

## 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

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### Abstract

**Objective**—To investigate the role of sleeping arrangements as risk factors for the sudden infant death syndrome after a national risk reduction campaign.

**Design**—Two year population based case-control study. Parental interviews were conducted for each infant who died and for four controls matched for age and date of interview.

**Setting**—Three regions in England with a total population of 17 million people.

**Subjects**—195 babies who died and 780 matched controls.

**Results**—Prone and side sleeping positions both carried increased risks of death compared with supine when adjusted for maternal age, parity, gestation, birth weight, exposure to smoke, and other relevant factors in the sleeping environment (multivariate odds ratio = 9.00 (95% confidence interval 2.84 to 28.47) and 1.84 (1.02 to 3.31), respectively). The higher incidence of side rather than prone sleeping led to a higher population attributable risk (side 18.4%, prone 14.2%). More of the infants who died were found with bed covers over their heads (21.58; 6.21 to 74.99). The use of a dummy had an apparent protective effect (0.38; 0.21 to 0.70). Bed sharing for the whole night was a significant risk factor for infants whose mothers smoked (9.25; 2.31 to 34.02). No protective effect of breast feeding could be identified on multivariate analysis.

**Conclusions**—This study confirms the importance of certain risk factors for the sudden infant death syndrome and identifies others—for example, covers over the head, side sleeping position—which may be amenable to change by educating and informing parents and health care professionals.

### Introduction

Despite the fall in the incidence of sudden unexpected deaths in infancy in the United Kingdom, particularly that which followed the "Back to Sleep" campaign in 1991, such deaths remain one of the largest single group of deaths in infancy.<sup>1</sup>

Previous studies have drawn attention to the importance of several features of the environment in which infants sleep—for example, sleeping position, bedding, use of dummies—as factors affecting the risk of the sudden infant death syndrome.<sup>2,3</sup> Other factors, such as breast or bottle feeding and bed sharing, have not consistently been found to be associated with risk of death.<sup>4,6</sup> No large scale studies have yet been published of the impact on such factors of the major national campaign aimed at reducing risk.

The study of sudden unexpected deaths in infancy was established as a part of the national confidential inquiry into stillbirths and deaths in infancy (CESDI), with funding from the Department of Health. The aim was to conduct a detailed case-control study of all sudden unexpected deaths in infancy in the participating regions of the United Kingdom combined with a confidential inquiry into such deaths over a two year period starting one year after the national risk reduction campaign. A summary of the preliminary results of this study and data relating to mattress covers have been published.<sup>7,8</sup>

In this paper we present the results of a detailed analysis of several aspects of the infant's sleeping environment and the risk of the sudden infant death syndrome.

### Methods

#### STUDY DESIGN, CASE NOTIFICATION, AND SELECTION OF CONTROLS

The study aimed to include all deaths from the syndrome in infants aged 7 to 364 days inclusive in two NHS regions in the United Kingdom (Southwest and Yorkshire) from February 1993 and a third region (Trent) from September 1993 until January 1995 inclusive, the total population of the study area being about 17 million. Cases were ascertained through a communication network of professionals and lay organisations who reported all sudden unexpected deaths within 24 hours.

Data were collected on a standard questionnaire by research interviewers, consistency of approach being maintained by regular training meetings. The interviewers visited each bereaved family twice. On the first occasion, usually within five days of the death, after obtaining informed consent they took a standardised semistructured history, including a narrative account of events leading up to and surrounding the infant's final sleep. On the second visit, a few days later and usually within two weeks of the death, they completed the full questionnaire.

The questionnaire contained over 600 items, including demographic and social data; the medical history of the infant and other family members; use of cigarettes, alcohol and drugs; the precise sleeping arrangements for the infant; and full details of the events preceding and the circumstances surrounding the death. Information was collected both with regard to the family's usual practices by day and by night and to the period when the baby died. Most of these data were obtained by parental interview, the remainder were derived from medical and nursing records.

Four controls for each case were selected by the method previously used in Avon.<sup>2</sup> The health visitor for the index case was asked to identify the two babies on

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her list next older and the two babies next younger, within two weeks of the age of the index baby. In the few instances where the family thus identified was not available or declined to be interviewed or when the health visitor thought inclusion inappropriate—for example, because of recent bereavement—then the family with the next closest baby in age was substituted. If a health visitor did not have four suitable babies on her own list she drew from the list of her nearest colleague.

This method of control selection gave a high compliance rate and allowed rapid collection of control data. The geographical matching inherent in this system, however, may lead to an underestimate of the significance of factors relating to socioeconomic status.<sup>9</sup>

The interviewer visited each control family within a week of the death to collect the same data as for the index case. A period of sleep (the "reference sleep") was identified in the control infant's life in the 24 hours before the interview corresponding to that in which the index baby had died, particular importance being given to the index parents' view of whether it had been a night or a daytime sleep. Data were collected for this period equivalent to those collected for the index baby.

#### REGIONAL CONFIDENTIAL REVIEW COMMITTEE

All available information on each case was reviewed in detail by a multidisciplinary confidential review committee. Only those deaths that were unexpected by history and for which no sufficient cause was determined by thorough investigation, including a full paediatric postmortem examination and review of the

circumstances of the death, were attributable to the sudden infant death syndrome.<sup>10-12</sup> The methodology has previously been used and validated in studies in Avon.<sup>2 5 9 11</sup>

#### STATISTICAL ANALYSIS

For both the univariate and the multivariate analysis the matching was taken into account by using conditional logistic regression. This was carried out with version 6 of the SAS package,<sup>13</sup> and results have been verified against similar procedures available in SYSTAT, GLIM, and EGRET. Odds ratios are quoted for categorical variables adjusted for the matching, P values are used for continuous variables, and the unadjusted Fisher's exact test was utilised for small cell frequencies. Centiles at birth were computed by using z scores from the FOX-PRO package.<sup>14</sup> Population attributable risk was calculated by using the multivariate odds ratio and percentage of exposed among the index group.<sup>15</sup>

The multivariate model included all effect modifiers that were significant in the univariate analysis ( $P < 0.05$ ) and remained significant in the multivariate analysis when we controlled for the other effect modifiers and variables being tested. These were maternal age, parity (defined as the number of liveborn children at the time of interview), gestation in weeks, birth weight adjusted for gestation and sex, and a measure for socioeconomic status. A number of markers of socioeconomic status were collected, including social class, parental education, weekly income, whether the family received any income support, and several questions regarding housing conditions. Detailed analysis has shown all of these factors to be significant,<sup>7</sup> the most significant being family income supplement, a means tested benefit which takes account of the family needs as well as income. This has therefore been used throughout this report as an indicator of socioeconomic deprivation.

Smoking was found to be an important risk factor and was also entered into the model, a detailed analysis of the data on smoking is included in the accompanying paper.<sup>16</sup>

#### Results

##### QUALITY OF DATA AND COLLECTION

*Ascertainment of cases and controls*—During the study period 266 sudden unexpected deaths in infancy were identified. Subsequent checking with statutory notifications revealed five such deaths in the study regions which had not been identified during the study period. Of the potential control families, 57 could not be used (21 were not available, 23 were thought unsuitable, and 13 refused). Replacements were immediately found so that ascertainment of controls was 100%. Most of the deaths (216 (81.2%)) were attributable to the sudden infant death syndrome; seven index families could not be interviewed, either because they were subject to a police investigation or could not be traced, and 12 families refused interview, which gives a consent rate of 94.3%. In two further cases no controls were taken because the index family lived outside the study area. This analysis therefore deals with 195 cases and their 780 matched controls.

*Time to first interview*—The median time from the discovery of the death until the first interview of the index parents was 4.5 days; 82% of families were interviewed within 14 days and 95% within 28 days of the death.

*Matching for age*—Over two thirds of the controls were matched within two weeks and over 90% within one month of the age of the index baby.

##### UNIVARIATE RESULTS ADJUSTED FOR MATCHING

*Sleeping position*—Table 1 shows the positions in which the babies who died and the controls were put

**Table 1**—Sleeping position in babies who died from the sudden infant death syndrome and matched controls

Detail	No (%) of babies who died	No (%) of controls	Odds ratio (95% confidence interval)
Position put down:			
Back	82 (43.6)	509 (65.8)	1.00
Side	76 (40.4)	241 (31.1)	2.01 (1.38 to 2.93)
Front	30 (16.0)	24 (3.1)	9.58 (4.86 to 18.87)
No with data available	188	774	
Position found:			
Back	67 (35.8)	618 (81.9)	1.00
Side	43 (23.0)	92 (12.2)	4.51 (2.65 to 7.66)
Front	77 (41.2)	45 (6.0)	21.36 (11.67 to 39.08)
No with data available	187	755	

**Table 2**—Tog values of bedding used for babies who died from the sudden infant death syndrome and matched controls

Tog value	No (%) of babies who died	No (%) of controls	Odds ratio (95% confidence interval)	
			Not adjusted	Adjusted*
Usually by night:				
<6 togs	81 (42.0)	391 (50.2)	1.00	1.00
6-9 togs	80 (41.5)	318 (40.8)	1.27 (0.86 to 1.87)	1.27 (0.83 to 1.95)
≥10 togs	32 (16.6)	70 (9.0)	2.27 (1.32 to 3.90)	1.65 (0.90 to 3.04)
No with data available	193	779		
Usually by day:				
<6 togs	135 (70.0)	643 (82.6)	1.00	1.00
6-9 togs	43 (22.3)	117 (15.0)	2.00 (1.26 to 3.15)	2.07 (1.24 to 3.46)
≥10 togs	15 (7.8)	18 (2.3)	4.32 (1.97 to 9.46)	3.94 (1.64 to 9.49)
No with data available	193	778		
When put down:				
<6 togs	90 (47.1)	456 (58.5)	1.00	1.00
6-9 togs	68 (35.6)	263 (33.8)	1.50 (0.99 to 2.26)	1.52 (0.96 to 2.42)
≥10 togs	33 (17.3)	60 (7.7)	3.38 (1.94 to 5.87)	2.78 (1.49 to 4.16)
No with data available	191	779		
When found:				
<6 togs	112 (58.9)	556 (71.4)	1.00	1.00
6-9 togs	51 (26.8)	183 (23.5)	1.61 (1.05 to 2.47)	1.57 (0.97 to 2.54)
≥10 togs	27 (14.2)	40 (5.2)	4.41 (2.20 to 7.62)	3.52 (1.74 to 7.11)
No with data available	190	779		

\*Controlled for socioeconomic status (with family income supplement).

down to sleep and found after sleep for the last or reference sleeps. The prone position was the least common sleeping position in which infants were put down, but it carried the greatest risk. An important new observation in these data is that the side sleeping position carried a significantly increased risk when compared with supine (odds ratio = 2.01; 95% confidence interval 1.38 to 2.93), regardless of whether the lower arm was extended forward or not. A change in position during the reference sleep from side to prone was rare among the controls (9/238 (3.8%)) compared with the babies who died (29/74 (39.2%)), while conversely the change from side to supine was rare among the babies who died but common among the controls. The major risk factor was for infants put down on their sides and found prone (21.69; 8.84 to 53.20) rather than for infants who remained on their sides or rolled to supine (1.21; 0.79 to 1.87).

**Thermal environment**—Significantly more of the mothers of control infants than of babies who died worried about their babies becoming too hot (0.47; 0.28 to 0.76). Twice as many babies who died (21.8%) as controls (11.9%) slept in rooms in which the heating was on for the whole duration of the last or reference sleep

(2.14; 1.33 to 3.15). Table 2 shows the thermal resistance (tog value) of bedding and clothing for sleep, usually and during the last or reference sleep for babies who died and controls. The babies who died were more heavily wrapped than the controls, both usually and during the last or reference sleep, the risk increasing as the tog value increased. A small but significant proportion of babies who died wore a hat to sleep, both usually at night (3.1% v 0.1% controls;  $P < 0.0003$ ) and for the last or reference sleep (5.2% v 1.8% controls;  $P < 0.015$ ) (Fisher's exact test). Data from the Meteorological Office showed no difference between the outdoor temperatures in the 24 hour periods preceding the deaths and those preceding the interviews of the controls.

**Arrangement of bedding**—Table 3 shows the type of bedding, how the bedding was arranged, where the infant was put in the bed, and whether the infant was usually found or found after the last or reference sleep with covers over the head. Very few babies who died or control infants were put down for the last or reference sleep at the bottom of the bed; this reflected usual practice. Significantly more babies who died (9.0% v 3.2%) were found at the bottom of the bed after the last or reference sleep (3.02; 1.42 to 6.25). More babies who died than controls were found with covers over their heads, and of these, more were sleeping under duvets (64% v 33% controls).

**Bed sharing and room sharing**—Routine bed sharing with parent(s) (two or more nights a week) was commoner among babies who died (26%) than controls (14.2%) (2.04; 1.36 to 3.07). During the last or reference sleep this difference was significant only for those who had been in bed with the parent(s) for more than one hour (25.7% v 15.3% controls; 1.86; 1.23 to 2.81) or for the whole night (14.9% v 4.0%; 4.12; 2.30 to 7.40). For most this was their usual practice; very few did so because the baby seemed unwell. More of these index mothers had consumed three or more units of alcohol in the preceding 24 hours (44.8%) compared with the control mothers (19.3%), although bed sharing was still significant among those who did not consume alcohol (2.92; 1.44 to 5.87). Most of the index mothers who shared their bed also smoked (86.2% v 35.5% controls). In a subgroup analysis the risk associated with bed sharing was not significant for non-smoking mothers (2.55; 0.80 to 8.19) but highly significant for mothers who smoked (17.57; 7.58 to 40.72). There was no difference in the proportions of babies who died and control infants sharing a room with an adult or another child usually or during the last or reference sleep.

**Use of dummies**—There was no difference in the proportion of the babies who died and controls who routinely used a dummy, but for the last or reference sleep there was a significant excess of control infants (52.8%) who used a dummy compared with babies who died (39.8%) (0.59; 0.42 to 0.84).

**Breast feeding or bottle feeding**—More of the control infants (60.3%) than the babies who died (45.1%) had ever been breast fed (0.50; 0.35 to 0.71), but the protective effect did not increase with increasing duration of breast feeding. Breast feeding was significant independently of dummy use, the cumulative protective effect of both being additive (0.26; 0.15 to 0.44). Bottle feeding was strongly associated with lower socioeconomic status and with smoking. When breast feeding was adjusted for socioeconomic status its apparent protective effect became non-significant (0.69; 0.47 to 1.02).

#### MULTIVARIATE MODEL

From the univariate analysis various factors seem to be associated with an increased or decreased risk of the sudden infant death syndrome. To examine their

**Table 3—Arrangement of bedding in babies who died from the sudden infant death syndrome and matched controls**

Detail of bedding	No (%) of babies who died	No (%) of controls	Odds ratio (95% confidence interval)
Duvet used for last or reference sleep:			
No	112 (57.7)	602 (77.3)	1
Yes	82 (42.3)	177 (22.7)	2.82 (1.95 to 4.08)
No with data available	194	779	
Bedding for last or reference sleep:			
Tucked in or no bedding	82 (44.3)	467 (60.3)	1
Lying loosely over	103 (55.7)	307 (39.7)	1.92 (1.35 to 2.73)
No with data available	185	774	
Where in bed:			
Top or middle	169 (98.3)	689 (98.1)	
Bottom	3 (1.7)	13 (1.9)	P = 1.0*
No with data available	172	702	
Usually found with covers over head:			
Sometimes or never	181 (94.3)	763 (97.9)	
Often or always	11 (5.7)	16 (2.1)	2.72 (1.11 to 6.77)
No with data available	192	779	
Found with covers over head after last or reference sleep:			
No	148 (81.3)	747 (97.6)	
Yes	34 (18.7)	18 (2.4)	18.93 (8.05 to 44.48)
No with data available	182	765	

\*Fisher's exact test.

**Table 4—Multivariate analysis of significant factors in sleeping environment for risk of the sudden infant death syndrome. Figures are odds ratios (95% confidence intervals)**

Variable*	Univariate	Multivariate	
		Sleeping†	All factors‡
Prone sleeping	9.58 (4.86 to 18.87)	10.03 (4.33 to 23.24)\	9 (2.84 to 28.47)
Side sleeping	2.01 (1.38 to 2.93)	2.16 (1.36 to 3.43)	1.84 (1.02 to 3.31)
Infant found with covers over head	18.93 (8.05 to 44.48)	31.38 (10.4 to 95.0)	21.58 (6.21 to 74.99)
Tog value (6-9 togs)	1.5 (0.99 to 2.26)	0.95 (0.55 to 1.63)	0.89 (0.45 to 1.76)
Tog value ( $\geq 10$ togs)	3.38 (1.94 to 5.87)	1.04 (0.44 to 2.46)	0.94 (0.31 to 2.83)
Wearing hat	P = 0.015§	6.21 (0.74 to 51.93)	4.13 (0.22 to 77.89)
Heating on all night	2.14 (1.30 to 3.50)	3.14 (1.60 to 6.17)	2.37 (0.96 to 5.84)
Whether mother ever breast fed	0.5 (0.35 to 0.71)	0.42 (0.26 to 0.67)	1.06 (0.57 to 1.98)
Bed sharing with parents all night	4.12 (2.30 to 7.40)	4.06 (1.78 to 9.23)	4.36 (1.59 to 11.95)
Using dummy	0.59 (0.42 to 0.84)	0.44 (0.27 to 0.70)	0.38 (0.21 to 0.70)
Using duvet	2.82 (1.95 to 4.08)	1.88 (1.14 to 3.12)	1.72 (0.90 to 3.30)
Loose bed covering	1.92 (1.35 to 2.73)	1.25 (0.79 to 1.99)	1.07 (0.61 to 1.89)

\*All variables are for last or reference sleep except for breast feeding.

† Controlled for all sleeping environment factors listed in table.

‡ Controlled for maternal age, parity, gestation, birth weight, whether family received family income supplement, exposure to tobacco smoke, and factors in sleeping environment that remain significant.

§ Fisher's exact test, hence odds ratio not given.

significance, however, we need to look at their relation to each other and to control for other significant risk factors. Table 4 shows how the significance of the variables associated with the sleeping environment changes when they are put in the multivariate model with each other and how it changes further when we control for other significant risk factors.

The risk associated with prone sleeping, side sleeping, and covering of the head by bedding and the protective effect of using a dummy remained significant when we controlled for other factors. Bed sharing also remained significant, but a subgroup analysis showed that the associated risk was significant only among smokers (multivariate odds ratio 9.25; 2.51 to 34.02) rather than non-smokers (2.27; 0.41 to 12.54). The risks associated with heating and using a duvet were significant among the factors associated with the sleeping environment but just failed to reach significance when we controlled for other risk factors. No protective effect of breast feeding was identifiable when we controlled for all other factors.

## Discussion

The results of this, the first large scale case-control study of the sudden infant death syndrome after the national risk reduction campaign, demonstrate the effects of the changes introduced and shed new light on the aetiology and epidemiology of the syndrome.

### SLEEPING POSITION AND BED SHARING

The significance of the prone sleeping position as a risk factor for the syndrome has been confirmed. A new finding is that the side sleeping position, previously recommended as a safer alternative to prone sleeping, is itself associated with a significantly increased risk of death when compared with supine. This added risk seems to result mainly from the tendency of babies placed on their sides to roll prone and was not influenced by the position of the infant's arm. The higher prevalence of side sleeping than prone sleeping in the present population means that the population attributable risk from side sleeping (18.4%) is higher than that of prone sleeping (14.2%) despite a much lower odds ratio.<sup>15</sup>

Interpretation of the effects of bed sharing on the risk of death is complicated by the interactions with several other factors. Mothers who habitually take their babies into bed with them are not homogeneous but come from disparate ethnic, social, and cultural groups with very different approaches to child care, breast feeding, smoking, and alcohol misuse. The data confirm the conclusion of the New Zealand study<sup>17</sup> that there is a significant risk from bed sharing if the parents smoke and support a previous suggestion (not borne out in the New Zealand study) that bed sharing is a risk if the mother has recently consumed alcohol.<sup>18</sup> There is no suggestion that taking the baby into bed for a short time for feeding or for comfort poses any risk—except that the mother may then fall asleep and keep the baby in her bed all night long.

### THERMAL ENVIRONMENT

Thermal stress emerges in the present study as a smaller independent risk factor for the syndrome than previously reported.<sup>2</sup> This might be expected from the known interaction between heavy wrapping and prone sleeping, the prevalence of which has sharply declined. It is postulated that the interaction may arise from a reduction in heat loss from the face of a baby lying prone.<sup>19</sup>

In the present study most babies slept supine or on their sides so that adverse effects of heavy wrapping would be less likely, unless the head became totally covered and heat loss from both face and scalp was prevented. Total covering by the bedding emerged from the multivariate analysis

## Key messages

- Despite the success of the "Back to Sleep" campaign, the sudden infant death syndrome remains a major cause of death in infancy
- This large case-control study is the first after the national campaign to reduce the risk of the syndrome
- The risk of sudden infant death is increased by prone or side sleeping position; loose bedding (particularly duvets), which can slip over the baby's head; and bed sharing by mothers who smoke
- The risk may be reduced by supine sleeping position; placing the baby with feet at the foot of the cot ("feet to foot"); ensuring that bedding is securely tucked in; and avoiding the use of duvets

as the most potent of all risk factors. The fact that babies who died had been previously found totally covered more often than the controls suggests that the way the bedding is usually arranged might be partly responsible. This lends support to the recent "Feet to Foot" initiative from the Foundation for the Study of Infant Deaths, which advocates that a baby's bedding should be made up so that the baby's feet are at the foot of the cot and risk of slipping beneath the covers is reduced. Our finding that very few mothers, index or control, practised this technique during the study, which preceded the initiative, suggests that there is a large potential for change. Duvets or quilts were associated with added risk both in themselves and through their propensity to total covering; this reinforces the advice that the use of duvets or quilts should be strongly discouraged for infants under 1 year.

### BREAST FEEDING AND DUMMY USE

As in the Avon study,<sup>5</sup> no independent protective effect was identified from breast feeding when we controlled for other significant factors. In the univariate analysis the lack of any "dose-response" effect from breast feeding suggests that it is acting as a marker of the lifestyle of mothers who breast feed rather than showing a biological effect in itself. The loss of significance when account is taken either of smoking or of socioeconomic status supports this interpretation, as does the very small protective effect among the infants of non-smoking mothers. There are of course other good reasons to continue recommending breast feeding.

The apparent protective effect of a dummy is in agreement with the observation in New Zealand,<sup>3</sup> but in that study a high proportion of infants were sleeping prone. Dummy use is more common in the more socioeconomically deprived groups in the United Kingdom and is the only factor over-represented in these groups that is associated with a significantly reduced risk of the syndrome. It is not clear whether use of a dummy is a marker of a particular pattern of infant care in this group. These findings should not be used to claim that dummies prevent cot death, but it may not be appropriate for health care professionals routinely to discourage the use of dummies in young infants. Further research is needed to identify any adverse effects of dummy use, in particular the reported adverse effects on breast feeding.<sup>20</sup>

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## Smoking and the sudden infant death syndrome: results from 1993-5 case-control study for confidential inquiry into stillbirths and deaths in infancy

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### Abstract

**Objective**—To investigate the effects of exposure to tobacco smoke and of parental consumption of alcohol and illegal drugs as risk factors for the sudden infant death syndrome after a national risk reduction campaign which included advice on prenatal and postnatal avoidance of tobacco smoke.

**Design**—Two year population based case-control study. Parental interviews were conducted for each infant who died and four controls matched for age and date of interview.

**Setting**—Three regions in England with a total population of 17 million people.

**Subjects**—195 babies who died and 780 matched controls.

**Results**—More index than control mothers (62.6% v 25.1%) smoked during pregnancy (multivariate odds ratio<sub>1</sub> = 2.10; 95% confidence interval 1.24 to 3.54). Paternal smoking had an additional independent effect when other factors were controlled for (2.50; 1.48 to 4.22). The risk of death rose with increasing postnatal exposure to tobacco smoke, which had an additive effect among those also exposed to maternal smoking during pregnancy (2.93; 1.56 to 5.48). The population attributable risk was over 61%, which implies that the numbers of deaths from the syndrome could be reduced by almost two third if parents did not smoke. Alcohol use was higher among index than control mothers but was strongly correlated with smoking and on multivariate analysis was not found to have any additional independent effect. Illegal drug use was more common among the index parents, and paternal use of illegal drugs remained significant in the multivariate model (4.68; 1.56 to 14.05).

**Conclusions**—This study confirms the increased risk of the sudden infant death syndrome

associated with maternal smoking during pregnancy and shows evidence that household exposure to tobacco smoke has an independent additive effect. Parental drug misuse has an additional small but significant effect.

### Introduction

Although the incidence of sudden unexpected deaths in infancy in the United Kingdom has fallen, especially since the "Back to Sleep" campaign in 1991, such deaths remain the largest single group of deaths of infants between 1 week and 1 year old.<sup>1</sup> The study of sudden unexpected deaths in infancy (part of the national confidential inquiry into stillbirths and deaths in infancy (CESDI), funded by the Department of Health) conducted a detailed case-control study and confidential inquiry of all sudden unexpected deaths in infancy in the participating regions of the United Kingdom in the two year period one year after the national intervention campaign. A summary of the preliminary results of this study has been published.<sup>2</sup>

Several case-control studies have shown an association between the risk of maternal smoking during pregnancy and the sudden infant death syndrome.<sup>3-13</sup> A recent meta-analysis of these studies, including cohort and smaller case-control studies, estimate a pooled relative risk (adjusted for prone sleeping position) of 2.99 (95% confidence interval 2.79 to 3.19) for maternal smoking during pregnancy.<sup>12</sup> Many of these studies, however, were conducted before the recent decreases in the incidence of such deaths which followed risk reduction campaigns in several countries.

Several studies have shown evidence of increasing risk of the syndrome with increasing exposure to tobacco smoke within the household.<sup>6 13-15</sup> We investigated the risk of the sudden infant death syndrome associated with exposure to tobacco smoke after the

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