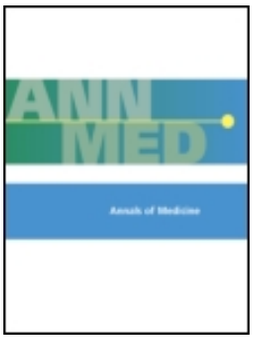

Annals of Medicine

ISSN: 0785-3890 (Print) 1365-2060 (Online) Journal homepage: informahealthcare.com/journals/iann20

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Robert K R Scragg & Edwin A Mitchell

To cite this article: Robert K R Scragg & Edwin A Mitchell (1998) Side sleeping position and bed sharing in the sudden infant death syndrome, Annals of Medicine, 30:4, 345-349, DOI: 10.3109/07853899809029933

To link to this article: https://doi.org/10.3109/07853899809029933

◆ REVIEW ARTICLE ◆

Side sleeping position and bed sharing in the sudden infant death syndrome

Robert K R Scragg and Edwin A Mitchell[1]

In the last decade there have been major reductions in the sudden infant death syndrome (SIDS) rate following prevention programmes in Australasia, Europe and North America, mainly due to changing infants from the prone sleeping position onto their sides or backs. This report reviews previous SIDS observational studies with data on side sleeping position and bed sharing. The relative risk for SIDS calculated from previous studies for side vs back sleeping position is 2.02 (95% CI = 1.68, 2.43). This result suggests that further substantial decreases in SIDS could be expected if infants were placed to sleep on their backs. With regard to bed sharing, the summary SIDS relative risk is 2.06 (1.70, 2.50) for infants of smoking mothers and 1.42 (1.12, 1.79) for infants of nonsmoking mothers. Public health policy should be directed against bed sharing by infants whose mothers smoke as they carry an increased risk of SIDS from bed sharing in addition to their already increased risk from maternal smoking. For infants of nonsmoking mothers, who have a low absolute risk of SIDS, the 40–50% increase in risk needs to be balanced against other perceived benefits from bed sharing, such as increased breastfeeding.

Key words: bed sharing; sleeping position; sudden infant death syndrome.

Ann Med 1998; 30: 345–349.

Introduction

Epidemiological studies carried out over the last 10 years have greatly increased our understanding of the risk factors of the sudden infant death syndrome (SIDS). A number of new risk factors have been identified, and the importance of some risk factors, such as prone sleeping position, recognized (1). SIDS prevention programmes, with advice given to parents to change infants from the prone sleeping position onto their sides or backs, has lead to major reductions in SIDS mortality in Australasia (2, 3), Europe (4, 5) and North America (6). The first aim of this review is to summarize the research on prone sleeping position and examine the interesting effects that removal of this risk factor has had on the epidemiology of SIDS.

The dramatic decline in SIDS during the early 1990s, and the attention given to prone sleeping position, largely eclipsed the possible importance of side sleeping position being an important risk factor in it own right. Our second aim is to review the evidence regarding side position as a risk factor for SIDS.

Despite the success of the prevention programmes, they were not without controversy. In New Zealand there was concern about the recommendation for infants not to bed share. Further analysis led to the identification of an interaction between bed sharing and maternal smoking, with the effect of bed sharing on SIDS risk being much stronger in infants of smoking mothers compared to those of nonsmoking mothers (7). Our third aim is to review the bed sharing evidence, and in particular evaluate whether infants of nonsmoking mothers have an increased risk of SIDS.

From the Department of Community Health, and the [1]Department of Paediatrics, University of Auckland, Auckland, New Zealand.

Correspondence: Robert Scragg, MD, Department of Community Health, University of Auckland, Private Bag 92019, Auckland, New Zealand. E-mail: r.scragg@auckland.ac.nz, Fax: +64 9 373 7503.

Prone sleeping position

Epidemiological studies in several countries, including Australia (8), New Zealand (1), the Netherlands (9), the UK (10) and Scandinavia (5), have identified prone sleeping position as an important risk factor for SIDS. A review of these studies has concluded that the evidence on prone sleeping position meets the Bradford–Hill criteria as a cause of SIDS (11).

The most compelling evidence that prone sleeping position is causal comes from the success of cot death prevention programmes in various countries. These have resulted in SIDS declines of 20% in the USA (6), 40% in the Netherlands (12), 50% in New Zealand (2), Australia (3) and the UK (13), and above 50% in Scandinavia (5).

A common theme in all prevention programmes, which have also included recommendations against other risk factors such as maternal smoking, has been advice to put babies to sleep on the back or side, rather than the front (4). Evaluation of these prevention programmes has shown that most of the SIDS decline can be attributed to the change from prone sleeping position (5, 13–15). This latter finding on prone sleeping position meets the strongest of the Bradford–Hill criteria of causation, namely that removal of the risk factor decreases the risk of disease.

The decline in SIDS, as a consequence of the recent removal of the practice of putting infants to sleep in the prone position, has produced two unexpected changes in the epidemiology of the syndrome. Firstly, the SIDS winter excess has been observed to decline in both New Zealand (2), Australia (16) and also the UK (16, 17); and secondly, the increased SIDS incidence in colder southern New Zealand, compared to the warmer north, has largely disappeared (2). Consistent with these changes in SIDS epidemiology following the recent removal of prone sleeping, the New Zealand Cot Death Study, a large nationwide case–control study, found from data collected before the prevention programme that the relative risk of SIDS from prone sleeping position was stronger in the winter than in the summer (18) and in the south compared with the north (19).

Other interactions with prone sleeping position have also been reported. The Tasmanian study has found that use of natural-fibre matresses, swaddling, recent illness and room heating potentiate the effect of prone sleeping (20); while the New Zealand study observed that the relative risk for prone sleeping was higher for infants sleeping in a room without an adult than with adults (21). These interactions with prone sleeping position may provide new insights into the mechanisms causing SIDS. For example, prone sleeping may increase the risk of SIDS by causing hyperthermia (22) or rebreathing of carbon dioxide (23). If parents are in the room with their baby, it is possible that they are able to provide appropriate assistance to the baby, if it should develop breathing difficulties from the prone position, and thus prevent the progression to fatal apnoea (21).

Side sleeping position

Several case–control studies (1, 10, 24–30) and a cohort study (8) have reported data on the frequency of putting infants to sleep on the side compared with the back. Relative risks from these studies, mostly carried out in Australasia and the UK, are consistently above 1 (Table 1). The Mantel–Haenszel summary odds ratio (31) for all studies combined, adjusting for individual studies, is 2.02 (95% CI = 1.68, 2.43) for side vs back sleep position (χ^2_9 for homogeneity = 6.88, $P = 0.65$).

There are also two case–control studies which compared the position found at death for cases with usual sleep position for controls. The SIDS relative risks for side vs back calculated from the data collected in these studies are 0.27 (32) and 0.43 (33). However, it is likely that both of these studies underestimated the frequency of the side sleeping position in cases in which some infants who were put to sleep on the side would have rolled into the prone position prior to death. This explanation is backed up by findings from the Californian study showing that,

Table 1. Relative risk of SIDS associated with putting infants to sleep in the side position compared with the back position.

Study, year (reference)	Cases		Controls		Odds ratio (95% CI)*	
	Side	Back	Side	Back		
New Zealand 1987–90 (1)	120	18	815	248	2.03	(1.21, 3.40)
New Zealand 1991–93 (24)	109	6	834	78	1.70	(0.72, 3.99)
Tasmania 1980–86 (25)	59	9	155	33	1.40	(0.63, 3.09)
Tasmania 1988–90 (8)	6	0	1579	118	∞	
England 1987–89 (10)	4	1	32	23	2.88	(0.30, 27.44)
England 1993–95 (26)	76	82	241	509	1.96	(1.38, 2.77)
Scotland 1992–95 (27)	75	45	104	147	2.36	(1.51, 3.68)
California 1989–92 (28)	28	14	18	18	2.00	(0.80, 5.00)
Germany 1993–94 (29)	10	13	78	61	0.60	(0.25, 1.46)
Scandinavia 1992–95 (30)	78	31	312	374	3.01	(1.91, 4.69)

* Exact confidence limits.
SIDS, sudden infant death syndrome.

while 15% of cases were placed to sleep on their sides, only 10% were found in this position at death (28). Similarly, the Nordic study reported that 33% of cases were placed to sleep the last time on their sides, but only 13% were still on their side at death (30).

The instability associated with the side position is the likely explanation for its higher SIDS risk compared with the back position. A New Zealand study found that at 1 month of age only 53% of normal infants placed on their side to sleep were found later still on their side, and this decreased to just 31% at 4 months of age (34). More recently, the English Confidential Enquiry into Sudden Death in Infancy (CESDI) study has found that cases were more likely than controls to change from the side to the prone sleeping position (39.2% vs 3.8%) (26), as did the Nordic study (41.1% vs 6.8%) (30). Thus, the side position appears to be a precursor of the prone position in the chain of events that leads to SIDS.

The prevalence of prone sleeping by infants in most postintervention populations is now very low, being 4% in Tasmania (16), 1–3% in New Zealand (24), 3% in England (26) and 2% in Scotland (27). As a consequence of this, the side position, because of its greater frequency (Table 1), is now of greater importance to public health than the prone position. In the English CESDI study the proportion of SIDS events caused by side position (population attributable risk) was 18.4% compared to 14.2% for prone (26). Using univariate data in the Scottish study we have calculated the population-attributable risks for side and prone to be 14% and 2%, respectively (27). Similar attributable risk calculations for New Zealand are 37% for side and 1% for prone (24). In Scandinavia, the difference in attributable risk calculations for side (26.0%) and prone (18.5%) is not so great because the prevalence of prone sleeping position (9% in controls) remains relatively high (5).

The above attributable risk values from post-intervention populations rank side sleeping position, as a cause for SIDS, second in importance only to maternal smoking, for which the attributable risk is now 50–60% (5, 24, 27, 35). However, side position is more preventable, because it is more likely to be changed, than is smoking, given the latter's addictive nature. Thus, concerted efforts against the side sleeping position should be mounted by public health agencies responsible for SIDS prevention. There is no reason why they should be any less successful than efforts to change infants from the prone sleeping position.

Bed sharing and maternal cigarette smoking

Since biblical times maternal overlaying of the infant while bed sharing has been thought to be a cause of sudden infant death. Earlier case–control studies in England and the USA reported an increased frequency of bed sharing (cosleeping) by cases compared with controls (36, 37). These results were confirmed by preliminary findings in the New Zealand study (1). However, further analyses of the New Zealand data showed that the increased SIDS risk from bed sharing was found only in Maori infants and not in non-Maori (38). This suggested that bed sharing was interacting with some other risk factor that was more common in Maori infants, which turned out to be maternal smoking (7). The effect of the interaction was to make bed sharing a strong and statistically significant risk factor for SIDS among infants with mothers who smoked, but not among infants of nonsmoking mothers. The interaction between maternal smoking and bed sharing was independent of other known risk factors including social class (7), and was consistent in all the three main ethnic groups in New Zealand, Maori, Pacific Islanders and Europeans (39). It has since been confirmed by case–control studies in England (26), Scotland (27) and the USA (40), and by a further New Zealand study (24).

Data on bed sharing by maternal smoking status, published in previous reports (24, 39, 40) and from case–control studies in England (P Fleming, unpublished observations, 1997), Scotland (H Brooke, unpublished observations, 1997) and Germany (J Schellscheidt, unpublished observations, 1997), are shown in Tables 2 and 3. Odds ratios associated with bed sharing by infants of smoking mothers are all elevated (Table 2), except for the Pacific Islander infants in the first New Zealand study (39). The Mantel–Haenszel summary odds ratio, adjusting for individual studies, was 2.06 (95% CI = 1.70, 2.50; χ^2_7

Table 2. Relative risk of SIDS associated with bed sharing by infants of smoking mothers.

Study (reference)	Cases Bed share Yes	Cases Bed share No	Controls Bed share Yes	Controls Bed share No	Odds ratio (95% CI)*
New Zealand (39)					
Maori	124	23	132	64	2.61 (1.53, 4.47)
Pacific Islanders	10	5	31	13	0.84 (0.24, 2.94)
European	49	50	93	177	1.87 (1.17, 2.98)
New Zealand (24)					
birth	27	50	43	171	2.15 (1.21, 3.82)
2 months	10	27	25	149	2.21 (0.95, 5.11)
USA (40)	238	254	109	214	1.84 (1.38, 2.46)
England (26)†	40	86	33	175	2.47 (1.45, 4.18)
Scotland (27)†	9	102	0	92	∞
Germany (29)†	6	23	2	28	3.65 (0.67,19.85)

* Exact confidence limits.
† Personal communication with authors.
SIDS, sudden infant death syndrome.

Table 3. Relative risk of SIDS associated with bed sharing by infants of nonsmoking mothers.

Study (reference)	Cases Bed share Yes	Cases Bed share No	Controls Bed share Yes	Controls Bed share No	Odds ratio (95% CI)*
New Zealand (39)					
Maori	23	8	65	39	1.73 (0.70, 4.23)
Pacific Islanders	5	3	70	23	0.55 (0.12, 2.47)
European	36	56	317	567	1.15 (0.74, 1.79)
New Zealand (24)					
birth	5	32	119	566	0.74 (0.28, 1.95)
2 months	4	18	61	523	1.91 (0.62, 5.81)
USA (40)	76	141	93	340	1.97 (1.37, 2.83)
England (26)†	10	56	78	493	1.13 (0.55, 2.30)
Scotland (27)†	1	33	6	177	0.89 (0.10, 7.67)
Germany (29)†	3	25	7	115	1.97 (0.48, 8.16)

* Exact confidence limits.
† Personal communication with authors.
SIDS, sudden infant death syndrome.

for homogeneity = 6.08, $P = 0.53$) using the birth data, and 2.06 (95% CI = 1.69, 2.51; χ^2_7 for homogeneity = 6.07, $P = 0.53$) using the 2-month data, from the follow-up New Zealand study (24). Thus, there is strong evidence now that bed sharing by infants whose mothers smoke is a major risk factor for SIDS. Public health policy should be directed against bed sharing by these infants, as they carry an increased SIDS risk from bed sharing in addition to their already increased risk from maternal smoking.

However, it is unclear from previous reports whether bed sharing is a risk factor among infants of nonsmoking mothers as most individual studies, except for the US study (40) and one bed sharing measure in the New Zealand study (7), did not find a statistically significant ($P > 0.05$) increase in SIDS risk for these infants. Table 3 shows bed sharing data for infants of nonsmoking mothers. The summary Mantel–Haenszel odds ratio, adjusting for individual studies, was 1.42 (95% CI = 1.12, 1.79; χ^2_7 for homogeneity = 8.76, $P = 0.27$) using the birth data, and 1.50 (95% CI = 1.18, 1.91; χ^2_7 for homogeneity = 6.91, $P = 0.44$) using the 2-month data, from the follow-up New Zealand study (24). Thus, bed sharing significantly increases the risk of SIDS by about 40–50% in infants of nonsmoking mothers.

The dilemma comes in deciding bed sharing policy for infants of nonsmoking mothers as the increase in risk, which is small, needs to be balanced against the perceived benefits from a common infant care practice. For example, infants who bed share have been observed to be breastfed more than infants who sleep by themselves (41). In New Zealand we have previously calculated attributable risks which show that only a small proportion of the SIDS deaths attributed to bed sharing (11%) are occuring in infants of nonsmoking mothers (39). These deaths make up only 3% of all SIDS deaths but come from 28% of the total infant populaton. In contrast, 26% of all SIDS deaths can be attributed to bed sharing among infants of smoking mothers, who comprise 16% of the total infant population. Thus, extending the current policy against bed sharing, which is targeted at infants of smoking mothers, to all infants would potentially save an additional 3% of deaths. But if public attitudes are favourable to bed sharing, there could be a marginal cost (against accepting a policy not to bed share) by including infants of nonsmoking mothers in the recommendation not to bed share, because in New Zealand they comprise 28% of the total infant population (39). In this situation, parents may refuse to accept, and act on, not only the advice not to bed share, but also other aspects of prevention programmes such as advice to parents not to smoke.

For countries without data on bed sharing for infants of nonsmoking mothers, absolute risk calculations can assist in determining public policy for these infants. If the absolute risk of SIDS in the first year of life is 1/1000 for all infants, the population-attributable risk values of about 50% for smoking (see above) imply that the absolute risk of SIDS for infants of nonsmoking mothers can be estimated to be about 0.5/1000. If an infant in this category then bed shares, the above summary odds ratio of 1.5 suggests that the absolute risk would increase by about 0.25/1000 in the first year of life. This relatively small increase in absolute risk can be weighed by parents and policy makers against the perceived benefits of bed sharing.

Conclusion

Further substantial decreases in SIDS could be expected if all infants were placed to sleep on their backs. In addition, there is a potential for saving many infant lives if infants of smoking mothers do not bed share. In contrast, the benefit of not bed sharing for infants of nonsmoking mothers is minor, although statistically significant, but needs to be balanced against the possible marginal cost.

The authors are grateful to Dr Jorn Schellscheidt, Mrs Hazel Brooke and Professor Peter Fleming, and their colleagues, for approval to use unpublished data on bed sharing and maternal smoking.

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