: the National Infant Sleep Position Study. *JAMA*. 2000;283:2135–2142
4. Kattwinkel J, Brooks JG, Keenan ME, et al. Changing concepts of sudden infant death syndrome: implications for infant sleeping environment and sleep position. *Pediatrics*. 2000;105:650–656
5. Nakamura S, Wind M, Danello MA. Review of hazards associated with children placed in adult beds. *Arch Pediatr Adolesc Med*. 1999;53:1019–1023
6. Drago DA, Dannenberg AL. Infant mechanical suffocation deaths in the United States, 1980–1997. *Pediatrics*. 1999;103(5). Available at: www.pediatrics.org/cgi/content/full/103/5/e59
7. Byard RW. Is breast feeding in bed always a safe practice? *J Paediatr Child Health*. 1998;34:418–419
8. Rosenberg KD. Sudden infant death syndrome and co-sleeping. *Arch Pediatr Adolesc Med*. 2000;154:529
9. McAfee T. Bed sharing is not a "consumer product." *Arch Pediatr Adolesc Med*. 2000;154:530–531
10. Ball HL, Blair PS, Ward-Platt MP. "New" practice of bedsharing and risk of SIDS. *Lancet*. 2004;363:1558
11. O'Hara M, Harruff R, Smialek JE, Fowler DR. Sleep location and suffocation: how good is the evidence? *Pediatrics*. 2000;105:915–917
12. Ford RPK, Mitchell EA, Scragg R, Stewart AW, Taylor BJ, Allen EM. Factors adversely associated with breastfeeding in New Zealand. *J Paediatr Child Health*. 1994;30:483–489
13. McKenna JJ, Mosko SS, Richard CA. Bedsharing promotes breastfeeding. *Pediatrics*. 1997;100:214–219
14. McKenna JJ. Breastfeeding and bedsharing still useful (and important) after all these years. *Mothering*. 2002;114:28–37
15. Kattwinkel J, Brooks J, Keenan ME, Malloy M, Willinger M, SIDS AAP Task Force on Infant Sleep Position and SIDS. Does bed sharing affect the risk of SIDS? *Pediatrics*. 1997;100:272
16. Rosenberg KD, Westling PR, Sandoval AS, Stebbins K, Kent T, Lahr M. Oregon PRAMS First Year Report, 1998–99: Appendix D: Weighting Scheme. Portland, OR: Oregon Department of Human Services, Office of Family Health; 2000. Available at: www.dhs.state.or.us/publichealth/pch/prams/9899/9899appd.cfm. Accessed February 6, 2005
17. Hodge JG, Gostin LO, with the CSTE Advisory Committee. *Public Health Practice vs. Research: A Report for Public Health Practitioners Including Cases and Guidance for Making Distinctions*. Atlanta, GA: Council of State and Territorial Epidemiologists; 2004. Available at: www.cste.org/pdffiles/newpdffiles/CSTEPHResRptHodgeFinal.5.24.04.pdf. Accessed March 31, 2005
18. 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
19. Blair PS, Fleming PJ, Smith IJ, et al. Babies sleeping with parents: case-control study of factors influencing the risk of sudden infant death syndrome. *Br Med J*. 1999;319:1457–1462
20. Willinger M, Ko C-W, Hoffman HJ, Kessler RC, Corwin MJ. 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
21. Lindgren C, Thompson JMD, Häggblom L, Milerad J. Sleeping position, breastfeeding, bedsharing and passive smoking in 3-month-old Swedish infants. *Acta Paediatr*. 1998;87:1028–1032
22. James C, Klenka H, Manning D. Sudden infant death syndrome: bed sharing with mothers who smoke. *Arch Dis Child*. 2003;88:112–113
23. Flick L, White DK, Vemulapalli C, Stulac BB, Kemp JS. Sleep position and the use of soft bedding during bed sharing among African American infants at increased risk for sudden infant death syndrome. *J Pediatr*. 2001;138:338–343
24. Kemp JS, Unger B, Wilkins D, et al. Unsafe sleep practices and an analysis of bedsharing among infants dying suddenly and unexpectedly: results of a four-year, population-based, death-scene investigation study of sudden infant death syndrome and related deaths. *Pediatrics*. 2000;106(3). Available at: www.pediatrics.org/cgi/content/full/106/3/e41
25. Unger B, Kemp JS, Wilkins D, et al. Racial disparity and modifiable risk factors among infants dying suddenly and unexpectedly. *Pediatrics*. 2003;111(2). Available at: www.pediatrics.org/cgi/content/full/111/2/e127
26. Gessner BD, Ives GC, Perham-Hester KA. Association between sudden infant death syndrome and prone sleep position, bed sharing, and sleeping outside an infant crib in Alaska. *Pediatrics*. 2001;108:923–927
27. Person TLA, Lavezzi WA, Wolf BC. Cosleeping and sudden unexpected death in infancy. *Arch Pathol Lab Med*. 2002;126:343–345
28. Scheers NJ, Rutherford GW, Kemp JS. Where should infants sleep? A comparison of risk for suffocation of infants sleeping in cribs, adult beds, and other sleeping locations. *Pediatrics*. 2003;112:883–889
29. Nelson EA, Chan PH. Child care practices and cot death in Hong Kong. *N Z Med J*. 1996;109:144–146
30. Farooqi IS, Lip GYH, Beevers DG. Bed sharing and smoking in the sudden infant death syndrome. *Br Med J*. 1994;308:204–205
31. Brooke H, Gibson A, Tappin D, Brown H. Case control study of sudden infant death syndrome in Scotland, 1992–1995. *Br Med J*. 1997;314:1516–1520
32. Tappin D, Brooke H, Ecob R, Gibson A. Used infant mattresses and sudden infant death syndrome in Scotland: case-control study. *Br Med J*. 2002;325:1–6. Available at: bmj.com/cgi/reprint/325/7371/1007.pdf
33. 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
34. Mitchell EA, Scragg R, Stewart AW, et al. Results from the first year of the New Zealand cot death study. *N Z Med J*. 1991;104:71–76
35. Mitchell EA, Taylor BJ, Ford RPK, 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
36. Scragg RK, Mitchell EA, Taylor BJ, et al. Bed sharing, smoking, and alcohol in the sudden infant death syndrome. *Br Med J*. 1993;307:1312–1318
37. Mitchell EA, Ford RPK, Stewart AW, et al. Smoking and the sudden infant death syndrome. *Pediatrics*. 1993;91:893–896
38. Mitchell EA, Scragg R. Observations on ethnic differences in SIDS mortality in New Zealand. *Early Hum Dev*. 1994;38:151–157
39. Scragg RKR, Mitchell EA, Stewart AW, et al. Infant room-sharing and prone sleep position in sudden infant death syndrome. *Lancet*. 1996;347:7–12
40. 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
41. Klonoff-Cohen H, Edelstein SL. Bed sharing and the sudden infant death syndrome. *Br Med J*. 1995;311:1269–1272
42. Fleming PJ, Blair PS, Bacon C, et al. 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. *Br Med J*. 1996;313:191–195
43. 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

44. Matthews T, McDonnell M, McGarvey C, Loftus G, O'Regan M. A multivariate "time based" analysis of SIDS risk factors. *Arch Dis Child*. 2004;2004:267–271
45. 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
46. Mitchell E, Krous HF, Donald T, Byard R. Changing trends in the diagnosis of sudden infant death. *Am J Forensic Med Pathol*. 2000;21: 311–314
47. Shapiro-Mendoza CK, Tomashek KM, Anderson RN. Is the recent decline in sudden infant death syndrome (SIDS) in the United States due to a diagnostic shift [Abstract]? 17th Annual Meeting of the Society for Pediatric and Perinatal Epidemiologic Research; June 14–15, 2004; Salt Lake City, UT. Available at: www.sper.org/Plenary%20Session%20II-Abstracts%202004.pdf. Accessed April 8, 2005
48. Knight LD, Hunsaker DM, Corey TS. Cosleeping and sudden unexpected infant deaths in Kentucky: a 10-year retrospective case review. *Am J Forensic Med Pathol*. 2005;26:28–32
49. Mitchell EA, Scragg R, Clements M. Soft cot mattresses and the sudden infant death syndrome. *N Z Med J*. 1996;109:206–207
50. Ponsonby AL, Dwyer T, Couper D, Cochrane J. Association between use of a quilt and sudden infant death syndrome: case-control study. *Br Med J*. 1998;316:195–196
51. Oregon Department of Human Services Health Services, Office of Disease Prevention and Epidemiology, Center for Health Statistics. Oregon Vital Statistics Annual Report 1999, Vol 1: Natality, Induced Terminations of Pregnancy, Teen Pregnancy, Tables 2–36. Available at: www.dhs.state.or.us/publichealth/chs/arpt/99v1/99v1.pdf. Accessed March 31, 2005
52. Arnestad M, Andersen M, Vege Å, 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
53. Carroll-Pankhurst C, Mortimer EA. Sudden infant death syndrome, bedsharing, parental weight, and age at death. *Pediatrics*. 2001;107: 530–536

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