

ETS AND SUDDEN INFANT DEATH SYNDROME

Sudden infant death syndrome (SIDS) is currently defined as the sudden death of an infant that remains unexplained by clinical or necropsy evidence¹. It is the most common single cause of death in the postneonatal period (1-12 months) in most developed countries¹. Following advice not to put babies to sleep in the prone position, SIDS deaths have reduced substantially in several countries, including the UK, Ireland, US, New Zealand, Australia, Scandinavia and the Netherlands²⁻⁷. In the UK the incidence fell by 70% from 2.2/1000 in 1987 to 0.7/1000 in 1992⁷.

Epidemiological studies have identified a large number of factors to be associated with SIDS^{1,8}. Apart from the prone sleeping position, these factors include use of soft mattresses, overheating, head covering, season, having had a recent illness (not only respiratory, but also gastro-intestinal), low birthweight, premature birth, not being immunised, being male, central nervous system abnormalities, lack of breast-feeding, sharing a bed with the parents, intrauterine growth retardation, illicit drug use by the mother during pregnancy, young age of the mother, no pre-natal care, size of family, race, the mother's education and socio-economic status and male sex of the child.

Although it is claimed that exposure of infants to ETS is associated with SIDS, there are many difficulties in interpreting the epidemiological data. Studies have compared the incidence of SIDS among infants exposed to ETS by a parent who smokes after the birth with the incidence among infants not so exposed.

Fifteen studies on SIDS and ETS exposure from smoking by the mother after pregnancy have been published⁹⁻²³, of which 14 have reported a statistically increased risk of SIDS among the exposed infants (Table 1). Seven of these studies^{9,15,16,19-21,23} also reported evidence of a dose-response relationship (data not shown).

Fifteen studies on SIDS and smoking by the father have been published^{9-11,13,15,16,18-21,23-27} (Table 2). Nine of these studies^{10,15,16,18-21,26,27} report a statistically significant increased risk of SIDS among the exposed infants.

There are also six studies that have investigated the relationship between ETS and smoking by other members of the household (data not shown). Three of these reported a significant unadjusted but not adjusted relationship^{15,18,21}, one reported a significant adjusted association in Whites but not Blacks¹⁴, one reported significant adjusted associations using various indices¹⁶, and one reported no significant association¹⁷.

There have been a number of recent reviews of the association between SIDS and parental smoking^{1,8,20,28}. When attempting to interpret the results relating to ETS exposure it is important to bear in mind the following points:

- Some of the studies^{10,11,13,25} reporting an association between SIDS and ETS exposure have not adjusted for any other risk factors, while many others^{9,12,14,16,17,21,23,26,27} have only taken a few of them into account.
- Four studies^{15,18-20} have taken into account quite an extensive list of potential confounding variables in at least some of their analyses. In two studies^{15,20}, such adjustment explained about 80% of the increased risk of SIDS associated with maternal smoking after pregnancy, and in a third study¹⁹ it explained about 50%. In the fourth study¹⁸, adjusted results were not reported for maternal smoking after pregnancy, but adjustment markedly reduced the relative risk associated with maternal smoking in pregnancy, from 4.84 to 1.78. Since such adjustments will inevitably be incomplete - partly because not all such factors will have been considered, and partly because data errors or use of surrogate variables limit the ability to control for confounding - it is not implausible that all of the claimed SIDS/ETS association could in fact be explained by confounding.
- In a recent study²⁹, infants with prolongation of the QT interval, as measured by electrocardiograph shortly after birth, had a more than 40-fold increased risk of SIDS. This abnormality, seen in 50% of the infants dying of SIDS, is a major risk factor that could not have been caused by postnatal ETS exposure and which has not been taken account of in any of the epidemiological studies of ETS and SIDS.

- Even if the association between parental smoking and SIDS cannot fully be explained by uncontrolled confounding by other risk factors, it may result, not from ETS exposure but from an effect of maternal smoking in pregnancy. Some studies have found that the association of SIDS with postnatal maternal smoking or paternal smoking has been reduced^{15,16,20} or even eliminated²¹ if adjustment is made for maternal smoking in pregnancy or if attention is restricted to nonsmoking mothers, though others have not^{14,19}.

Little is known about the cause or causes of SIDS, or the mechanisms by which such causes may act. The epidemiological data are difficult to interpret. It is concluded that the scientific evidence, considered as a whole, does not demonstrate that exposure to ETS is a cause of SIDS.

ETS AND SIDS**THE DATA**

The tables that follow summarize the key evidence on SIDS and ETS, as indexed by maternal smoking after pregnancy (Table 1) and paternal smoking (Table 2). The tables show, for each successive study providing data, relative risks (RRs) and 95% confidence intervals (CIs), unadjusted and adjusted for the factors listed. The tables are adapted and extended from tables presented by Thornton and Lee⁸, and include all the relevant studies considered in recent reviews^{1,20,28}

Table 1 - Maternal smoking after pregnancy and SIDS

Ref	Author	Year	Unadjusted RR (95% CI)	Adjusted RR (5% CI)	Adjustment factors
9	Bergman	1976	2.42(1.22-4.82) ¹	2.38(1.17-4.83) 2.05(1.00-4.24)	MA ED
10	Cameron	1986	4.04(2.63-6.20) ^{1,2}	-	-
11	McGlashan	1989	1.92(1.26-2.92) ¹	-	-
12	Dwyer I	1991	3.13(1.06-9.26)	Not significant	MA
13	Engelberts	1991	1.47(0.97-2.23) ¹	-	-
14	Schoendorf	1992			
	(i) after or during pregnancy				
	- Black		2.77(2.08-3.70) ^{1,5}	2.78(2.12-3.64)	ED,MA,MS,MSA,MSP
	- White		3.65(2.27-4.81)	2.66(2.04-3.48)	As above
	(ii) after pregnancy only				
	- Black		2.40(1.49-3.83) ⁵	2.33(1.48-3.67)	As above
	- White		2.22(1.29-3.78)	1.75(1.04-2.93)	As above
15	Mitchell I	1993			
	- any		4.24(3.39-5.31) ³	1.70(1.21-2.37)	A,AN,BF,BS,BW,CAN, GA,MA,MAP,MS,P,R, REG,S,SA,SE,SES,SL, TD
	- in house		2.20(1.38-3.51) ⁴	-	-
	- never in house		5.07(1.50-15.41)	-	-
16	Klonoff-Cohen	1995			
	- any		3.13(1.75-5.60)	2.28(1.04-4.98)	AN,BF,BW,MC,MSP,SL
	- same room		6.17(2.60-14.61)	4.62(1.82-11.77)	
17	Ponsonby	1995	3.96(1.91-8.24)	3.82(1.43-10.2) 2.39(1.01-6.00)	BH,FAS,MA,SL, VIS EMP,FAS,MA,SL
18	Blair	1996	5.19(3.57-7.55)	-	-
19	Brooke	1997	5.91(3.61-9.68)	4.01(2.19-7.33) ¹	BF,BW,CBP,DEP,DRG, ED,GA,MA,MS,MTO, OID,P,S,SES,SL,SPR, SS,SWD,SYM,TOG
20	Mitchell II	1997			
	- after birth		6.56(4.32-9.95) ¹	6.26(4.07-9.63) ¹ 2.36(1.27-4.37) ¹	BS BF,BS,BW,MA,MS, P,R,S,SA,SL
	- 2 months after birth		5.85(3.37-10.2) ¹	5.42(3.10-9.47) ¹ 1.73(0.75-3.95) ¹	BS BF,BS,BW,MA,MS, P,R,S,SA,SL
21	Alm	1998	3.8(2.8-5.3)	3.7(2.5-5.5)	A,ED,MA
22	Kohlendorfer	1998			
	- early SIDS		1.9(0.9-4.0)	Not significant	AN,BW,FID,GA,MA, NS,RAE,SL
	- late SIDS		1.0(0.5-1.8)	Not significant	As above
23	Dwyer II	1999	3.38(1.58-7.23)	2.20(0.67-7.23) ¹	MSP

¹ Estimated from data given² Women smoking 20 or more cigarettes per day³ Data came from reference³⁰. An alternative reference³¹ gave an unadjusted estimate of 4.24 (3.33-5.40) and an estimate of 1.79 (1.30-2.48), adjusted for a similar list of factors but including INT and MP and excluding CAN⁴ Data came from reference³²⁵ Relative risk compared to mothers smoking neither during pregnancy nor after infant's birth

Key to adjustment factors:

A = Postnatal age	AN = Antenatal classes	BF = Breast feeding
BH = Bedroom heating	BS = Bed sharing	BW = Birthweight
CAN = Cannabis use by mother since birth	CBP = Cot bumper used	DEP = Deprivation
DRG = Drug treatment	ED = Education	EMP = Employment status
FAS = Family history of asthma	FID = Family history of infant death	GA = Gestational age
HY = Hypothermia	INT = Neonatal intensive care unit admission	
MA = Maternal age	MAP = Mother's age at first pregnancy	
MC = Medical conditions at birth	MP = Months pregnant mother started attending antenatal class	
MS = Marital status	MSA = Maternal postnatal smoking	MSP = Maternal smoking in pregnancy
MTO = Old mattress used	NS = Night sweating	OID = Other infant death
P = Parity	PS = Paternal smoking	R = Race
RAE = Repeated apnea episodes	REG = Region	S = Sex
SA = School leaving age	SE = Season	SES = Socio-economic status
SL = Sleep position	SPR = Sleeps with parents	SS = Sweating during sleep
SWD = Usually swaddled	SYM = Symptoms	TD = Time of day
TOG = Tog value	VIS = Visits to health clinic	

Table 2 - Paternal smoking and SIDS

Ref	Author	Year	Unadjusted RR (95% CI)	Adjusted RR (5% CI)	Adjustment factors
9	Bergman	1976	1.53(0.78-3.01) ¹	-	-
24	Lewak	1979	No association	-	-
10	Cameron	1986	1.85(1.32-2.60) ¹	-	-
25	Lee	1989	3.57(0.98-13.0)	-	-
11	McGlashan	1989	1.73 [p=0.05]	-	-
13	Engelberts	1991	-	-	-
	- during pregnancy		1.02(0.68-1.55) ¹		
	- after birth		0.96(0.63-1.45) ¹		
26	Nicholl	1992	1.99(1.38-2.86)	1.63(1.11-2.40)	BW,MA,P,SRA
27	Gilbert	1993	2.78(1.59-4.87) ¹	2.43(1.32-4.48) ¹	SES
15	Mitchell I	1993	2.41(1.92-3.02)	1.37(1.02-1.84)	A,BF,BS,BW,MA,MS, R,REG,S,SE,SES,SL,TD
16	Klonoff-Cohen	1995	-	-	-
	- during pregnancy (around mother)		3.56(2.11-6.00)	-	-
	- after birth		3.53(1.99-6.27)	3.46(1.91-6.28)	AN,BF,BW,MC,MSP, SL
	- after birth, in same room		9.20(3.66-23.15)	8.49(3.33-21.63)	As above
18	Blair	1996	3.04(2.13-4.36)	2.50(1.48-4.22)	AL,BF,BS,BW,DU,GA, M,MA,MS,P,SES,SL,TB
19	Brooke	1997	2.40(1.57-3.65) ¹	1.85(1.08-3.18) ¹	BF,BW,CBP,DEP,DRG, ED,GA,MA,MS,MTO, OID,P,S,SES,SL,SPR, SS,SWD,SYM,TOG
20	Mitchell II	1997	-	-	-
	- after birth		3.84(2.54-5.80) ¹	-	-
	- 2 months after birth		3.21(1.87-5.52) ¹	-	-
	- time not stated		-	2.1(1.3-3.4) ¹	MSA
21	Alm	1998	-	-	-
	- before pregnancy		1.6(1.2-2.1)	0.8(0.5-1.2)	A,ED,MA,MSP
	- during pregnancy		1.7(0.3-2.3)	0.9(0.6-1.4)	
	- after pregnancy		2.0(1.5-2.8)	1.2(0.8-1.9)	
23	Dwyer II ²	1999	1.10(0.56-2.16)	-	-

¹ Estimated from data given

² Smoking postnatally by any household resident than the mother

Key to adjustment factors:

A = Postnatal age

BF = Breast feeding

CBP = Cot bumper used

DU = Use of illegal drugs

M = Matching factors

MS = Marital status

MTO = Old mattress used

R = Race

SE = Season

SPR = Sleeps with parents

SWD = Usually swaddled

TD = Time of day

AL = Maternal alcohol consumption

BS = Bed sharing

DEP = Deprivation

ED = Education

MA = Maternal Age

MSA = Maternal postnatal smoking

OID = Other infant death

REG = Region

SES = Socio-economic status

SRA = State of major accommodation

SYM = Symptoms

TOG = Tog value

AN = Antenatal classes

BW = Birthweight

DRG = Drug treatment

GA = Gestational age

MC = Medical conditions at birth

MSP = Maternal smoking in pregnancy

P = Parity

S = Sex

SL = Sleep position

SS = Sweating during sleep

TB = Type of birth

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