

THEIR FIRST 500 SLEEPS

Pēpi-Pod Report: 2012-2014

Describing three years of distribution and use of portable sleep spaces for babies at increased risk of sudden infant death.

Prepared by Stephanie Cowan

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March 2015

Their First Five Hundred Sleeps: Pēpi-Pod Report 2012-2014

Describing three years of distribution and use of portable sleep spaces for babies at increased risk of sudden infant death.

We dedicate this report to those who have provided, gathered and entered the data described here, making it possible to tell the Pēpi-Pod® Story and to learn from it.

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Their First Five Hundred Sleeps: Pēpi-Pod Report 2012-2015

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" I LOVE (commenter's emphasis) the pēpi-pod. At first I didn't want the pēpi-pod when I was offered it in maternity, but my baby was admitted to the Children's Ward with a skin infection when she was a week old. They had a pēpi-pod there that I used for her to sleep in and I really wanted one of my own.

I saw the lactation consultant from maternity who got in contact with the midwife who gives out the pēpi-pods. She came up and saw me the next day and gave me my own pēpi-pod.

In my culture, Tongan, we always sleep with our babies so when my family saw that I had my baby in the pēpi-pod they were a little bit unsure of it, but when I explained it to them and how it is used to keep baby safe when we are all sleeping together, they really liked the idea.

My sister-in-law is due in August and she wants my pēpi-pod for her baby."

Tongan mother of a 7 week old baby

Prepared by:

Stephanie Cowan
Programme Director

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EXECUTIVE SUMMARY

Overview: A child's first five hundred sleeps are more vulnerable than those that follow, but the translation of 'evidence of risk' into 'protected infants' is complex. Since 2000, New Zealand has been frustrated by a slow rate of change to sudden infant death rates. Information technologies, such as advice-giving and print materials, successful in the past, seem less effective, especially with more vulnerable groups, where known risk persist.

While information approaches are important to maintaining past changes, in some situations and communities knowing is not always enough to support the uptake of recommended practices. Also needed, are personalised and enabling strategies for infants at increased risk. The Pēpi-Pod® programme embraces such strategies.

The programme promotes key principles of infant protection through the targeted supply of portable sleep spaces (PSSs) plus personalised education, to families of more vulnerable babies. What began as an emergency response to the Christchurch earthquakes in 2011, is now an integral part of infant health and safety activity in many parts of New Zealand.

This report describes the application of the programme in 13 regions of New Zealand in the three years from 2012 to 2014. It reports the data collected for: the issue of **3961** PSSs to more vulnerable babies, follow-up information for **2915** on acceptability of the approach, and feedback from a survey of **701** PSS users about their experiences.

Main Findings: All but two PSSs were issued to babies with identified risk factors for sudden infant death. PSSs were acceptable to families, most (74%) of whom were Māori and most (72%) of whom already had a baby bed. At follow-up, 80% of recipients had discussed safe infant sleep with a mean 6.2 others, engaging a recorded 14,451 people into conversations about safe infant sleep, and 92% of families wanted to keep their PSS after an initial period of use.

Feedback from a sample of surveyed users identified that 83% received their PSSs before their babies were 4 weeks old. Duration of use fell between 8 and 12 weeks, from 83% to 57%, with 30% of infants still using their PSS from 16 weeks. Same-bed co-sleeping at some stage was common (73%), with babies 'always or usually' also in a PSS (76%).

Overall, surveyed families rated the PSS highly (7-9/9 by 94%), valuing specifically its support with safety (89%), convenience (87%), and settling babies (71%). Most survey babies were breastfed 'yesterday' (74%), and placed for sleep on their backs (87%), with 89% sleeping in a baby bed, and 89% in the same room as a parent, 'last night'. Most babies (89%) were, or were expected to be, sleeping in cots when too big for PSSs.

Infant mortality (7 days-1 year, all causes) fell significantly during the intervention period from 2.4 per 1000 live births in 2011 to 1.9 in 2014, and from 4.5 to 3.5 for Maori.

Conclusion: The Pēpi-Pod® programme was applied consistently and appropriately by distributors, PSSs were acceptable to and used appropriately by recipient families, and safety advice was reflected in snap shots of infant care. Infant death rates (7 days to 1 year, all causes) have fallen during the intervention period, especially for Maori.

"I love how she can see out the sides, how it feels like she's in bed with you, but safe."

RECOMMENDATIONS

The *programme* has been implemented to a high standard in its first three years. These recommendations are made to strengthen the programme and are based on the findings of this report as well as on information from coroners' reports.

1. That participating agencies ensure programme families understand the alarmingly high-risk of death for babies when sharing any sleep surface with a person impaired by alcohol or drugs.
2. That participating agencies promote 'in safe hands' as a protection message for when babies are in the care of others, or need to be because main caregivers expect to be impaired by alcohol or drugs.
3. That participating agencies consider a new role of whānau champion be established within this programme, to project urgency into the need for babies to develop smokefree.
4. That distributors maintain high vigilance for safe positioning of both the PSS and the baby within it, acknowledging back sleeping as the most effective single factor in prevention against sudden infant death.
5. That distributors promote the portable sleep space as a tool for supporting breastfeeding as well as settling and safety.
6. That portable sleep space programmes be appropriately resourced.

INTRODUCTION

Every year, around the anniversary of the Christchurch earthquake of 22 February 2011, we report to participating agencies on the Pēpi-Pod® Sleep Space programme (hereafter called the *programme*). The *programme* involves the supply of portable sleep spaces (PSS) plus infant health and safety education, to families of babies more vulnerable to sudden infant death.

We report data gathered for the purposes of monitoring the implementation process, ensuring *programme* standards and being accountable. This is intervention and not research so results cannot be generalized beyond these data. However, they do document the impact of an innovative intervention designed to address a recalcitrant issue within a priority population; they show what has been possible.

Information has been provided by those with the greatest stake in preventing sudden infant death, being families of infants at highest risk of such a tragedy, and gathered by the professionals who support them. It may have been easier simply to issue PSSs without the burden of paperwork that accountability requires. Yet most providers have been attentive to documentation standards, despite assumed pressure on their time and resources.

This report describes the large scale application of the PSS *programme* in real world conditions and non-emergency times. It combines data from across three years of implementation, making it the most comprehensive record available on the distribution and use of portable sleep spaces as an intervention to protect more vulnerable infants from sudden infant death.

The report examines distribution, follow-up and user-feedback records, held on the *programme* database and entered by participating agencies. Specifically, it aims to answer these questions:

- ▶ Did PSSs reach a population at increased risk of sudden infant death?
- ▶ Were PSSs acceptable to Māori recipients?
- ▶ Did PSSs support recipient families to increase infant safety?
- ▶ Did recipient families follow health and safety recommendations for infant sleep?
- ▶ Were PSSs used to increase protection for recipient infants when bed sharing?
- ▶ Did PSS recipients spread safe sleep awareness to others in their networks?
- ▶ Was the *programme* able to be replicated across providers?
- ▶ What research questions emerge from the findings?
- ▶ Has post-neonatal mortality changed during this period?
- ▶ How can the PSS *programme* be improved?

“Awesome. Told everyone in my whānau. Will be giving the pēpi-pod to my whānau.”

LITERATURE REVIEW

High rates of sudden infant death, however such deaths are classified, persist where there is high exposure to identified risks. The international evidence behind current recommendations for safe infant sleep has been well reviewed in the literature^{1,2} and the package of key responses can be summarised as: place infant on the back for sleeping, maintain a clear airway, avoid smoking in pregnancy.

Identified risk factors for sudden infant death that are relevant to the current report include: babies exposed to any smoking, positioned for sleep on their sides or fronts, getting covered faces, sleeping in rooms distant from carers, sharing beds (especially if also smoke-exposed, or with someone impaired by alcohol or drugs), in unsafe sleeping environments (beds and bedding), not breastfed, and premature or low birth weight.

New Zealand has high rates of sudden unexpected death in infancy (SUDI) compared to other developed countries³, although there is evidence that these may be reducing in recent times⁴. At rates of 1.1 deaths per 1000 live births (2006-2010), and more than twice these rates for Māori, about sixty babies have died each year in this way. Currently, most sudden infant deaths are considered preventable, whatever term is used (cot death, SIDS, SUDI, SUID, accidental suffocation, unascertained, sleep accidents), most are expected because known risk factors are involved, and many are also explained with accidental suffocation on the rise as a clear cause of death⁵.

While sudden infant death rates declined dramatically following 'back to sleep' campaigns, most developed countries, including New Zealand³, report little further change to SUDI mortality. Although it has been known for more than twenty years⁶ that the risk from smoking in pregnancy is magnified alarmingly when infants share the same sleep surface as others, prevention efforts have not significantly reduced exposure to this combination of factors.

Controversy⁷ amongst experts about a suitable approach has stymied prevention efforts, due to differences in interpretation of the strength of evidence related to co-sleeping and sudden infant death. The tension is between 'targeted' versus 'whole population' approaches. *'In a bassinet beside your bed'* is the recommended place of sleep promoted by the American Academy of Pediatrics², and the New Zealand Ministry of Health advises in its current leaflet⁸ *"It is never safe to put your baby to sleep in an adult bed, on a couch or on a chair"*. These recommendations are based on evidence of risk for all infants from bed sharing⁹, especially on couches and chairs¹⁰.

However, it is also agreed that the risk of sudden infant death for babies when sharing a sleep surface with others, is far greater for infants exposed to smoking in pregnancy, born prematurely, of low birth weight, very young, or when sharing with someone impaired by recent alcohol or drug use, than infants not exposed to these factors¹¹.

Recently published guidance commissioned from the UK's National Institute for Health Care Excellence (NICE)¹² and based on a review of scientific evidence, acknowledged the

"It has meant that she has somewhere safe to sleep no matter where we are."

statistical association between co-sleeping and sudden infant death, but found insufficient information to confirm a casual link. Professionals were advised to inform parents of the risks from contributing factors, being those mentioned in the previous paragraph.

Clear agreement amongst experts is indicative of strong science, which is essential to effective intervention. A group from the University of Illinois has discussed the bed sharing controversy, and its impact on health policy and family resilience, in a recently published paper¹³ and promoted the concept of 'adversarial collaboration' for finding common ground where experts disagree. The PSS *programme* is based on the areas of clear agreement: increased risk for more vulnerable infants when also sharing a sleep surface.

A New Zealand study¹⁴ of 221 sudden infant deaths in Auckland from 2000-2009 found that 83% were of Māori or Pacific babies, 64% of babies sharing a bed, and 57% of babies not placed on their backs. Most (92%) of the 25 babies who died aged less than one month, were sharing a bed at the time. While no data on smoking was available, the study group has previously established smoking rates in the region of 52% for Māori and 29% for Pacific mothers, so it can be assumed that many babies who died were exposed to both smoking and bed sharing.

In another local study of South Auckland parents, low rates of diffusion of safe sleep knowledge and practice amongst Māori were found¹⁵. More than half of Māori mothers smoked while pregnant and up to 65% had their babies sleeping in their beds for at least some of the night. A third had soft items other than bedding in the sleep environment, and 21% who also smoked, were sharing their beds with their babies. Authors concluded that appropriate approaches to improving safe sleep awareness and practice need to be developed for the high risk infant, especially for Māori.

Wahakura projects are a sleep space approach that has been acceptable and effective in Māori communities¹⁶ since 2006. PSSs have developed to complement wahakura and help achieve large scale application. It has been previously reported¹⁷ that PSSs were widely and appropriately used, enhanced closeness and safety and were rated highly by parents. In 2012¹⁸, same bed co-sleeping with a PSS was common (68%), safe sleep recommendations were widely applied (83% back sleeping 'yesterday', 88% in same room as sleeping parent 'last night'), and safe sleep awareness was spread to an average 5.4 others per PSS recipient.

The reasons why parents bring their babies into their beds are many and varied. A narrative synthesis¹⁹ of the findings of thirty-four studies that met inclusion criteria, identified 10 themes for categorising reasons: breastfeeding, comforting, sleep quality, monitoring, bonding, environmental, crying, tradition, disagreement with degree of danger, and maternal instinct. These suggest the need for pursuing a 'safer bed sharing' prevention approach over a total ban.

Beginning in late 2009, education to resolve the bed sharing debate in New Zealand and align the health workforce with the areas of strong agreement, was reported to have high participation rates in peer education sessions and its online version²⁰. This education was

part of a three-pronged strategy to redirect prevention efforts to current needs, that has been previously described in detail²¹. The three components were: align with evidence, build networks of influence, promote approaches of value.

The PSS *programme* was designed as an intervention positioned within this strategy, to facilitate safer sleeping options for more vulnerable infants during their period of greatest risk. Annual *programme* reports to participating agencies have been published for 2012¹⁸ and 2013²² mapping the emergence of the PSS *programme*. This report includes data from these earlier reports as well as from 2014, to describe the full first three years of implementation.

METHODS

The supply of PSSs was embedded into a comprehensive package of safety education for recipients, and implementation support for providers, as well as into the infant health strategies of regions. Partner agencies signed a participation agreement with the lead agency to clarify expectations and ensure standards for providing the programme.

Materials: The PSS was a 100% virgin polypropylene general-purpose storage box fitted out as an infant bed with the addition of a culturally-themed fabric lining to enhance appeal, a made-to-fit foam mattress and full bedding set. The *programme* was supplied on a 'cost recovery' basis with sales the only funding source. Safety information was provided as a sticker on the device itself, an information card included with the bedding set, and as 'infant care' labels sewn into the covers, mattresses, blankets and sheets.

Coordination: A lead agency provided national coordination and participating agencies established local-level coordinators to manage regional implementation. Coordinators and their teams identified local providers to act as distribution outlets and set up local-level systems for promotion, referral, distribution and monitoring of the programme. Core criteria for referral were: infants aged less than two weeks who were also smoke-exposed, premature or low birth weight, with local discretion for exceptions based on safety assessments of the care-giving professional.

Distribution: PSS distributors were supported by local coordinators who liaised with the lead agency. Distributor training involved completing an e-learning foundation programme²³ for SUDI prevention and a three-hour 'face to face' workshop specific to implementation. The goal of training was a standard experience for PSS recipients in terms of assembly of PSSs, delivery of the safety education, completion of data forms and the seeking of signed agreement from recipients, to conditions of use.

Training: Initial training and core training materials were provided by the lead agency and were similar for all regions. A dedicated web page²⁴ was developed to support regional coordination by sharing *programme* information, enabling easy data entry and downloads of e-forms, and promoting contact details for local providers.

Safety briefing: The standard safety briefing was a key aspect of implementation. A picture card and checklist acted as tools to guide intervention fidelity and to prompt topics that included: how babies get their oxygen, importance of supine positioning and why, who are the more vulnerable infants and why, what are the more vulnerable sleep locations, how infants breathe and can suffocate, safety features of the PSS, how to make it up, and its safe placement and use.

Referred families were offered a PSS for an initial period to assess usefulness to them, and in exchange for the PSS were asked to help with the protection work by sharing their PSS with others, once their baby outgrew it. They were also invited to help spread safety education to others in their networks. Recipients signed their consent to participation in the *programme* and to its terms and conditions.

"It's been good to have at tangi and when at the marae."

Data collection: Forms were designed to collect data at distribution (demographic and infant risk information), follow-up after two to three weeks using PSSs (acceptability and diffusion of awareness information) and to collect feedback data from a sample of user's after eight to ten weeks.

Specific questions asked at follow-up to assess acceptability were: *"Has your baby slept in the PSS yet?"* and *"Do you want to keep it?"*. The question asked to assess participation in sharing information with others was: *"How many others have you spoken with about protecting babies as they sleep?"* A 29 question survey recorded recipient feedback on PSS usage and infant care practices applied 'yesterday' and 'last night'.

From July 2013, forms were modified to include extra questions. Data were collected in the forms of: a) a summary checklist of eight topics promoted as part of the safety briefing, b) questions relating to uptake of the eight recommended practices. Topics included the infant safety principles of: on the back, face clear, own space, carer near, breastfeeding, being smokefree, immunisations, gentle handling. Recommended practices included: on the back, firmly tucked, or in a sleep bag and no covers, in a PSS when in or on adult beds or couches, in same room as a parent at night, breastfeeding, accessing smoking cessation support if parent was not smokefree, timely immunisation, and demonstrating the gentle handling of a baby to others.

Data entry: Data were entered by agencies themselves into an on-line database. Given the high mobility of the recipient group, a goal of 80% was set for follow-up contact after 2 weeks, and 20% for gaining completed feedback surveys at 8-10 weeks. Usually, survey responses were gained from interviews and then entered on-line by agency staff. Where recipients had provided an email address, a link to the survey was emailed to them with an invitation for them to complete on-line.

Data Analysis: Distribution, follow-up and survey data entered between 1st January 2012 and 1st February 2015, for PSSs distributed between 1st January 2012 and 1st January 2015, were analysed by frequency distributions. Where there was missing data, percentages are of the total denominator group, unless stated. Results were grouped by 'Midland' DHB regions versus 'others', 'smoking in pregnancy' versus 'no smoking in pregnancy', and 'Maori' versus 'non-Maori'. Survey data for infant care practices 'yesterday' and 'last night' were analysed for babies 'younger' and 'older than or equal to' 16 weeks.

A thematic analysis of text responses was made using the 'find' feature of MSWord to highlight key words associated with themes. Where a chi-square test of independence was performed, results were considered significant for $p < 0.05$.

A customised data report was purchased from Statistics New Zealand for infant mortality data (infants seven days to one year, all causes, by DHBs and years 2003-2014). These data are licensed by Statistics New Zealand for re-use under the Creative Commons Attribution 3.0 New Zealand licence.

RESULTS

More than 11,000 PSSs were requested from New Zealand health and community agencies prior to 31st December 2014, with 10,000 of these supplied. Orders exclude the 1000 supplied to earthquake families in 2011, and the requests for 775 from Australia.

Supply

Requests spanned 13 district health board regions and included the national Child, Youth and Family (CYF) service. Three regions were starting their PSS service in late 2014, two of which have yet to contribute data. Some regions received their orders in bulk, others in increments, so quantities actually distributed to families are not known. Also not known are: number of people offered a PSS who declined, PSSs held in stock, or issued to distributors, but not yet to families; total numbers issued to families, but not, or not yet, recorded on the database; attempts to follow-up recipients or invite feedback; nor the number of PSSs reused within the community.

Table 1. Quantities of PSSs ordered, supplied, distributed and with data entered

PSS Status	N	PSS Status	N
Ordered	11,000	Reuse in the community	?
Supplied	10,000	Distribution data entered	3,961
Awaiting distribution to whanau	?	Follow-up data entered	2,915
Distributed to whanau	?	Feedback data entered	701

Agencies provided data on PSS distribution (N=3961, 100.0%), recipient follow-up (N=2915, 73.6%) and user-feedback (N=701, 17.7%). These data form the basis of the report. The one response for Southern DHB was from CYF service.

Agencies joined the *programme* at different times over the three-year period and services varied in intensity, in terms of PSSs issued relative to the size of their vulnerable (Māori) infant populations. Overall, intensity for PSS-providing DHBs was 10.7%. Waikato distributed the most PSSs of any DHB (36.7%). Hawkes Bay had the most intensive service, as a proportion of vulnerable infants (represented as Māori births) (28.2%).

From July 2013, the five DHBs that make up the Midland health region (Waikato, Lakes, Taranaki, Tairāwhiti and Bay of Plenty) provided a 'whole of region' PSS service under the leadership of Te Puna Oranga of Waikato DHB, and supported by the Midland Maternity Action Group. This one health region accounted for 60.7% of all PSSs distributed, being 16.0% of all Māori births of this region during the three year period.

Table 2. Comparing health regions by PSSs issued as a percentage of Māori births

Health Region	Number		%
	PSSs	Māori births (2012-15)	PSSs/Māori births
Northern	563	16959	3.3
Midland	2405	15012	16.0
Central	940	8208	11.5
Southern	53	6756	0.8
Total for PSS DHBs	3961	36933	10.7

"I would settle baby in the pēpi-pod and then carry her to the cot."

Distribution

The regional distribution of PSSs by DHB, health region and year, is presented on Table 3.a.. PSSs were intended for use by new-borns until five months old or starting to roll to the front. An emphasis on early issue was to help build safe sleep habits from the start, when babies wake and feed often, and bed sharing is more likely and more dangerous.

Results show that the *programme* was provided to appropriate babies at an appropriate time in most cases. All but 2 PSSs went to babies with identified risks, and 64.0% to babies less than 2 weeks of age at the time of issue (11.3% infants were unborn). Most (74.1%) recipients were also Māori, 12.7% were Pacific and 17.1% neither Māori nor Pacific. There were just 6 infants issued a PSS for whom the only named risk factor was 'ethnicity includes Māori(1) or Pacific (5)'.

Infant vulnerability factors that were identified included: smoking in pregnancy (64.8%) with tobacco, alcohol or drug use in households (74.2%), premature birth (<37 weeks) or low birth weight (<2500 g) (25.2%), and social factors such as young maternal age (45.5% < 25 years with 15.6% < 20 years) and low income (68.6% of mothers used a community services card). Many(41.2%) babies were also their mother's first child and 28.1% had no other baby bed. Few recipients (13.8%) were able to provide an email address with their contact information.

Follow-up

PSSs were also intended to be *offered* to families for a trial period, for them to assess usefulness. Follow-up was expected to occur 2-4 weeks after getting PSSs, to assess acceptability in terms of parents wanting to keep them, and parents' participation in spreading safe sleep information to others. Follow-up information is presented in Table 4.a..

Most families (N=2915, 78.3%) received follow-up contact and were asked if they wanted to keep or return their PPS. The age of babies at follow-up was less than 4 weeks for 29.7%, and less than 8 weeks for 91.%. Most (95.6%) babies had slept in their PSSs and most (91.9%) parents wanted to keep their PSSs. Of the 219 who did not, 158 babies already had a baby bed, and all but two of the remaining 61 babies were protected from significant risk by being smokefree in pregnancy (33), full term (15) and older than three months (11).

In exchange for the *programme*, recipients were invited to help spread safe sleep awareness to whānau and friends, by sharing what they had learned in the safety briefing. Of the 2915 recipients followed up, 80.2% participated in this work reaching 14,451 others (mean 6.2) and engaging them in conversations about safe infant sleep. For the 219 families who did not want to keep their PSS, an encouraging 127 of them did participate in sharing safe sleep information to a collective 516 others (mean 4.1).

"When we were all together, our babies were all in their pēpi-pods."

Infant health topics

From July 2013, data forms were modified to include questions at distribution and follow-up related to recommended safe sleep and infant care practices. For **3270** (82.6%) PSSs distributed from July 2013, there were high levels of recorded discussions on all topics, from 95.2% for 'on the back to sleep' to 85.0% for 'immunisations'.

A snapshot of infant health practices, in place at follow-up was taken against the eight topics promoted at distribution. For families followed up from July 2013, there were missing data for 154 ('on the back') to 200 ('in own space') responses, due to the transition to new forms. Results are presented as a proportion of maximum responses (N=2122) and summarised on Table 4.b..

- ▶ There was high uptake of promoted '**safe sleep**' practices across all 4 topics from 'always or usually on the back' (96.1%) to 'always or usually in a baby bed' (88.1%).
- ▶ Uptake of '**safe baby**' practices varied from 96.7% for immunised (started, booked or intending to), 91.0% for gentle handling (demonstrated to others), 78.1% for breastfeeding (exclusive/full (1245) or partial (413)), and 58.0% for either being smokefree (726) or receiving support to become so (505). Most (88.6%) were also enrolled with a Primary Health Organisation, doctor or general practice.

For reasons of comparison with standard reporting ages, breastfeeding at follow-up was analysed for babies older than six (N=666) and thirteen weeks (N=171). The frequency of 'some' breastfeeding at both age points was 75.9% and 67.3% respectively, with a fall-off in exclusive or full breastfeeding from 54.2% to 41.3%, between 6 and 13 weeks.

- ▶ Where infant health and safety practices were not as recommended, a brief intervention was expected to be performed, to provide further support as appropriate. There were low levels of recorded follow-up interventions, although modest levels for smokefree support. Discussion was recorded for 147 of the 861 (17.1%) recipients currently smoking and not receiving smoking cessation support.

In summary, follow-up results show high rates of contact of PSS recipients by distributors, acceptability of the programme to Māori and other families, promotion and uptake of recommended practices, and spread of safe sleep awareness by the PSS recipient group.

Feedback

Service providers were expected to collect user feedback data when babies were 8-10 weeks old, from a minimum one in five recipients. Feedback surveys were completed for **701** (17.7%), and data entered online, mostly by distributors, although directly by respondents in some cases. Where PSS recipients had provided an email address at distribution (13.8%), they were sent the internet link and invited to complete the survey online. Responses are presented by DHB regions on Tables 5.a. (pick-up), 5.b. (usage), 5.c. (infant care for 'yesterday' and 'last night') and 5.d. (household characteristics).

Pick-up: Most people got their PSSs from a health or whānau worker (93.6%), before their babies were four weeks old (83.3%). There was consistency in the distribution experience for: showing how to make up the PSS (94.7%), explaining the 'rules of protection' (96.6%) and being asked to help spread what they were told to others (94.4%).

Frequency of use: About half of respondents (356) were current users of PSSs, at the time of the survey. Their babies used PSSs for 'all or most' (47.5%) and 'some' sleeps (52.5%). This question was not asked if babies were no longer using PSSs.

Duration of use: Considering current (356) and completed (345) PSS use together to ascertain a minimum period, usage reduced from 95.3% at age 4 weeks, to 82.7%, 57.3% and 29.8% at ages 8, 12 and 16 weeks respectively. For those no longer using their PSSs at the time of completing the survey, the main reason was that babies had outgrown them (76.8%). Other reasons included: babies settling well in cots or bassinets (13.6), babies or parents not liking the PSS (5.5%), or mitigating circumstances (3.8).

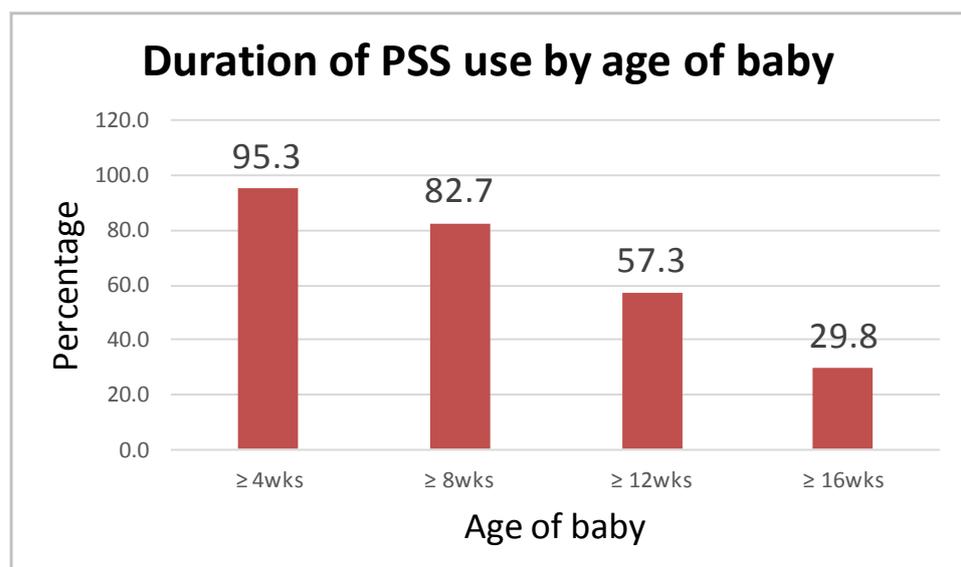


Fig.1. Duration of PSS use by age of baby

Same bed co-sleeping: It was common for babies to have slept in the same bed as parents at some time since getting their PSSs (72.8%) and in most cases babies were 'always' (255), or 'usually' (113), in PSSs (76.5%).

Of those 'sometimes' (90), or 'never' (23), in PSSs when same-bed co-sleeping, 75.2% were 12 or more weeks old at the time of completing the survey. For the 28 babies known to be younger than 12 weeks, 13 were exposed to smoking in pregnancy and three were born before 36 weeks gestation indicating potential high risk from bed sharing. However, when sleeping 'last night', only three of these 16 babies were reported to be sleeping in the same bed as their parents, 13 in the same room, 14 to be breastfed and 15 placed 'on the back' to sleep 'yesterday'.

"The pēpi-pod was good to have close by so I could touch him."

Next bed: Most respondents were using, or planned to use cots after stopping using the PSS (89.4%). Other arrangements included, with an adult in their bed (41), sometimes in a cot and sometimes in bed with parent (10), makeshift settings involving single beds and couches (7), and unknown (15).

Value: Respondents were asked to rate the PSS on a scale of 1 (low) to 9 (high) in terms of the overall idea and its support of them. Most gave high ratings (7-9/9) for the overall idea (93.6%), and for its support of them with safety (89.0%), convenience (87.3%), and settling their babies (70.9%). Bedding items that came with the PSS were also commonly used; 90.9% used the wrap around sheet and 92.4% used the merino blanket.

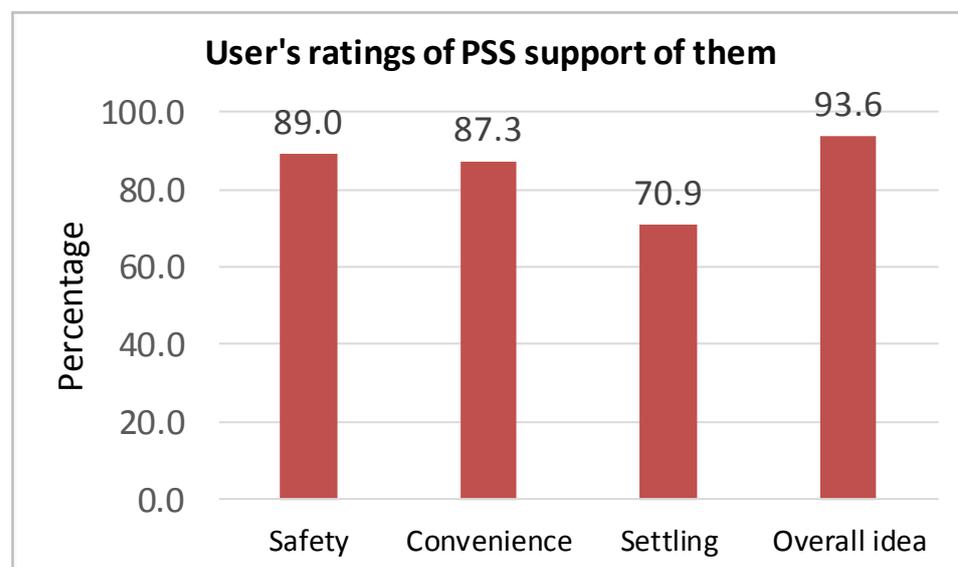


Fig.2. Users' ratings of PSS support of them

Half (55.6%) of survey respondents named 'other' ways in which PSSs had supported them. Most comments related to convenience due to the features of 'transportability' (181), expressed as having a bed for baby when away from home, and 'proximity' (78), expressed as supporting closeness to baby due to ease of moving the PSS about the house. Examples of such comments are listed below.

"It was good to have him next to me in bed in the early days when he was breastfeeding all the time and I was tired. I don't think I would have breastfed him if he wasn't right next to me."

"Great for when travelling. It's light and she loves sleeping in it so when we go away it is not a different bed for her to get used to."

"It's been good to have at tangi and when we've been at the marae because baby always has his own place to sleep."

"It's easy to move around the house and I know that my baby is always close to me."

"The pēpi-pod has helped me in every way possible."

Infant care for 'yesterday': Most babies (73.5%) were breastfed (exclusively/fully (299) or partially (216)) 'yesterday'; 52.8% of younger (<16 weeks) and 47.2% older (≥16 weeks) babies. Half of younger (51.1%), and many *programme* babies overall (42.7%) were fully breastfed 'yesterday'.

While most babies (86.9%) were placed for sleep on their backs 'yesterday', a concerning 46 of younger babies (aged <16 weeks) were not. They were placed instead, on their sides (31), fronts (6) or in no usual position (9). Many were also exposed to other risk factors: smoking in pregnancy (31), prematurity (11) or both these risks (7). All but one of the 46 babies slept in the same room as a parent 'last night', 37 in some type of baby bed and just 4 directly in the adult bed. Sleep position for 'yesterday' was not known for 5 babies, 4 of whom were in the younger age group.

At greatest potential risk was one baby aged 9 weeks, positioned prone 'yesterday', smoke-exposed during pregnancy and born prematurely. These risks were potentially mitigated somewhat by the baby being fully breastfed and in a PSS when same-bed co-sleeping 'last night'.

Infant care for 'last night': Most babies were sleeping in a baby bed 'last night' (88.6%), most in the same room as a parent (87.2%), with 79.4% protected in both these ways. There were 49 babies in the same bed as an adult, and not in a baby bed. Twenty-two were babies younger than 16 weeks some of whom were also exposed to smoking in pregnancy (7), prematurity (3) or both risks (1). Protective practices for these babies 'yesterday' included back sleeping (18), and exclusive/full (15) or partial (5) breastfeeding. The baby exposed to both smoking in pregnancy and prematurity was 13 weeks, fully breastfed and placed to sleep on the back 'yesterday'.

Accidents and incidents: There was one reported accident from a sibling attempting to carry the PSS with baby in it, and dropping it, and seven reports of incidents or safety concerns. One parent reported a crack in the PSS, although continued to use it, but not to carry it with baby in it. Another parent got a fright on one occasion when her baby slipped down under the covers. One young sibling liked to try to tip the PSS, a parent was concerned about tipping when the PSS was used on a soft, uneven bed surface, and three parents commented that their babies were able to move the PSS slightly as they became more active. These were babies older than 17 weeks and at the end of their period of PSS use. There were four comments that revealed breakages or other issues, but none that related to risk to babies.

Household characteristics: Smoking was common; smoking by the baby's mother before (58.4%) and during (52.1%) pregnancy, and by household members (63.3%). Reported ethnicity of babies included Māori (74.5%), Pacific (23.4%), Māori and/or Pacific (76.5%) and neither Māori nor Pacific (16.6%). Ethnicity information was not

supplied for 49 respondents.

Comparison of distribution versus feedback groups: Where data allowed, characteristics of the distribution (N=1373) and feedback (N=701) groups were compared to identify any variations. There were similar proportions of Māori (74.1% vs. 74.5%) and premature or low birth weight (25.2% vs. 28.4%) babies represented in the both group, but fewer babies exposed to smoking in pregnancy in the feedback group (64.8% vs. 52.1%).

General comments: When asked “*What else would you like to share about your experience using a PSS?*” 516 (73.6%) respondents provided comments. Many related to the convenience features of ‘portability’ and ‘proximity’ as reported above, and also to general appreciation, ease of settling, sleep quality, reassurance, safety, bonding and being a talking point. Examples of comments are listed by theme below.

Convenience

“It is such an awesome idea. Easily transportable, convenient and safe.”

“Great for when away from home so baby stays settled in his own bed.”

Transportability

“It’s good to take anywhere you’re going, day or night.”

“Great to use when on the marae and away from home. Very light and portable.”

Proximity

“It’s easy to move around the house and I know that my baby is always close to me.”

“Having baby so close to us at night, but still safe, was fantastic.”

Settling

“Baby hated the bassinet, but settled straight away in the pēpi-pod.”

“A life saver when he is unsettled or over tired.”

Talking point

“I told all the new mums at church about it and I look forward to passing it on.”

“I’m telling everyone about it, ‘cause everyone should know about it.”

Sleep quality

“My son is sleeping so much better after starting with the pēpi-pod.”

“You get a good night’s sleep having baby sleep close to you.”

Bonding

“Gives him security, too, knowing that we are there and he feels safe.”

“I liked that I could see baby when I was sleeping next to him.”

Use by others

“My sister is having a baby and she wants the Pēpi-Pod.”

“Excellent, totally ataahua (beautiful) pēpi-pod.”

"Have passed it on to a friend who also enjoys using it."

Reduced stress

"The pēpi-pod has helped reassure a mum like me who has lost a baby before."

"Having them has lessened stress, made life a million times easier and kept me sane!"

General

"Highly recommend it for all mums with new-borns."

"I think this is probably the most useful and positive baby initiative I have seen, ever, and this is my eighth baby."

Acceptability by Māori : An objective of the study was to assess acceptability of PSSs, and uptake of recommended practices, by Māori. Results of this analysis are presented on Table 6.. Māori recipients were as likely as non-Māori to want to keep their PSS (93.1% vs. 90.1%), be breastfed 'yesterday' (73.4% vs. 74.1%), to place baby on the back to sleep 'yesterday' (87.1% vs. 87.9%), sleep in a baby bed 'last night' (91.8% vs 89.0%), and to rate the PSS highly (94.6% vs. 94.9%).

There were some variations, largely due to the bias of the eligibility criteria. Māori babies were more likely than non-Māori to have a baby bed at distribution (75.4% vs. 61.9%), to be premature or low birth weight (73.8% vs. 66.5%) to sleep in the same room as parents 'last night' (90.9% vs 81.5%), and to be both in a baby bed and in the same room as a parent 'last night' (90.1% vs. 79.7%). Fewer Māori than non-Māori babies, lived in smokefree households in both survey (24.7% vs. 65.5%) and distribution groups (47.9% vs 66.4%).

Comparisons: A chi-square test was performed to examine the relationship between high value ratings for 'settling' and intensity of PSS use. The relationship was significant ($\chi^2 = 12.31$, $df=1$, $p<0.0005$). There were higher ratings for 'support with settling' where PSSs were used for 'all' or 'most' compared to 'some' infant sleeps.

A Chi-square test was also performed to examine the relationship between PSS usage and smoking in pregnancy. Again this relationship was significant. Compared to smokefree babies, those exposed to smoking in pregnancy were more likely to use PSSs for 'all or most' rather than 'some' sleeps ($\chi^2 = 6.81$, $df=1$, $p<0.01$), and to be 'always' or 'usually' rather than 'sometimes' or 'never' in a PSS when same-bed co-sleeping with parents ($\chi^2 = 7.38$, $df=1$, $p<0.01$).

Competency assessments: Fifty-two distribution sessions were observed for assessment of competence of distributors, 43 from Hawkes Bay, 7 from Waitemata and 2 from Lakes DHBs. All observees were considered competent.

Infant mortality changes: Infant mortality data (for infants aged seven days to one year, all causes, by year of death), was purchased as a customised report from Statistics New Zealand²⁵, and birth data was from Infoshare on the Statistics New

"It is calming knowing my child can be right next to me."

Zealand website²⁶. The changing pattern of infant death rates is presented in the graph below. It shows that total infant deaths per 1000 live births reduced slightly in the 2009-11 period, from 2.8 to 2.6, but increased for Maori from 4.2 to 4.4. During the intervention years of 2012-14, rates fell from 2.6 to 2.1 overall, and from 4.4 to 3.0 for Maori.

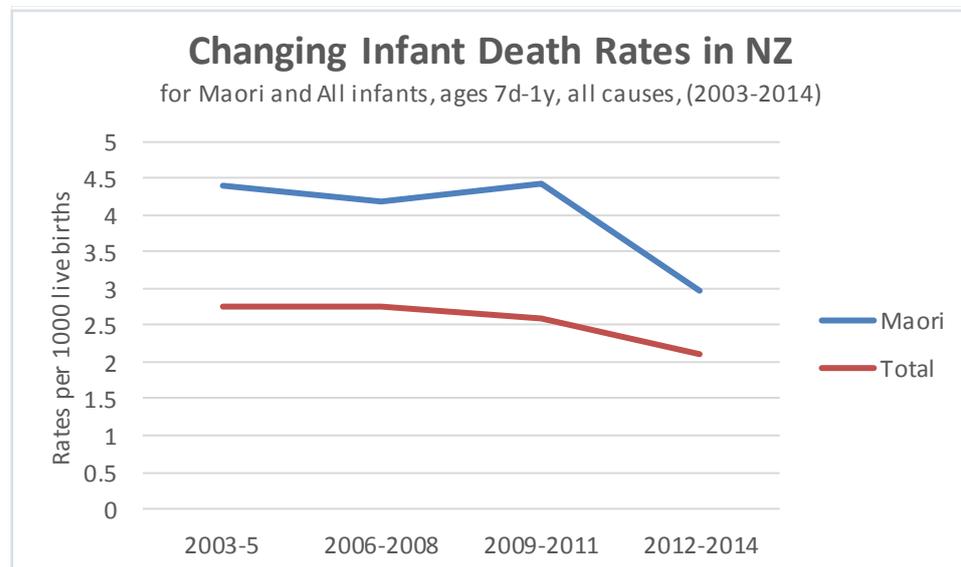


Fig. 3. Changing infant death rates in NZ, (2003-2014) Source: Statistics New Zealand

An analysis was made of the distribution of infant deaths for New Zealand’s four health regions over the three intervention years, compared to the distribution of Māori births and recorded distribution of PSSs. Māori births were used as a marker for ‘more vulnerable’ infant. Results are displayed on Table 7. and Figure 4, below.

The proportion of infant deaths for the period was spread evenly across regions relative to total birth numbers, but unevenly relative to proportion of more vulnerable infants (Māori). Given that infant death rates are higher for Māori, Midland had the greatest prevention challenge. Thirty percent of all Māori infants born in New Zealand during the three year period were from Midland. Yet just 18.8% of the overall deaths were Midland infants. Midland also distributed by far the greatest number of PSSs (60.7%) compared to other regions.

Southern DHBs on the other hand had a lesser prevention challenge with just a 13.6% share of vulnerable infants (Māori births) for the period. Yet 21.6% of overall deaths were infants from Southern DHBs where the share of PSSs supplied was minimal (1.3%).

Table.7. Comparing health regions by proportions of infant births, deaths, vulnerable (Maori) infants and PSS issued during 2012-2014.

2012-2014	% All births	% infant deaths	% Māoribirths	% PSS distributed
Northern	41.3	40.9	34.2	14.2
Midland	19.7	18.8	30.4	60.7
Central	18.8	18.8	21.8	23.7
Southern	20.2	21.6	13.6	1.3

“Continued the bond between mother and baby.”

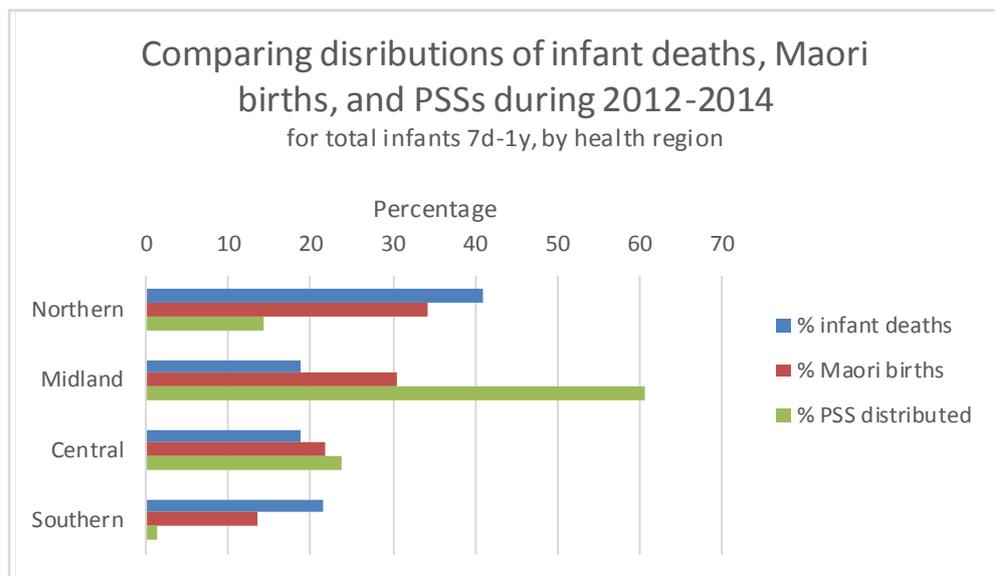


Fig.4. Comparisons of distribution during 2012-14 of total infant deaths (7d-1y),

DISCUSSION

Research and intervention are different activities, with different purposes and methods. The Pēpi-pod Programme was designed as an intervention to improve the health and safety of more vulnerable infants, especially when sleeping. It involved the personalised application of evidence-based knowledge, the invitation to spread that knowledge to others, and the offer of enabling tools. Design was based on methodologies^{27,28,29} for achieving a large scale impact and sustainable change.

The programme was not designed as research, the purpose of which is to prove or disprove an hypothesis. Research is charged with creating knowledge, with controlling conditions so that results can be generalised. Because this report describes an intervention, caution is needed in interpreting results. Findings are meaningful only within the context and limitations of the report and cannot be generalised more widely. Real world conditions lack the control that is possible in formal studies, and convenience sampling brings inevitable bias.

However, for the data available, all but two babies issued with PSSs, carried a statistically increased risk for sudden infant death. The report describes what was possible for this group of families and is feedback to participating agencies on the collective effort to improve protection for this group of infants.

The task of protecting the sleep of the nation's infants is a big one. Assuming an average five sleep events per day over the first sixteen weeks, there are an estimated 32.5 million opportunities to get it right, or get it wrong; 8.4 million for Māori. The *programme* was designed to increase opportunities for more vulnerable babies to be healthy, and to be safe when sleeping. Within this context, the report set out to answer these questions:

► **Did PSSs reach a population at increased risk of sudden infant death?**

Yes. The answer is 'yes' for *programme* babies, although access relates to PSSs availability within a region. It is likely that many priority babies missed out. Most regions have temporary provision for PSSs and supply to less than 10% of their populations of vulnerable infants. Exceptions are Waikato and Hawkes Bay where a DHB-wide approach has been taken.

Evidence from scientific studies describe vulnerability in terms of infant age, infant care, and social factors. Excluding premature infants, 67% of babies received their PSS before two weeks. Where resources are limited, there is diminishing return in issuing to older babies at the expense of younger ones, as the period of risk lessens with development. Also, babies and parents accommodate to the sleep conditions in place, and may not adapt as easily to a PSS, if receiving it later, as results suggest.

Smoke-exposure in pregnancy is currently the leading single risk for SUDI in New Zealand. This risk is amplified when associated with bed sharing and non-supine sleep positions, and with prematurity or low birth weight. Yet 25% of babies were not exposed to either risk (smoking in pregnancy nor prematurity/low birth

weight), although they were to social factors such as young maternal age and low income. These suggest an opportunity for further targeting of the intervention, if needed.

While the preferred outcome is improved access to PSSs, vulnerability criteria could also be tightened in regions with a limited PSS resource, to only babies less than 2 weeks old and also exposed to smoking in pregnancy. This recommendation is supported by the finding that there was more intensive and appropriate use of PSSs with infants exposed, compared to not exposed, to smoking in pregnancy.

► **Were PSSs acceptable to Māori recipients?**

Yes. PSSs were highly acceptable to Māori recipients, and text comments are rich in detail about why. Comments also suggest PSSs were acceptable to whānau members, that they supported a mobile lifestyle of frequent visiting, travelling and movement about the house, and were shared with others along with the safe sleep information. Much of the value of the PSS was expressed as convenience; enabling safe sleep for baby while supporting cultural norms.

One alarming difference between Māori and non-Māori infants was the low number from smokefree households; 26% vs. 61% for survey babies and 50% vs. 68% for the *programme* group as a whole. While the PSS may support cultural norms, it cannot be part of supporting smoking. Promoting smokefree whenua and whānau, as protection for babies, needs to be raised as a priority of this *programme*.

► **Did PSSs support families to improve infant safety?**

Yes. Results from snapshots of infant care practices, describe most infants in safe sleep conditions at the time of follow-up, and, for survey babies, when sleeping ‘yesterday’ and ‘last night’. That PSS usage was more intensive and appropriate for babies exposed to smoking in pregnancy, suggests parents were aware of their babies’ increased vulnerability and took appropriate steps to improve safety.

Of concern, are the few babies exposed to unsafe practices despite a personalised safety briefing and enabling device, although in all cases there is evidence of risks being mitigated to some extent. What may be useful to support belief in safe sleep recommendations, where there is a mismatch between these and actual practice, is to revisit ‘breathing’ as the underlying function at risk, and to involve whānau in the explanation for why. As one parent humbly commented “*sometimes we have a ‘she’ll be right’ attitude when it comes to sleeping*”.

► **Did recipient parents follow health and safety recommendations for infant sleep?**

Yes. There were high levels of uptake of ‘safe sleep’ recommendations and encouraging levels of ‘strong baby’ practices in the *programme* group. More than one third (37%) of those smoking at the time of follow-up were also receiving

cessation support. Almost all (97%) of recipients had either started, booked or intended to book their babies' immunisations. Promotion of 'gentle handling' as a strategy to help reduce injury and death of infants from violence, was reported by 90% and took the form of showing others how to handle their babies gently. In all these ways, families were active in helping to boost the resilience and protection of their babies.

The prevalence of breastfeeding was also encouraging given that Māori and Pacific peoples, low-income families and young mothers have lower breastfeeding rates than other groups³³. Some comments indicated that the PSS facilitated breastfeeding, especially in the night, and distributors were particularly vigilant about supporting breastfeeding. However, with 54% of programme babies exclusively or fully breastfed from 6 weeks, and 24% with no breastfeeding, there is some way to go to reach current population targets set by the Ministry of Health for 74% at six weeks and 63% at three months. Promotion of specific ways that the PSS can support breastfeeding, and measuring parent's perceptions of how well this is achieved, could be introduced, as this has been useful for assessing support with settling.

► **Were PSSs used to increase protection for recipient infants when bed sharing?**

Yes. The snapshot of infant care taken at follow-up, shows 88% of babies 'always' or 'usually' in a PSS when sleeping in, or on, an adult bed or couch. For survey infants, bed sharing was common with 70% having shared the same bed as parents at some time since getting their PSSs. The snap shot taken of the infant care practices 'last night' for survey families showed that 94 babies under 16 weeks slept in the same bed as their parent and 77% were also in a PSS. There were still some infants unprotected for at least some sleeps although there was evidence of mitigation from the application of other protective practices such as supine sleeping and breastfeeding.

► **Did PSS recipients spread safe sleep awareness to others in their networks?**

Yes. Evidence for the diffusion of safe sleep awareness within the social networks of PSS recipients is contained within the number 14,451 others reached, and also in respondents' comments. It would seem that the PSS drew attention to itself and, together with the expectation that recipients participate in spreading awareness, and their positive experience using a PSS, created an opportunity for conversations to flow easily from there.

This aspect of the *programme* is the mechanism for leverage from a limited resource; for achieving scale, reach and penetration into the social systems of more vulnerable groups. It is at the heart of the programme's influence and the hope of sustainable change.

► **Were infant health priorities promoted as an integral part of the programme?**

"Much safer having baby in a pēpi-pod than just in bed where he could get rolled on."

Yes. From July 2013, we have measured action, by distributors and families, on infant health priorities related to SUDI, summarised as ‘strong baby’ principles. This change was suggested by Waikato DHB who saw an opportunity for the *programme* to support the broader accountabilities of regional health plans, and in a measured way.

It was not that there were new intervention expectations of distributors, but there were additional data collection demands which were kept to a meaningful minimum. There is a tendency to ‘value what we measure’, so it is important to ‘measure what we value’ - that being key conversations had in this instance. Answers to questions introduced at the follow-up contact, allowed a data snapshot of usual infant care for regions, that gave value to the previously invisible work of the programme.

► **Was the *programme* able to be replicated across providers?**

Yes. Programme monitoring measures tracked the inclusion of core elements and these measures were built into data records at follow-up and feedback points. Records indicate high levels of promoting the eight infant health and safety principles, high levels of providing the safety briefing and a demonstration of how to make up the PSS, and high levels of inviting participants to help spread safe sleep education to others.

► **What research questions emerge from this report?**

Is a more vulnerable baby better protected from ‘sudden infant death’ if ‘in’ compared to ‘not in’ a PSS when bed sharing? Such a study would be ethically challenging, given the clear evidence that a baby is better protected when sleeping in an infant bed, and a PSS is a form of infant bed, and the evidence of increased risk for infants from sleeping directly with others on a shared surface. However, robust scientific evidence would strengthen confidence in the approach and is desirable.

To what extent do PSSs support parents to align their care with the developmental needs of young babies? Parent responses suggest a broader value than just safety, from PSS use. Most families (72%) already had a baby bed at the time of PSS issue, and were just as likely as families with no other baby bed, to want to keep their PSSs, and to use them when babies slept in risk locations. It would be helpful to understand *Why do parents value and use a PSS when they already have an infant bed?*

Why do parents bring their babies into their beds at night, and make the other care decisions that they do? Comments from surveyed users of PSSs, cover a range of valued attributes of the device, from practical features such as portability to cultural and other values such as closeness and reassurance. Improved understanding of the many reasons why parents do what they do in regard to infant sleep, specifically,

“Best invention, huge talking point.”

and night time care, generally, would improve the precision of health education.

There are studies, in place looking at feasibility and acceptability of the PSS concept in high risk communities in South Auckland, Aboriginal communities in Queensland, Australia, and Hispanic communities in Texas, USA, and one proposed in the UK. There is also a New Zealand study comparing infant sleep responses in home settings when in sleep spaces (wahakura and Pēpi-Pod) compared to bassinets.

► **Has infant mortality changed during this period?**

Yes. Statistics New Zealand collects infant death information (all causes) from death registrations. The review process, to classify by cause of death, takes time, so SUDI-specific deaths cannot be current. Yet a current view of mortality is important during a period of intensive intervention, to monitor potential for unintended outcomes (positive and negative) and assess confidence in implementation. Since SUDI captures most preventable deaths, if mortality change from 'all causes' is reducing, and it is, then it can be assumed that SUDI mortality is also reducing.

Very young babies are at increased risk from bed sharing with and without other risk factors, which is one reason why the PSS *programme* targets new-borns and why monitoring infant mortality in the late neonatal period (7-28 days) is of interest, too.

The targeted approach to promoting breastfeeding, smoking cessation, immunisation and gentle handling of babies, as part of the intervention, is intended to influence more than sleep safety and also enhance infant protection in an holistic sense. It is therefore relevant to monitor infant mortality from *all causes*, and not just SUDI deaths, accepting that many will not be from preventable causes.

The fall in infant death rates during the intervention period was most marked for Māori, and while this is a temporal association, it cannot be claimed to be causal. However, the impact in Midland DHBs is encouraging, where there was the greatest proportion of both PSSs and vulnerable infants (Maori) compared to other regions, and an equitable share of deaths for the period, with the reverse of this in Southern DHBs.

Causality would be difficult to prove given the uneven spread of the intervention, its lack of regional specificity, that sharing the education and PPSs within social networks of recipients was an in-built feature of the programme, and that other public health activities, such as safe sleep policy development by DHBs, were occurring in the period. Yet it must be kept in mind that this was an intensive and targeted intervention, successfully engaging large numbers of more vulnerable infants in enabling ways, so it would be fair to say that the intervention is likely to have *contributed* to reducing infant mortality and to supporting parents in ways valued by them.

► **How can the PSS *programme* be improved?**

While the majority of users commented positively, and rarely about the look of PSSs, some comments provided insights into how the device might be improved. These including a preference for the device to be: a little wider so that babies did not hit the sides with their arms and could use it for longer, to have no cover as it made tucking the sheets difficult and could make the PSS look like a coffin, to slip and slide less, to come in a second size, to have ventilation holes, and for one person, that it be made of flax. Features appreciated were the low sides facilitating easy access for comforting babies, portability and the bedding. A customised sleep space has since been produced accommodating these suggestions where possible and marking the base with safety information such that recommendation's travel with the PSS.

Results point to how implementation could be strengthened, including tighter criteria for access, where supply is limited, and increased emphasis on support for breastfeeding and smoking cessation. Concern about infant deaths where a PSS has been issued, alcohol is involved and the PSS is not used on that occasion, emphasises the need to step up promotion of 'arrange a sober carer' as part of the safety briefing at distribution.

Intervention fidelity

The effectiveness of this *programme* is heavily dependent on the quality of the safety briefing provided at the time a PSS is issued. Great care has been taken by the lead agency, in the design of the *programme*, and by local coordinators in its implementation, to support a standard here in terms of training, timing and content. It is likely that this care has influenced the effective replication of the programme across a range of distributors, providers, settings and regions.

Results reflect intervention fidelity^{34,35} (conformity to standards) in how and when PSSs were supplied, the components included in the safety briefing, and completion of data records. As well, for Hawkes Bay DHB, Lakes and Waitemata DHBs there was use of the 'competency checklist' system for confirming the competence of PSS distributors.

Programmes often fail if they are not implemented as designed, and in the matter of a safe infant sleep programme, the stakes are high from reduced effectiveness. Yet fidelity needs to be balanced with adaptation to local settings. In this *programme*, process measures were further supported with two quality assurance tools introduced during 2013: the previously mentioned 'competency checklist' for observing the quality of the distribution process, and a 'programme fidelity' tool for assessing the competence of an agency or service in providing the programme. All partner agencies will be encouraged to use these tools to assess competence and fidelity in 2015.

Voices of parents

"It is wonderful, having baby close to us and knowing he is safe."

This report projects the voices of participating families by presenting examples of text comments as provided. Comments give colour, context and confirmation to the numbers, and tell a collective story of parents managing their day to day realities supported by the PSS programme, as they pursue protection for their babies within the context of their cultural and social norms.

Next Steps

The *programme* and product continue to be upgraded. The customised New Zealand-made device has been developed to be a better fit for purpose over the original general purpose container that got the programme started. It has been designed to meet the developmental needs of babies for closeness, connection, regulation and safety, and to meet the practical needs of parents in deciding their responses. It is intended to fill the gap left by conventional baby furniture options when babies sleep in places other than these. Figure 6. is a photo of the modern PSS.



Figure 6. New version Pēpi-Pod® sleep space

Resourcing

Resourcing new initiatives is always a challenge and many fall by the way because of it. They may emerge with one-off funding arrangements and then struggle to continue in the pursuit of committed funding. It takes time to describe impact and establish the confidence that funding bodies require. This report tells a compelling story of effective implementation and uptake of recommended practices by families, against a background of falling infant death rates.

Resourcing is a challenge for all parties in this work and threatens the continuity of the *programme* in some regions. In others, funding is built in to a ‘business as usual’ approach. Despite being a highly cost effective intervention, further cost-efficiencies can and must be found. They have been built into the device upgrade, in being wider and stronger, and able to protect more babies for longer. They have also been built in to the methodology, through the ‘training’ of infant protection advocates in the safety briefing process,

“It was compact enough to fit nicely between my husband and me.”

enabling a ripple of benefit beyond the single conversation. Further cost efficiencies can be had from tightening the criteria for access and reducing annual volumes in line with increasing numbers of sleep spaces circulating in the community.

There is a price that society must pay in order to protect the lives of vulnerable infants. It is time to decide if this sleep space work has a value, and if it does, to resource it appropriately. Adequate and sustained funding support for DHBs who provide sleep space programmes is recommended for it would be an unwanted experiment, in the light of this report, to discontinue such programmes and 'see what happened' to infant deaths rates.

CONCLUSION

The Pēpi-Pod programme was designed to help protect the first 500 sleeps of babies more vulnerable to sudden infant death and to be a vehicle for precision in engaging their families in infant health and safety education and promotion. This report is evidence that the *programme* met all of its aims.

Portable sleep spaces were distributed to priority babies and were acceptable to recipient parents, most of whom were Māori. They were used to enhance infant safety in various risk locations and not just shared beds. Infant health and safety recommendations, promoted at distribution, were reflected in snapshots of infant care, and recipient families were effective in spreading safe sleep awareness to others in their networks.

During the three year intervention period infant mortality rates fell, especially for Maori. While cause and effect cannot be claimed, the association is encouraging.

Safe sleep for babies is a human rights issue. Caution has a cost. The right of a child to survival and development is a foundation principle of the United Nations Convention on the Rights of the Child (UNCRC)³⁶, ratified by New Zealand in 1993. There is, therefore, an obligation on us, as individuals and a nation, to safeguard survival through promoting and enabling safe sleep for every baby, every sleep and in every place of sleep. This *programme* has a key role to play in meeting that obligation.

Our safe sleep solutions need to be realistic for people, solve problems, make things easier. The supply of portable sleeping spaces, within a structured programme of education and support, considers the interdependent nature of the infant-parent relationship. It works to meet the needs of babies *and* their parents so that everyone benefits, with a ripple of other benefits also likely. Consideration of this approach is recommended where status quo approaches to preventing sudden infant death are failing the vulnerable infant.

TABLES

Table 3.a. Distribution of PSSs by district health board regions and year (N=3961)

	N	%
HEALTH REGION		
Northern	563	14.2
Auckland	7	0.2
Counties Manukau	192	4.8
Northland	240	6.1
Waitemata	124	3.1
Midland	2405	60.7
Bay of Plenty	298	7.5
Lakes	288	7.3
Tairāwhiti	223	5.6
Taranaki	145	3.7
Waikato	1451	36.6
Central	940	23.7
Hawkes Bay	846	21.4
Hutt Valley	22	0.6
Whanganui	72	1.8
Southern	53	1.3
Canterbury	52	1.3
Southern	1	0.0
YEAR		
2012	451	11.4
Q1	17	0.4
Q2	104	2.6
Q3	180	4.5
Q4	150	3.8
2013	1592	40.2
Q1	154	3.9
Q2	372	9.4
Q3	567	14.3
Q4	499	12.6
2014	1918	48.4
Q1	454	11.5
Q2	526	13.3
Q3	540	13.6
Q4	398	10.0

“It would be great if there was a stage two pod for bigger or older babies.”

Table 3.b. Distribution of PSSs by characteristics of babies and parents for Midland and 'Other' health regions (N=3961)

	Midland N	Other N	TOTAL N %	
BABY CHARACTERISTICS				
Risk factors for SUDI				
smoking in pregnancy	1586	980	2566	64.8
household smoking, drug or alcohol use	1376	495	1871	47.2
prematurity/low birth weight	607	391	998	25.2
No stated SUDI risks	1	1	2	0.1
Baby's ethnicity				
includes Maori	1961	975	2936	74.1
includes Pacific	224	278	502	12.7
includes Māori or Pacific	2081	1175	3256	82.2
does not include Māori or Pacific	318	358	676	17.1
Has a baby bed				
yes	1847	1002	2849	71.9
no	558	554	1112	28.1
Age of baby when PSS received (in days)				
not yet born	201	246	447	11.3
0-15 days	1399	687	2086	52.7
15-28 days	238	168	406	10.2
>28 days	476	311	787	19.9
missing data	91	144	235	5.9
PARENT CHARACTERISTICS				
Age of mother (in years)				
<20	350	269	619	15.6
20-24	726	460	1186	29.9
≥25	1175	779	1954	49.3
missing data	154	48	202	5.1
Age of father (in years)				
<20	137	104	241	6.1
20-24	78	46	124	3.1
≥25	924	512	1436	36.3
missing data	962	738	1700	42.9
Known to hold a Community Services Card				
mother	1737	979	2716	68.6
father	703	301	1004	25.3
Mother's first baby				
yes	972	661	1633	41.2
Email address provided				
yes	457	89	546	13.8

"Both my husband and I loved the pēpi-pods for our twins."

Table 4.a. Follow-up information on age of baby, timing of follow-up, PSS acceptability, and safe sleep awareness diffusion rates, for recipients of a PSS (N=2915).

	Midland	Other	TOTAL	
	N	N	N	%
FOLLOW-UP DETAILS				
Received follow-up contact				
yes	1654	1261	2915	100.0
Age of baby at follow-up				
<4 weeks	490	376	866	29.7
4-8 weeks	1054	740	1794	61.5
>8 weeks	31	16	47	1.6
missing data	79	129	208	7.1
Acceptability of PSS at follow-up				
baby had slept in pod	1590	1197	2787	95.6
parents wanted to keep it	1558	1120	2678	91.9
Age of baby <4 weeks + want to keep	474	356	830	0.0
Diffusion of safe sleep awareness				
number who spoke with others	1472	865	2337	80.2
number of others reached by recipients	10714	3737	14451	
diffusion rates (people/recipient)	7.3	2.6	6.2	

Table 4.b. Description of topics discussed, uptake of recommended practices, and further intervention provided, by health regions (new data from July 2013)

	Midland	Other	TOTAL	
	N	N	N	%
TOPICS DISCUSSED AT DISTRIBUTION (N=3271)				
'Safe Sleep'				
On the back	1736	1379	3115	95.2
Face clear	1736	1375	3111	95.1
Own space	1733	1283	3016	92.2
Carer near	1719	1228	2947	90.1
'Strong baby'				
Breastfeeding	1695	1234	2929	89.5
Smokefree	1717	1344	3061	93.6
Immunisation	1606	1174	2780	85.0
Gentle handling	1661	1232	2893	88.4
UPTAKE OF RECOMMENDED PRACTICES AT FOLLOW-UP from July 2013 (N=2122)				
'Safe Sleep'				
a) on the back: always/usually	982	1057	2039	96.1
b) Firmly tucked (or in sleep bag): always/usually	994	1071	2065	97.3
c) Same room as carer at night: always/usually	911	1047	1958	92.3
d) In PSS if in risk locations: always/usually	924	946	1870	88.1
'Strong Baby'				
a) Breastfed: exclusively/fully	603	642	1245	58.7
partially	222	191	413	19.5
not at all	188	245	433	20.4
b) Smokefree support for main carer: yes	272	233	505	23.8
no	375	486	861	40.6
N/A (main carer is smokefree)	369	357	726	34.2
c) Immunisations: started	424	437	861	40.6
not yet but booked	153	169	322	15.2
not yet, but intend to	416	452	868	40.9
do not intend to	15	18	33	1.6
d) Gentle handling of baby shown to others				
yes	948	964	1912	90.1
Enrolled with a PHO/Doctor/Medical Practice				
yes	926	955	1881	88.6
FURTHER INTERVENTION PROVIDED AT FOLLOW-UP				
Smoking cessation discussion: yes	110	37	147	6.9
All other topics: yes	<54	<52	<105	<4.9

"People are really interested in it, including the nannies at the marae."

Table 5.a. Feedback from recipients on getting their PSS, by health region (N=701).

	HEALTH REGIONS		TOTAL	
	Midland N	Others N	N	%
Feedback surveys completed	508	193	701	100.0
PSS Distributor				
health or whānau worker	351	305	656	93.6
Age of baby when got PSS				
unborn or <1 wk	257	94	351	50.1
1-4 wks	176	57	233	33.2
5 or more wks	75	41	116	16.5
Distribution process				
shown how to make up pod	482	182	664	94.7
‘rules of protection’ explained	494	183	677	96.6
asked to help spread awareness	489	173	662	94.4
Age of baby when survey completed (N=116)				
< 16 wks	282	88	370	52.8
≥ 16 wks	226	105	331	47.2
Premature or low birth weight	137	53	190	27.1

“The midwife who gave me my pēpi-pod also gave me a quit pack and some NRT.”

Table 5.b. Feedback from recipients on using their PSSs, by smoking status in pregnancy (N=701).

	Smoking in Pregnancy		TOTAL	
	Yes N	No N	N	%
Number of respondents	367	336	701	100.0
Still using PSS at time of survey				
all or most sleeps	109	60	169	24.1
some sleeps	95	92	187	26.7
no, stopped using it	161	184	345	49.2
Reason for stopping (N=345)				
baby too big / starting to roll	124	141	265	76.8
settling in cot / bassinet	19	28	47	13.6
baby or parent didn't like it	8	11	19	5.5
extenuating circumstances	9	4	13	3.8
Age of baby at stopping (N=345)				
≥8wks	111	150	261	75.7
≥12wks	80	115	195	56.5
Age of baby for current users (N=356)				
≥8wks	182	137	319	89.6
≥12 weeks	116	91	207	58.1
Minimum length of use (combining current and completed users)				
≥ age 4wks	342	326	668	95.3
≥ age 8wks	293	287	580	82.7
≥ age 12wks	196	206	402	57.3
≥ age 16wks	97	112	209	29.8
Any same bed co-sleeping				
Yes	272	238	510	72.8
baby always/usually in a PSS	219	167	386	75.7
sometimes/never in PSS	53	71	124	24.3
Used bedding provided with PSS				
wrap-around sheet	333	304	637	90.9
merino blanket	338	310	648	92.4
Ratings of high support (7-9/9) for				
safety	329	295	624	89.0
convenience	327	285	612	87.3
settling	266	231	497	70.9
overall idea	337	319	656	93.6
Place of sleep after PSS				
cot or other baby bed	333	294	627	89.4
in adult bed with adult	16	25	41	5.8
makeshift sleep space	7	12	19	2.7
Any accidents, incidents, breakages or safety concerns with baby in PPS				
accidents, incidents, breakages, safety concerns	4	4	8	1.1

"I felt like I could have a deep sleep when my baby slept in his pod in the same bed as me."

Table 5.c. Feedback from recipients on infant care practices applied ‘yesterday’ and ‘last night’, grouped by younger (<16 weeks) and older (≥16 weeks) babies (N=701).

	AGE OF BABY		TOTAL	
	<16 wks	≥ 16 wks	N	%
	N	N		
Age of baby	370	331	701	100
Infant care practices of ‘yesterday’				
Breastfeeding				
exclusive / full	189	110	299	42.7
partial	102	114	216	30.8
no breastfeeding	75	106	181	25.8
Position placed for sleep				
back	320	289	609	86.9
front or side	37	27	64	9.1
no usual position	9	14	23	3.3
Infant care practices of ‘last night’				
Slept in baby bed				
yes, in PSS	140	49	189	27.0
yes, in another type of baby bed	191	241	432	61.6
no	28	34	62	8.8
Slept in same room as parent				
yes, but not in same bed	266	224	490	69.9
yes, and in same bed and in PSS	72	49	121	17.3
yes, and in same bed but <u>not</u> in PSS	22	27	49	7.0
some other place	25	55	80	11.4

“I have passed the pod on to my sister in law and I told her how to use it safely.”

Table 5.d. Household characteristics of survey respondents, by health regions (N=701).

	DHB REGIONS		TOTAL	
	Midland	Other	N	%
	N	N		
Region of nearest town/city				
number	508	193	701	100
Ethnicity of baby				
includes Māori	420	102	522	74.5
includes Pacific	111	53	164	23.4
includes Māori and Pacific	423	113	536	76.5
does not include Māori or Pacific	52	64	116	16.5
Maternal Smoking				
of mother before pregnancy	309	100	409	58.3
of mother during pregnancy	275	90	365	52.1
Household smoking				
by 1 person	170	36	206	29.4
by 2 people	110	37	147	21.0
by 3 or more people	59	32	91	13.0
total number of smoking households	339	105	444	63.3

Table 6.a. A comparison of Māori and non-Māori recipients on acceptability measures and uptake of recommended practices (missing data exclude).

	MĀORI		TOTAL	
	yes N (%)	no N (%)	N	%
Have a baby bed at distribution (N=3961)				
yes	2215 (75.4)	634 (61.9)	2849	71.9
no	721	391	1112	
Want to keep PSS at follow-up (N=2883)				
yes	1938 (93.1)	726 (90.1)	2664	92.4
no	144	75	219	
Characteristics at time of feedback				
Premature or low birth weight (N=680)				
yes	385 (73.8)	105 (66.5)	490	72.1
no	130	51	181	
Smokefree household (N=665)				
yes	137 (26.7)	96 (63.1)	233	35.0
no	376	56	432	
Any breastfeeding 'yesterday' (N=680)				
yes	383 (73.4)	117 (74.1)	500	73.5
no	137	41	178	
Back sleeping 'yesterday' (N=678)				
yes	454 (87.1)	138 (87.9)	592	87.3
no	67	19	86	
Slept in a baby bed 'last night' (N=665)				
yes	468 (91.8)	138 (89.0)	606	91.1
no	42	17	59	
Slept in same room as a parent 'last night' (N=673)				
yes	469 (90.9)	128 (81.5)	597	88.7
no	47	29	76	
Slept in a baby bed and same room as parent 'last night' (N=602)				
yes	420 (90.1)	110 (79.7)	530	88.0
no	44	28	72	
High rating (7-9/9) for PSS idea (N=680)				
yes	494 (94.6)	150 (94.9)	644	94.7
no	28	8	36	

"Easy to use, keep clean, light weight, so easy to take in the car when staying away from home."

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“It has allowed me to be closer to baby, safely.”

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Competing interests: None known. Neither Stephanie Cowan nor Change for our Children Limited benefit financially from the distribution of *pēpi-pod* sleep spaces. The components of the sleep spaces are assembled by Change for our Children Limited from goods provided, some at subsidised prices, from a range of New Zealand companies. The *programme* is provided to health services on a 'cost recovery' basis.

Acting on professional advice, and given the life-protecting purpose of the *programme*, the *pēpi-pod* mark has been registered with the Intellectual Property Office of New Zealand to protect the quality and integrity of the complete programme (education plus sleep space) and assure the public of a consistent standard of goods, services and care.

Current provider: In October 2013, the programme was repositioned to sit under the umbrella of Tender Shoot Limited, a social enterprise with charitable status with the New Zealand Department of Internal Affairs (CC38187), and a separate legal entity from Change for our Children Limited. This move was to separate the commercial and professional aspects of delivery, safeguard viability and enable a sustainable future as a self-funded, cause-driven programme.

Author information: Stephanie Cowan is director of Change for our Children Limited, Christchurch, a social innovations company seeking fresh solutions to infant health concerns that are more resistant to change from traditional approaches.

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Participating agencies have raised funds locally for the *programme* and have integrated education and documentation requirements into existing staff allocations in most cases. Reliance on the commitment and drive of regional champions has led the development of the Pēpi-Pod® programme.

Participating families have powered the spread of safe sleep awareness within their networks.

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