

SPECIAL REPORT

Cot Death—Cause and Prevention Experiences in New Zealand 1995–2004

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Abstract

There is a general perception that the cause of cot death remains unknown. This is not so. The cause of cot death (often erroneously termed Sudden Infant Death Syndrome or SIDS) has been elucidated as being due to extremely toxic 'nerve' gases generated by fungal activity on chemicals frequently present in cot mattresses and in certain other bedding commonly used in baby bedding. However, this explanation, often referred to in Britain as 'the Richardson Hypothesis', has aroused considerable controversy, especially among individuals and organizations closely associated with cot death. Interventions based on this explanation have been widely advocated in two countries: first in Britain (1989 and 1994) and far more intensively in New Zealand through a nationwide public information programme from late 1994 continuously to the present. Both interventions were followed by significant reductions in cot death, especially the 10-year 'mattress-wrapping' programme in New Zealand. Mattress-wrapping (a logical intervention based on the toxic gas explanation) is an obvious corollary to that explanation. If this intervention method is successful in preventing cot death, that outcome provides very strong proof of the validity of the explanation. And this has been the outcome—during the 10-year intervention period in NZ there has never been a report of a cot death when the baby has been sleeping on a mattress wrapped in accordance with the simple protocol based on the explanation, and the NZ cot death rate has fallen markedly. Given the close examination of all cot deaths in New Zealand (about 650 from 1995 to the present) nil reported deaths on wrapped mattresses effectively means that there have been no such deaths. The apparently total success of the intervention, and the reduction in cot deaths, provide a standard of proof of the toxic gas explanation which nullifies the opposition of those who would deny it. The success of mattress-wrapping for the prevention of cot death is such that it behoves all people and organizations who provide advice to parents about cot death prevention to inform parents of the NZ experience using this technique.

Keywords: cot death, SIDS, mattress-wrapping.

TERMINOLOGY

In this text the term 'cot' is synonymous with 'crib'. The term Sudden Infant Death Syndrome, and its acronym SIDS to describe cot death, have become widely used; however, the term is a misnomer. The term syndrome is defined in *the New Oxford Dictionary* as:

“Concurrence of several symptoms in a disease; set of concurrent symptoms characterizing it.”

But there are no observable or described symptoms of cot death—the only commonality is death itself. Therefore, the term SIDS is incorrect and should be abandoned. It is highly

misleading, and has added greatly to the confusion which surrounds this topic because it perpetuates the incorrect assumption that cot death has a medical cause.

THE CAUSE OF COT DEATH

There is a general perception that the cause of cot death remains unknown. This is not so. The cause was first suggested, in principle, by the writer (T.J. Sprott) who postulated in 1986 [1] that cot death was caused by accidental poisoning, the poisons being one or more gases generated by microbiological activity on chemicals in the baby's cot; and that the gases, more dense than air, caused death by interfering with the baby's nerve function, thus causing breathing and then heart function to cease. However, I was unable to identify the gas/es or the chemicals from which they were derived.

In 1989 B.A. Richardson of Britain [2] independently came to the same conclusion, but in addition was able to identify the gases as the hydrides and/or lower alkyl derivatives of phosphorus (P), arsenic (As) and antimony (Sb). He also identified a common fungus, *Scopulariopsis brevicaulis*, as being probably the principal organism with that capability to be found in babies' mattresses and other bedding. In a lengthy series of elegant tests he demonstrated the generation of these gases from cot mattresses on which cot deaths had occurred, and confirmed the identity of the organism responsible for the gas generation. Richardson also noticed that the incidence of cot death seemed to be much higher when babies were sleeping on previously used mattresses, compared with the incidence of death on new mattresses.

In June 1989 Richardson advised parents in the UK to protect their babies from cot death either by providing a new mattress for each baby, or by covering their babies' mattresses with an inert gas-impermeable diaphragm (polythene sheeting). This advice was given nation-wide coverage. Immediately following this announcement sales of new cot mattresses in Britain rose by 15% [3]. It is not known how many parents adopted the advice to cover mattresses with polythene.

Having risen steadily for the previous 30 years, the British cot death rate immediately began to fall and by November 1991 (the date of commencement of the 'Back-to-Sleep' promotion) the UK cot death rate had fallen by 38%. The only feasible explanation for this immediate and significant reduction in cot death was the adoption by British parents of Richardson's advice. A subsequent claim by the UK Foundation for the Study of Infant Death that this reduction was due to face-up sleeping is incorrect—the Back-to-Sleep programme in Britain was not introduced until 1 December 1991, 30 months after publication of Richardson's advice to parents. The British cot death rate then fell more sharply, but levelled off in 1994, the overall reduction since June 1989 being 73% [4].

Controversy about the validity or otherwise of 'the Richardson Hypothesis' (as it was known) became intense, and that controversy continues to the present time both in Britain and in other countries, New Zealand included. Various researchers became interested in Richardson's explanation of the cause of cot death and embarked on tests to replicate Richardson's findings, some with no success, but others with some success. UK government-sponsored research was also carried out, again with variable results, and in 1997 the so-called Limerick Report was published [5]. This report stated in effect that the Richardson Hypothesis was invalid.

THE NEW ZEALAND INTERVENTION

By late 1994 I had realized that for the validity or otherwise of the toxic gas explanation for cot death to be determined, one way or the other, further laboratory-type research was futile. The success in cot death prevention, clearly arising from Richardson's initial advice,

was self-evident and in order to reduce the very high cot death rate in New Zealand (2.1/1000 live births in 1994) I decided to promote a cot death prevention public awareness programme based on the toxic gas explanation. I adopted Richardson's method of a gas-impermeable diaphragm over the cot mattress, together with the use of bedding known to be free of P, As and Sb.

Various local factors made NZ an ideal country in which to carry out a programme of this nature:

- A relatively small population, about 4 million
- Excellent nation-wide communications available through a very small number of media outlets
- A high incidence of cot death
- A highly developed system of reporting of cot death
- Individual examination of every cot death
- Official compilation of numbers of cot deaths by ethnicity covering the three main ethnic groups: Maori, Pacific Islands, other (see definitions below).

The term 'mattress-wrapping' was coined for this programme, and I drew up a protocol designed:

- (a) to protect babies from any gases generated from mattresses by means of a polythene wrap; and
- (b) to ensure that bedding used over the 'wrapped' mattress did not contain any phosphorus, arsenic and antimony.

This protocol (detailed below) was widely publicized throughout NZ and this publicity has continued (in various forms) to the present time. In 1996 I designed a range of ready-made slip-on, sealable cot mattress covers made of a selected grade of polythene, and these products, known as '*BabeSafe*' covers, have been marketed nation-wide in New Zealand ever since. I also published a book on the topic [6], and circulated nation-wide, and on a continuing basis, a very large number of free booklets written for parents, midwives and other baby care professionals [7]. I also published a series of brochures [8] which were mailed individually to all known midwives and baby care organizations in NZ.

Mattress-wrapping, and then *BabeSafe* covers, were quickly adopted by many parents in NZ, and their use is now commonplace throughout the country, especially among the major ethnic group known as 'Pakeha' (Pakeha is a Maori word meaning non-Maori, referred to in official cot death statistics as 'Other'). Essentially Pakeha are of European descent, predominantly British, with a small proportion of Asiatics. Pakeha comprise about 80% of the NZ population. Maori (the indigenous ethnic group) constitute about 17%, the remainder being mostly Polynesian people from islands in the South Pacific—Samoa, Cook Islands, Tonga, etc.

As stated above, a particular feature in NZ is that official cot death statistics are kept on the basis of these three major ethnic groups [9]. The individual statistics greatly facilitate research and determining trends in the three ethnic groups. It is known that Pakeha parents have tended to adopt mattress-wrapping to a greater extent than the other ethnic groups [10]. For various communication and cultural reasons [11] it appears that Maori parents have not adopted the technique as readily; and furthermore bed-sharing between parents and babies is much more common among Maori than among Pakeha. (Mattress-wrapping is not applicable to adult beds and I advise strongly against parents bed-sharing with babies. The higher incidence of cot death in bed-sharing situations has been reported by several observers.)

OUTCOME OF MATTRESS-WRAPPING PROGRAMME

The outcome of 10 years of mattress-wrapping is impressive and it can be gauged from Table 1. An additional and vitally important factor is that during the period of mattress-wrapping, no cot death has been reported when a baby has been sleeping on a mattress wrapped according to the protocol (see below).

By contrast, at the time of writing, about 650 cot deaths have occurred in NZ during the same period. Given the close scrutiny of cot deaths by various organizations in NZ, it can be stated with confidence that not one of these deaths occurred on a mattress wrapped according to the protocol.

Face-up sleeping was introduced in NZ in 1989 and by 1993 fewer than 5% of babies were sleeping face down [12]. The above reductions occurred after the benefits of face-up sleeping had been recognized (about 45% reduction), and the NZ cot death rate had remained static at 2.1/1000 live births for three years.

PROOF OF TOXIC GAS EXPLANATION FOR COT DEATH

'Mattress-wrapping' for cot death prevention is an obvious corollary to the toxic gas explanation for cot death, in that—if the explanation is correct—it is the obvious solution to cot death. Put another way, if the explanation is valid then protecting babies against any gas generation in their cots should prevent cot death. Given the extremely high (apparently total) success of mattress-wrapping in preventing cot death, it is therefore suggested that this constitutes very strong evidence of the validity of the toxic gas explanation for cot death. This type of proof of a proposition (testing of a corollary) is commonly adopted when it is difficult or impossible to test a proposition directly, and its use in this instance is equally valid in respect of cot death prevention.

Kapuste *et al* [13] published a statistical analysis of the results of the New Zealand mattress-wrapping campaign and found that the 'p' factor for the mattress-wrapping intervention was $p = \text{less than } 1.9 \times 10^{-22}$. Since it is usual in medical circles to regard a 'p' of less than 0.01 (10^{-2}) as sound proof of a scientific proposition; and p less than 0.001 (10^{-3}) as virtually certain proof, p of 1.9×10^{-22} constitutes undeniable proof of the proposition.

Certainly the level of proof is such that information on the mattress-wrapping

TABLE 1. New Zealand cot death statistics 1994–2002

% New Zealand population	Cot Deaths per 1000 Live births			NZ rate
	Maori ~ 17%	Pacific Island ~ 3%	Other (Pakeha) ~ 80%	
Mattress-wrapping programme commenced December 1994				
1994	6.90	N/A	1.40	2.10
1995	4.94	2.11	1.14	2.10
1996	5.68	1.80	0.65	1.90
1997	4.56	0.81	0.52	1.46
1998	3.05	0.66	0.68	1.21
1999	3.40	0.77	0.40	1.12
2000	3.41	1.08	0.35	1.11
2001	2.87	0.31	0.41	0.95
2002	2.90	0.95	0.28	0.93
2003	No data available from NZ Health Information Service			
Reductions	58%	55%	80%	56%

protocol—and the outcomes—should be provided to all parents where cot death is a problem by appropriate government departments, baby care organizations and professionals who offer advice on cot death prevention to parents, and to individuals responsible for the care of babies within the cot death risk age. The oft-repeated claim by Dr Peter Fleming that the UK CESDI Study found that three babies had died on mattresses wrapped in polythene is not substantiated, as Fleming conceded in February 2000 when he was being interviewed on New Zealand national radio [14].

BabeSafe mattress covers have now been supplied to parents in about 30 countries including the UK, with no reports of cot death on wrapped mattresses. The numbers of covers supplied overseas is not great; however, acceptance of this technique is steadily increasing despite continued and unexplained opposition from various SIDS and related organizations in Australia, Canada, the UK and the USA.

CONTROLS

It has been suggested that during the 10 years of mattress-wrapping there have been no ‘controls’ whereby a comparison can be made between those babies who slept on wrapped mattresses and those who did not. This suggestion is not valid. The mattress-wrapping programme has been widely publicized throughout New Zealand since December 1994, and since that time there have always been two groups of babies: those who slept on mattresses wrapped according to the protocol, and those who did not. The latter can be looked upon as ‘controls’. And all cot deaths during the period occurred among the ‘controls’.

APPLICATION TO KNOWN EPIDEMIOLOGY OF COT DEATH

The toxic gas explanation for cot death also provides valid scientific explanations for the various so-called ‘risk factors’ which have been identified by means of epidemiology. For example:

- The known benefit of face-up sleeping comes about because the baby’s mouth and nose are removed from the mattress and bedding where gas generation occurs. (Face-up sleeping is unnecessary on wrapped mattresses, and thus avoids the risk of head-flattening.)
- The same explanation applies to the finding that a baby sleeping with a ‘dummy’ or ‘pacifier’ in the mouth is less likely to succumb to cot death—a baby with a dummy in its mouth cannot sleep directly face down.
- The link between smoking and cot death is simply a socio-economic parallel; it is well known that the incidence of smoking rises as socio-economic status reduces; and (for economic reasons) the re-use of mattresses also rises as socio-economic status reduces. It is highly significant that no ‘cause-and-effect’ relationship between smoking and cot death has been established or even suggested.
- It has been observed that face-up sleeping programmes in various countries have all brought about a reduction in cot death, but that the extent of the reduction is only partial, usually in the range 45–50%. Then the cot death rate levels off. This is explained by the fact that the gases readily diffuse through the baby’s skin into the bloodstream, a process which is unaffected by sleeping position.
- The observation that over-heating causes cot death was explained by Richardson who found that the rate of gas generation by the fungus is highly temperature-dependent, an increase in temperature of 3°C resulting in a 10–20 fold increase in the rate of generation; hence the increase in cot death if babies are over-heated.
- The link between cot death and vaccination is explained on the same basis. Vaccination usually results in a slight fever, with—on a mattress capable of generating one or more of the gases—a consequent increase in gas generation due to a rise in temperature.

- This explanation also accounts for the frequent observation that cot death babies often had a cold or fever prior to death.
- Of prime importance is the explanation provided by the toxic gas explanation for the known rise in cot death with sib-ship (Figure 1) [15]. This data also refutes all theories for the cause of cot death based on medical or physiological disorders. The only valid explanation for the increased incidence of cot death with sib-ship is the re-use of mattresses.

The data in this graph repeat year after year, and are typical of data from other countries where cot death occurs. The graph destroys all propositions for the cause of cot death relating to babies themselves (genes, illness, vaccination, smoking by parents, physiological deficiencies etc). It forms part of the extensive proof that poisoning by extremely toxic nerve gases is the single cause of cot death, fully explains, and is completely compatible with, the toxic gas explanation for cot death.

If a mattress (or other bedding) contains any compounds of phosphorus, arsenic or antimony, and if certain household fungi become established in the mattress (or bedding), the gas/es which cause cot death can be generated. And if fungi have become established in the mattress during previous use by another baby, generation of toxic gas commences sooner and in greater volume when the mattress is re-used.

This science accounts for the rising rate of cot death from one sibling to the next. It also accounts for the very high cot death rate among babies of solo parents, who—for economic reasons—are more likely to sleep their babies on previously used mattresses.

CONCLUSION

- (1) The 10-year NZ mattress-wrapping programme provides overwhelming proof of the toxic gas explanation for cot death (the Richardson Hypothesis).
- (2) It provides a cheap, safe and simple means for avoiding cot death.
- (3) All parents and caregivers of babies within the cot death risk age have the right to be fully informed about the NZ mattress-wrapping programme.
- (4) No individuals or organizations in this field have the right to withhold this information.
- (5) Those individuals and organizations who continue to oppose mattress-wrapping for cot death prevention and/or deny the validity of the toxic gas explanation for cot death should be called upon to justify, scientifically, their opposition.

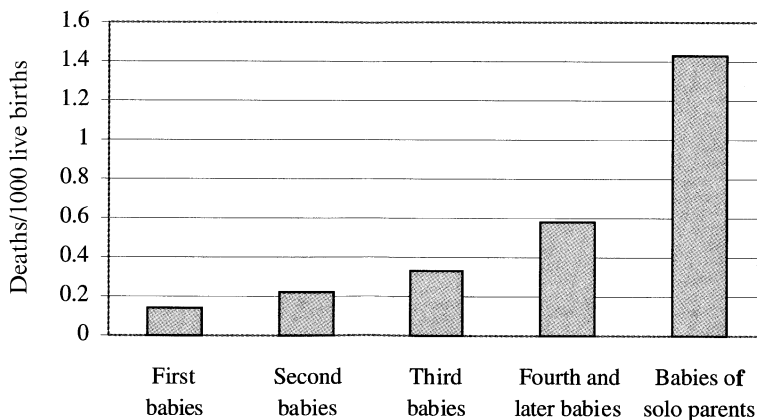


FIG. 1. Cot death rates for first and later babies and babies of solo parents, Britain, 1996–1999.

- (6) Reliance on the findings of the Turner Committee and the Limerick Committee is now not warranted.

PROTOCOL FOR WRAPPING A COT MATTRESS

- (1) Wrap the baby's mattress in a chemically inert, gas-impermeable diaphragm of adequate thickness (minimum 125 micron) made of a material which does not contain detectable amounts of phosphorus, arsenic and antimony. Small ventilation holes should be provided in the underside of the wrap. (A *BabeSafe*[®] cot mattress cover complies with these requirements.)
- (2) Make up the bedding according to the following instructions:
 - (a) On top of the wrapped mattress place a 100% pure cotton underblanket* and tuck this in securely.
 - (b) On top of the underblanket place two cot sheets. (The baby sleeps between these sheets. These sheets may be pure cotton or polyester/cotton mix.)
 - (c) On top of the upper cot sheet place 100% pure woollen or 100% pure cotton overblanket/s.
 - (d) Do not use any of the following items in the baby's cot:
 - Sheepskin
 - Sheepfleece underlay
 - Any form of moisture-resistant crib mattress protector
 - Any underblanket which is not made of pure cotton
 - Acrylic blanket
 - Any blanket containing polyester
 - Any bedding item which is quilted/padded/filled
 - Sleeping bag
 - Duvet
 - Pillows or cushions

*NOTE: This item must not be a so-called 'cotton mattress pad'.
 - (e) The baby must not sleep in any 'clothing' item which is in the form of a bag.

DISCLAIMER

While Sprott invented *BabeSafe* covers, and the covers bear his name, he does not manufacture these products and he declined an offer of a royalty by the manufacturer. Sprott has not received any financial assistance in regard to cot death research.

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APPENDIX

THE CAUSE OF COT DEATH

AND

HOW TO PREVENT IT

A booklet produced by

*Cot Life 2000, a non-profit organization whose
aim is to eliminate cot death*

Cot death (crib death) is caused by gaseous poisoning, the gases being phosphine, arsine and stibine (and/or derivative gases). These toxic gases can be generated from the mattress on which a baby sleeps. The gases are formed by the action of common household fungi (e.g. *Scopulariopsis brevicaulis*) on compounds of (respectively) the elements phosphorus, arsenic and antimony within the mattress.

The cot death risk increases as a mattress is re-used from one baby to the next.

The risk of cot death can be virtually eliminated by ensuring that babies sleep on mattresses known to be free from compounds of phosphorus, arsenic and antimony (and using only certain specified bedding). The **BabeSafe** range of bassinet and cot mattresses complies with this mattress specification.

Any mattress which has not been proved by chemical analysis to be free from phosphorus, arsenic and antimony should be enclosed in a **BabeSafe** slip-on mattress cover.

BabeSafe mattress covers are manufactured in six sizes (one size for bassinet mattresses and five sizes for cot mattresses).

There is no risk of suffocation on a **BabeSafe** mattress or **BabeSafe** mattress cover.

- For instructions on how to wrap a baby's mattress for cot death prevention, see below.
- For instructions on the specified bedding to use on a **BabeSafe** mattress or **BabeSafe** mattress cover, see points 5 and 6 below.

BabeSafe mattresses and mattress covers are sold throughout New Zealand at Baby Factory shops and other retail outlets. **BabeSafe** mattress covers are available in other countries by mail order.

HOW TO WRAP A BABY'S MATTRESS FOR COT DEATH PREVENTION

The advice to wrap mattresses applies to every mattress on which a baby sleeps (except a *BabeSafe* mattress) and includes: portable cot mattresses; pram mattresses; rubber mattresses; and all mattresses made of or containing natural products such as wool, sheepskin, tree bark, kapok, coconut fibre, etc.

To wrap a baby's mattress for cot death prevention, use a *BabeSafe* mattress cover and bedding as specified below.

Instructions for use of a *BabeSafe* mattress cover:

1. Air the mattress well before putting it inside the *BabeSafe* cover. Once the mattress is sealed inside the cover, do not remove it for airing. Airing is provided by the ventilation hole/s on the underside of the cover.
2. Place the mattress inside the *BabeSafe* cover and seal the cover using the adhesive strip.
3. If the cover is larger than the mattress, fold the extra width or length of plastic under the side/s or ends/s of the mattress so that the cover is firm and smooth on the top of the mattress. Then tape the excess plastic on to the cover using strong adhesive tape, taking care not to cover the ventilation hole/s.
4. Place the covered mattress in the bassinet or cot. The ventilation hole/s must be on the *underside* of the mattress.
5. It is imperative to use the correct bedding on top of a *BabeSafe*-wrapped mattress. On top of the wrapped mattress place a pure cotton underblanket. Then make the bed using sheets and pure wool or pure cotton overblanket/s.
6. Do not use any of the following items: sheepskin; sheepfleece underlay; moisture-resistant mattress protector; sleeping bag or 'clothing' bag; any underblanket which is not made of pure cotton; any blanket which contains polyester or acrylic; duvet; pillows or cushions; any bedding item which is quilted or padded or filled.
7. Do not use the *BabeSafe* cover if it is punctured or torn.
8. To clean a *BabeSafe* cover, wipe the cover with pure soap and water, and then dry it with a towel. Do not use chemical bleaches or sterilants.

ABOUT SHEEPSKINS

Sheepskins can contain significant quantities of arsenic. The action of common household fungi on compounds of arsenic can lead to the generation of highly poisonous nerve gases known as arsines. This gas generation resulted in the deaths of many children in Europe during the 1800s. The cause of these deaths was discovered by the Italian chemist Gosio in 1892.

All sheepskins tested by *Cot Life 2000* were shown by chemical analysis to contain significant quantities of arsenic and therefore were capable of generating arsine gas.

At the Sixth SIDS International Conference in February 2000 scientist Dr W R Cullen reported proof of the generation of trimethylarsine (a form of arsine) from sheepskin intended for use as baby bedding.

ABOUT ORTHODOX COT DEATH PREVENTION ADVICE

- Breastfeeding does not prevent cot death.
- Smoking does not cause cot death.
- If a baby is sleeping on an *unwrapped* mattress, face-up sleeping is a partial preventive against cot death. This is because phosphines, arsines and stibines are all more dense than air and diffuse away from a baby's face. However, many babies sleeping face up on

- unwrapped mattresses have died of cot death. (There is no need for a baby to sleep face up if the baby's mattress is wrapped in accordance with the *Cot Life 2000* specifications.)
- Sleeping a baby with feet to the foot of the cot does not prevent cot death. If an unwrapped mattress contains phosphorus, arsenic or antimony, any area on the mattress where the baby sleeps is a potential source of toxic gas, since that is the area which becomes warm and moist (promoting the fungal activity which can cause gas generation).

COT DEATH RATES FOR FIRST AND LATER BABIES AND BABIES OF SOLO PARENTS, BRITAIN, 1996–1999

Figure 1 on page 226 forms part of the extensive proof that gaseous poisoning is the single cause of cot death. These statistics refute every proposition that cot death has a medical or physiological cause.

The more times an unwrapped mattress is used from one baby to the next, the greater is the risk of cot death. This accounts for the higher cot death rate among poorer families, who are more likely to sleep babies on previously used mattresses.

If a mattress contains any of the elements phosphorus, arsenic or antimony, and if certain common household fungi have become established in the mattress during prior use, any generation of toxic gas commences sooner and in greater volume when the mattress is re-used. For this reason, previously used mattresses should be wrapped for cot death prevention.

New mattresses should also be wrapped unless they have been proved by chemical analysis to be free from phosphorus, arsenic and antimony. This is because fungal growth can quickly become established in a new mattress once a baby begins sleeping on it.

SUCCESS OF MATTRESS-WRAPPING FOR COT DEATH PREVENTION

Mattress-wrapping for cot death prevention, which has been publicized nationwide in New Zealand since late 1994, has had a 100% success rate. About 600 cot deaths occurred in New Zealand during the years 1995–2002 inclusive, but there has been no reported cot death among the very large number of babies who have slept on mattresses wrapped to the *Cot Life 2000* specifications.

New Zealand cot death rates have fallen markedly since mattress-wrapping commenced. From 1994 to 2001 the nationwide cot death rate fell by 52%. The reduction in the Pakeha rate over the same period was even greater—about 75%. These major reductions in cot death rates cannot be attributed to the cot death prevention advice publicized by the New Zealand Ministry of Health or the New Zealand Cot Death Association. There has been no material change in that advice since 1992.

Sales information relating to *BabeSafe* products shows that a very large number of New Zealand babies have slept on wrapped mattresses, and also that mattress-wrapping has been enthusiastically adopted by Pakeha parents. The Ministry of Health has confirmed that mattress-wrapping is more prevalent among the Pakeha community than among other ethnic groups. Cot death is now very rare among Pakeha families.

A considerable body of research has been reported which supports the toxic gas theory for cot death (on which mattress-wrapping is based). Contrary to media publicity, the 1998 UK Limerick Report did not disprove the toxic gas theory—as a highly qualified environmental scientist has stated in the *New Zealand Medical Journal*. In fact, the Limerick Committee's analyses proved the fungal generation of toxic gases (forms of stibine and arsine) from cot mattress materials.

Parents, however, are more interested in the practical proof:

Results of analysis of baby bedding

<i>Mfr</i>	<i>New products</i>	<i>Phosphorus</i>	<i>Arsenic</i>	<i>Antimony</i>	<i>No.</i>	<i>Cot death baby bedding</i>	<i>Phosphorus</i>	<i>Arsenic</i>	<i>Antimony</i>
A	Waterproof wool mattress cover	+++	-	-	CD1	Pillow cover	++	-	-
A	Bassinet mattress (polyester inner)	++	-	+++	CD1	Pillow polyester inner	+	-	+++
A	Bassinet mattress (foam inner)	-	-	-	CD2	Mattress cover	+++	-	-
B	Imported PVC cot sheet	+++	-	-	CD2	Mattress foam	++	++	-
C	PVC-lined cotton mattress protector	++	-	-	CD3	Mattress cover	+++	-	-
D	Acrylic underblanket	+	-	-	CD3	Mattress foam	+++	+	-
E	Sheepskin baby rug	+++++	+	++	CD3	Sheepskin rug	+++++	+	+++
F	Lambskin rug	+++++	+	+++	CD4	Mattress cover	+++	-	-
G	Ti-tree bark bassinet mattress	+++	-	-	CD4	Mattress foam	-	-	-
H	Innersprung cot mattress	++	-	-	CD5	Mattress foam	+	-	-
I	Ventilated cot mattress	++	-	++++	CD5	Mattress cover	+++++	-	-
J	Kapok	++++	-	-	CD5	Sheepfleece underlay	+++	-	-
K	Innersprung cot mattress	++++	-	++++	CD5	Sheepskin rug	+++++	+	+++
L	Imported innersprung mattress	+++	-	+	CD5	Wool blanket	++	-	-

<i>No.</i>	<i>Used products</i>	<i>Phosphorus</i>	<i>Arsenic</i>	<i>Antimony</i>
1	Sheepskin baby rug	++++	+	+++
2	Bassinet mattress	++++	-	-
3	Innersprung mattress	+++++	-	-
4	Foam mattress	++++	-	-
5	Foam mattress	+++++	-	-
6	Innersprung mattress	+++++	-	+
7	Coconut fibre	+++++	+	-
8	Foam mattress	++	-	-
9	Reconstituted foam mattress	+++++	-	-
10	Innersprung mattress	++++	-	+
11	Innersprung mattress	++++	-	+
12	Innersprung mattress	+++++	-	+++
13	Innersprung mattress	++++	-	-
14	Innersprung mattress	+++	-	-
15	Innersprung mattress	+++++	-	-

- = not detected (<10mg/kg)
+ = 10-50mg/kg
++ = 51-100mg/kg
+++ = 101-200mg/kg
++++ = 201-500mg/kg
+++++ = 501-1000mg/kg
++++++ = >1000mg/kg

No reported cot deaths on correctly wrapped mattresses.

Question: What is the mechanism of cot death (crib death)?

Answer: The baby's lungs stop breathing (apnoea) and the baby's heart stops beating.

Question: Why do the lungs and heart stop functioning?

Answer: Because the relevant nerve impulses from the brain don't reach the lungs and heart to cause them to function.

Question: Why don't the nerve impulses reach the lungs and heart?

Answer: Because the nerves stop transmitting the impulses.

Question: Why do the nerves stop transmitting the impulses?

Answer: Because of accumulation of acetylcholine in the blood.

Question: Why does acetylcholine accumulate in the blood?

Answer: Because the cholinesterase enzyme is de-activated.

Question: What de-activates the cholinesterase enzyme?

Answer: Anticholinesterase agents.

Question: What are these anticholinesterase agents?

Answer: Nerve gases formed from compounds of phosphorus, arsenic and/or antimony.

Question: Where are the compounds of phosphorus, arsenic and/or antimony?

Answer: In the baby's bedding (along with fungus which converts the compounds into the gases).

Mattress-wrapping in accordance with the *Cot Life 2000* protocol prevents exposure of the baby to the gases.

There have been no reported cot deaths among the very large number of babies who have slept on mattresses wrapped to the *Cot Life 2000* specifications.