



# Bed-Sharing in the First 8 Weeks of Life: An Australian Study

H. M. Cunningham<sup>1</sup> · H. Vally<sup>2</sup> · L. Bugeja<sup>3,4</sup>

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## Abstract

**Background** As the evidence continues to emerge about the relationship between sudden unexpected death in infancy (SUDI) and the way an infant sleeps, providing consistent and evidence-informed recommendations on how best to sleep infants is an ongoing challenge. A recent case series study in the state of Victoria, Australia, identified 45.8% of sleep-related infant deaths occurred whilst bed-sharing. This study prompted the need for further exploration of infant sleeping practices, including bed-sharing, in this population. **Methods** A cross-sectional survey of 2745 mothers attending the Maternal and Child Health (MCH) Service across Victoria, Australia was conducted. Data included the prevalence and circumstances of bed-sharing, family demographics, and SUDI risk and protective factors. Associations between bed-sharing and SUDI risk and protective factors were examined using univariate and multivariate analyses. **Results** Bed-sharing prevalence was found to be 44.7%, with 21.5% reporting that this was intended. Multivariate analyses showed bed-sharing was less likely amongst those with an annual household income above \$AUS104, 000 (OR 0.72; 95% CI 0.54–0.96) and more likely amongst mothers who breastfed (OR 1.71; 95% CI 1.23–2.37). **Conclusions** Bed-sharing prevalence in this population compares closely with the Victorian case series study and a previous cross-sectional study in the state of Queensland, Australia, in 2002. Noted gaps in how families are implementing current recommendations about reducing the risk of SUDI were identified for sleep position, sleep location and the sleep environment. Further consideration needs to be given to addressing these gaps and applying these findings of current bed-sharing practices to the development of infant safe sleeping policy and programs.

**Keywords** Bed-sharing · Sudden infant death syndrome (SIDS) · Infant · Safe sleeping · Sudden unexpected death in infancy (SUDI) · Triple risk model

## Significance

*What is already known on this subject?* The evidence continues to emerge about the relationship between sudden unexpected death in infancy (SUDI) and the way an infant sleeps. Providing consistent and evidence-informed recommendations on how best to sleep infants is an ongoing challenge. Bed-sharing has been identified as a risk factor for SUDI and a recent case series study in the State of Victoria, Australia identified that 45.8% of infant deaths occurred when bed-sharing. *What this study adds?* This study is the first in Victoria, Australia, to describe the context in which parents are sleeping their infants in the first few months of life. The prevalence of bed-sharing is 44.7%, a majority of families did not intend to bed-share and those that did intend to bed-share articulated an awareness of SUDI risks. Noted gaps in how families are implementing current recommendations about reducing the risk

✉ H. M. Cunningham  
helicun@qec.org.au; helen.m.c@bigpond.com

H. Vally  
H.Vally@latrobe.edu.au

L. Bugeja  
lyndal.bugeja@monash.edu

<sup>1</sup> Child, Family and Community Nursing, Queen Elizabeth Centre, 53 Thomas Street, Noble Park, VIC 3174, Australia

<sup>2</sup> School of Psychology and Public Health, College of Science, Health and Engineering, La Trobe University, 215 Franklin Street, Melbourne, VIC 3000, Australia

<sup>3</sup> Health Law and Ageing Research Unit, Department of Forensic Medicine, Monash University, Division of Academic Programs, Victorian Institute of Forensic Medicine, 65 Kavanagh Street, Southbank, VIC 3006, Australia

<sup>4</sup> School of Nursing and Midwifery, Monash University, Clayton Campus, Level 3, 35 Rainforest Walk, Wellington Road, Clayton, VIC 3800, Australia

of SUDI were identified for sleep position, sleep location and the sleep environment.

## Objectives

Providing the safest environment for infants every time they sleep is a global public health priority. The body of international research on SUDI is often described through the ‘triple risk model’, which highlights the multifactorial nature of these deaths (Kinney and Thach 2009). This model translates the evidence into three key areas of risk: (i) *the vulnerable infant*, which includes prematurity, low birth weight, illness, gender and genetics; (ii) *the critical developmental period*, which is in the first 6 months of life, with a peak at 2–4 months and few babies dying in the first month (Trachtenberg et al. 2012) and (iii) *outside stressors*, which include sleep position, bed-sharing, sleep environment, smoking and substance use by parents, which are also referred to as modifiable risks (Kinney and Thach 2009).

While not all causes of SUDI are known, the incidence of SUDI has reduced significantly since targeting the modifiable risks (Mitchell and Blair 2012). The worldwide ‘Back to Sleep Campaign’, which promoted placing babies on their backs for all sleeps, has been regarded as the largest single intervention program to be associated with the dramatic reduction in the incidence of SUDI (Mitchell and Blair 2012; Moon et al. 2007). Since the introduction of this Campaign in the late 1980s, there has been an 83% reduction in SUDI deaths in Australia (SIDS and Kids 2014). Despite this reduction, SUDI remains the leading cause of infant death in Australia and continues to be a key public health priority (SIDS and Kids 2014; Australian Bureau of Statistics (ABS) 2014; Moon et al. 2007).

While consistent messages relating to ‘Back to Sleep’ have been adopted, attempts to provide consistent messages relating to bed-sharing have not. Bed-sharing is defined as *bringing baby onto a sleep surface when co-sleeping is possible, whether intended or not* (United Nations International Children’s Emergency Foundation (UNICEF) 2013; International Society for the Study and Prevention of Perinatal and Infant Death (ISPID) 2013). The recognition of bed-sharing as a modifiable risk factor has resulted in two distinct approaches to infant safe sleeping recommendations ‘risk minimisation’ and ‘risk elimination’ (Mitchell and Blair 2012; Fetherson and Leach 2012; McIntosh et al. 2009; Ball 2009). The risk minimisation approach recognises that it is not bed-sharing itself but the particular circumstances in which bed-sharing occurs, that puts an infant at risk of SUDI (Gettler and McKenna 2010; Mitchell and Blair 2012). Studies that have shown that the risk of SUDI increases when

one or more of the following are present: smoking; drug and alcohol use; exhaustion; and unsafe sleeping environments (Mitchell and Blair 2012; Horsley et al. 2007; Ockwell-Smith et al. 2013). The risk minimisation approach advises that families need to be informed that sleeping an infant in a cot next to the parental bed is the most risk free environment and if they decide to bed-share, intentionally or unintentionally, they need to be aware of the risks involved (Mitchell and Blair 2012).

In Australia professional organisations such as Red Nose (formerly SIDS & Kids) and the Australian College of Midwives follow the United Nations Children’s Funds (UNICEF) recommended approach of risk minimisation (SIDS and Kids 2014; UNICEF 2013; Young et al. 2013).

The risk elimination approach advises it is not worth the risk and families need to be told that the safest place for their infant is in a cot beside the parental bed (Carpenter et al. 2013). In Australia two State Governments have recommended the risk elimination approach (Government of South Australia 2011, Dodd 2012).

These differing approaches have resulted in significant challenges for health professionals advising families on infant safe sleeping practices (Dodd 2012). While the debate about which approach to apply when developing policy and recommendations relating to bed-sharing practice continues, the knowledge gap around how families are sleeping their infants grows (Horne et al. 2013). A recent case series study in Australia that examined 72 sleep-related infant deaths and found that 33 (45.8%) of these deaths occurred whilst bed-sharing (Bugeja et al. 2015).

This study set out to address this gap by describing current infant sleeping practices, determining the prevalence and circumstances in which infant bed-sharing is occurring, and identifying the presence of other SUDI risk factors.

## Methods

### Setting

Victoria is a south-eastern state of Australia, with a population of 5.86 million and 77,427 births in 2013–2014 (Department of Education and Training (DET) 2014). The Victorian Maternal and Child Health (MCH) Service is a free primary health service available to all families with children from birth until school age that focuses on optimal health outcomes (Department of Education and Early Childhood Development (DEECD) 2011). Each year, all newborn infants and their families are provided an initial home visit by a MCH nurse and then linked to a local community based MCH Centre for subsequent care and visits (Department of Education and Early Childhood Development (DEECD) 2009). Since 2009, a Safe Sleeping Checklist, developed

by the State Government in partnership with SIDS and Kids Victoria, has been completed at all MCH home visits (Department of Education and Early Childhood Development (DEECD) 2013). This checklist translates the evidence to safe infant sleeping recommendations for families and currently takes a risk minimisation approach to bed-sharing (SIDS and Kids 2014; Department of Education and Early Childhood Development (DEECD) 2013).

## Study Design

A cross-sectional survey of parents with 8-week old infants attending any of the 79 local government MCH Services, was conducted to explore infant sleeping practices. Parents presenting with their infants for their booked 8-week MCH visit from Monday 6th October until Friday 17th October 2014 were invited to participate in this study. Data were collected via a self-report questionnaire and interpreters were available. In 2013, 71,925 MCH 8-week visits were completed, which equates to an average of 1383 per week. While the MCH Service is voluntary, the participation rate at the 8-week MCH visit in the 2013–2014 year was 96% (DET 2014). Utilising this annual report data, the number of 8-week MCH visits for the defined 2-week period of this study was calculated and 2745 questionnaires distributed across the state.

## Definitions

### SIDS

The sudden and unexpected death of an infant under 1 year of age, with the onset of the lethal episode apparently occurring during sleep, that remains unexplained after a thorough investigation including performance of a complete autopsy and review of the circumstances of death and the clinical history (International Society for the Study and Prevention of Perinatal and Infant Death (ISPID) 2013). SIDS is a subset of SUDI and is a classification of exclusion (International Society for the Study and Prevention of Perinatal and Infant Death (ISPID) 2013).

### SUDI

Sudden Unexpected Death in of an Infant usually occurring during sleep, in which the cause is not immediately obvious. SUDI refers to a broad category of sudden and unexpected deaths, which includes SIDS, infections or anatomical or developmental abnormalities not recognised before death, fatal sleep accidents due to unsafe sleep environments, and

sudden unexpected deaths that are revealed by investigations to have been the result of non-accidental injuries (Red Nose 2017).

## Bed-Sharing

Bringing baby onto a sleep surface when co-sleeping is possible, whether intended or not (United Nations International Children's Emergency Foundation (UNICEF) 2013; International Society for the Study and Prevention of Perinatal and Infant Death (ISPID) 2013).

## Questionnaire Design

A forty-two item questionnaire was designed to measure the prevalence, examine the circumstances of infant bed-sharing and the presence of other known risk and protective factors for SUDI. The final questionnaire was based on a review of the literature and previous tools used (Australian Bureau of Statistics (ABS) 2011; Australian Institute of Health and Welfare (AIHW) 2013; Blabey and Gessner 2009; Blair and Ball 2004; Centers for Disease Control and Prevention 2014; Colson et al. 2013; Young et al. 2007). The questionnaire was structured in four sections: mother/primary caregiver; Baby's birth; baby's health; and baby's sleeping. Bed-sharing was defined within the questionnaire as 'has your baby slept with another person at any time since birth?' with 'another person' being defined as an adult or a child. This was followed by the question 'where did your baby bed-share' with the options floor, bassinet, port-a-cot, adult bed, cot, sofa/couch, single bed and other.

While it is noted that the primary caregiver of the infant may be a mother, father and/or others, they were collectively regarded as 'mothers' in this research. The questionnaire was provided in hard copy and written in English and piloted on ten mothers of varying education and literacy levels.

## Data Analysis

Information from the completed surveys were entered into a Microsoft Excel spreadsheet then exported into the Statistical Package for the Social Sciences (SPSS) for analysis. The full text of the two open-ended questions were transcribed into Microsoft Excel.

Descriptive statistical analysis was performed to report the frequency and proportions for each variable. Demographic and birth data were compared to the most recent available data collected by the Victorian Consultative Council on Obstetric and Paediatric Mortality and Morbidity (Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) 2014). Univariate analyses were used to explore the associations between bed-sharing

and a range of maternal, birth and infant exposure variables. Relative risks, 95% confidence intervals and a p value with level of significance less than 0.05 were applied.

A multivariate analysis of the variables found to be statistically significant associated with bed-sharing in univariate analyses was completed (using backward regression).

## Ethics Approval

Ethics approval was granted from the Faculty Human Ethics Committee, La Trobe University (Application No. FHEC 14/173). Approval to conduct this study within an early childhood setting (MCH Service) was obtained from the Director of the Research, Evaluation and Analytics Branch of the Victorian Department of Education and Early Childhood Development.

## Results

### Response Rate

Of the 2745 questionnaires distributed across Victoria, 1144 (41.7%) were returned completed, with 1126 (41.0%) included in the analysis. Eighteen completed questionnaires were excluded from the analysis as they did not meet the inclusion criteria. Eight as the age of the child was greater than 8 months and ten did not answer the question relating to bed-sharing. Sixty-five of the 79 MCH Services across Victoria returned one of more completed surveys, with an equal distribution across metropolitan and rural services.

### Demographics of Mothers

Mothers' socio-demographic characteristics are summarised in Table 1. Most of these findings aligned with Victorian comparative statistics except for first time mothers who were over represented in this study at 47.1% compared to 33.4% in the Victorian data (CCOPMM 2014). Health Care Cards are issued to individuals/families residing in Australia that already qualify for one of many government allowances that support the disadvantaged (Department of Education and Early Childhood Development (DEECD) 2009; Department of Human Services 2015).

### Infants' Birth Details

Infants' birth details are summarised in Table 2. Birth weights ranged from 773 to 5190 g with the mean birth weight being 3432 g. The average gestation being 39.1 weeks (reported range 25.4–44 weeks).

**Table 1** Mothers'/primary caregiver demographics

| Characteristics of the mother/primary caregiver | n   | %    |
|---|-----|------|
| Age   |     |      |
| Range 16–49 years                               |     |      |
| Median = 32 years                               |     |      |
| Mothers < 23 years                              | 39  | 3.5  |
| First time mother                               | 530 | 47.1 |
| English main language                           | 919 | 81.6 |
| Born overseas                                   | 352 | 31.3 |
| Aboriginal and/or Torres Strait Islander        | 15  | 1.3  |
| Mother's mother born overseas                   | 513 | 45.6 |
| Mother's father born overseas                   | 530 | 47.1 |
| Health care card                                | 294 | 26.1 |
| Highest level of education                      |     |      |
| ≤ Year 11                                       | 98  | 8.7  |
| Year 12   | 153 | 13.6 |
| TAFE  | 226 | 20.1 |
| University—all levels                           | 646 | 57.4 |
| Last 12 months household gross income           |     |      |
| < \$20,799                                      | 65  | 5.8  |
| \$20,800–41,599                                 | 115 | 10.2 |
| \$41,600–67,599                                 | 148 | 13.1 |
| \$67,600–83,199                                 | 127 | 11.3 |
| \$83,200–10,3999                                | 161 | 14.3 |
| > \$104,000                                     | 407 | 36.1 |

### Infants' Health Status

Approximately 20% (n = 209, 19.2%) of infants had at least one illness since birth. These illnesses included chest infections (n = 20, 9.6%), ear infections (n = 7, 3.3%), gastroenteritis (n = 5, 2.4%) and meningitis (n = 2, 0.96%). Amongst the remaining 175 (83.7%) that ticked 'other' a variety of conditions were reported, which included: colds, jaundice, conjunctivitis, skin infections, colic, hernias, hydroceles, cardiac anomalies, and haemangioma.

At the time of the study 970 (86.1%) of the infants had completed their first scheduled vaccinations as per the National Immunisation Schedule for 2 months of age (Australian Government Department of Health 2014). Eight hundred and fifty-three (75.8%) of the infants were breastfeeding exclusively or partially at the time of this 8 weeks MCH visit.

### Infants' Sleeping Environment

Five key areas relating to specifically how the infant was slept were explored and these include the infants sleeping place, room, position, environment and wrapping. The questionnaire asked 'where has your baby usually slept in since birth' with list of options provided and permission to tick

**Table 2** Infants' birth details

| Infants' birth details  | n     | %    |
|-------------------------|-------|------|
| <b>Mode of delivery</b> |       |      |
| Vaginal                 | 742   | 65.9 |
| Caesarean               | 379   | 33.7 |
| Missing value           | 5     | 0.4  |
| <b>Gender</b>           |       |      |
| Male                    | 560   | 49.9 |
| Female                  | 562   | 50.1 |
| Multiple births-twins   | 13    | 1.2  |
| <b>Birth weight</b>     |       |      |
| < 2500 g                | 48    | 4.2  |
| <b>Gestation</b>        |       |      |
| Term                    | 1,035 | 91.9 |
| Preterm (<37 weeks)     | 60    | 5.3  |
| Missing value           | 31    | 2.8  |

more than one. Many infants were reported to have slept in a variety of environments since birth. The bassinet was the most frequently reported sleep location ( $n = 785$ , 69.7%). The cot was the next most commonly reported sleeping location ( $n = 375$ , 33.3%) followed by the adult bed ( $n = 191$ , 17%). Thirty-one (2.8%) were reported to be sleeping on a sofa/couch and 76 (6.7%) reported 'other'. 'Other' responses included pram, bouncer/rocker, co-sleeper/side bed, being held, car capsule, infant carrier, swing, hammock, snuggle bed and bean bag.

The majority of infants 1021 (90.7%) had been placed to sleep on their backs since birth, with 50 (4.4%) reported to have slept on their sides and 30 (2.7%) on their fronts. A total of 79 (7.7%) mothers who reported to have slept their infants on their backs, had also slept their infants prone and/or on their side on one or more occasion since birth.

Approximately 80% ( $n = 888$ , 78.9%) of mothers reported that their infant's sleep environment did not include any additional items. Of those infants that did sleep with additional items these items included: pillow/s ( $n = 90$ , 8.0%), doonas/duvet ( $n = 74$ , 6.6%), toys ( $n = 39$ , 3.5%), sheepskins ( $n = 26$ , 2.3%), cushions ( $n = 17$ , 1.5%) and bumpers ( $n = 14$ , 1.3%). Just over 15% ( $n = 36$ , 16.4%) of responses included combinations of these items. This study identified that a high number of infants were wrapped to go to sleep ( $n = 869$ , 77.2%).

### Infant Bed-Sharing

Almost half ( $n = 503$ , 44.7%) of the mothers indicated that their infants had bed-shared for any period of time since birth. Of these mothers, 390 (77.5%) reported that they had not planned to bed-share, whilst 108 (21.5%) reported that bed-sharing was planned. For the mothers who had

not planned to bed-share, explanations centred on a need to get some sleep and falling asleep by accident. Most of the respondents ( $n = 503$ , 93.4%) stated that bed-sharing occurred in an adult bed. A further 29 (5.8%) reported bed-sharing on a sofa/couch and four sets of twins were identified as sharing a cot.

Bed-sharing frequency varied from every day to just once in the first 8 weeks of life; the most common occurrence being every day ( $n = 147$ , 29.2%). A further 122 (24.3%) reported bed-sharing occurred 2–3 times a week. Bed-sharing duration varied with the most frequent response between 1 and 3 h for each occurrence ( $n = 245$ , 48.7%). Of the 108 (21.5%) mothers who indicated they had planned to bed-share, a much higher number 34 (31.5%), bed-shared for longer than 6 h. The majority of bed-sharing occurred during the night, 315 (62.6%), with the remaining 118 (23.4%) during the day, and 67 (13.3%) reported both day and night.

Four hundred and seventy (93.4%) mothers reported that infants bed-shared with them and 220 (43.7%) with their fathers. A total of 200 (39.8%) infants bed-shared with both their mother and father. Twenty (4.0%) reported bed-sharing with another adult and 18 (3.6%) reported the infant bed-sharing with another child.

Four hundred and ninety-two (97.8%) of mothers that reported bed-sharing described their reasons in an open text response and key themes are summarised in Table 3. Of the mothers who had indicated they intended to bed-share, 106 (98.2%) provided a reason with most expressing bed-sharing as beneficial for baby, mother and family. For the mothers who had not planned to bed-share, the reasons centred more on a need to get some sleep and falling asleep by accident.

### Associations Between Bed-Sharing Behaviours and SUDI Risks

The associations of bed-sharing and a range of maternal, birth and infant variables using univariate analyses are shown in Table 4. Higher infant bed-sharing prevalence was noted for: mothers born overseas, who were 1.39 (95% CI 1.23–1.58,  $p < 0.001$ ) times more likely to bed-share; mothers whose both parents were born overseas, who were 1.15 (95% CI 1.00–1.32,  $p = 0.0440$ ) times more likely to bed-share; mothers holding a Health Care Card who were 1.16 (95% CI 1.01–1.34,  $p = 0.0356$ ) times more likely to bed-share; and mothers breastfeeding who were 1.31 (95% CI 1.10–1.57,  $p = 0.0021$ ) times more likely to bed-share. Significantly lower infant bed-sharing prevalence was noted with mothers whose gross annual household income was greater than \$AUS104,000, compared to mothers of household incomes < \$AUS104,000 (OR 0.84; 95% CI 0.73–0.97,  $p = 0.0170$ ) and those mothers who gave birth via caesarean section, compared to vaginal births (OR 0.82; 95% CI 0.71–0.96,  $p = 0.0105$ ).



**Table 3** Reasons for bed-sharing

| Reasons for bed-sharing                                  | n   | %    |
|--|-----|------|
| Settling and comforting infant                           | 318 | 64.6 |
| Breastfeeding  | 112 | 22.8 |
| Bonding/attachment                                       | 64  | 13.0 |
| Maternal exhaustion                                      | 59  | 12.0 |
| Mother sleeps better                                     | 47  | 9.5  |
| Falling to sleep together after early morning feed       | 37  | 7.5  |
| Baby unwell  | 23  | 4.7  |
| Convenient   | 20  | 4.1  |
| Baby safer   | 16  | 3.2  |
| Cultural   | 12  | 2.4  |
| Not wanting to wake older child                          | 6   | 1.2  |
| Away from home   | 4   | 0.8  |
| Following caesarean                                      | 4   | 0.8  |
| No cot—could not afford, baby came early, awaiting order | 3   | 0.6  |
| Bed-shared in hospital                                   | 2   | 0.4  |
| Post immunisations                                       | 2   | 0.4  |
| Play   | 2   | 0.4  |

Multivariable analyses indicated bed-sharing was found to be less likely amongst mothers with an annual household income above \$AUS on104, 000 (OR 0.72; 95% CI 0.54–0.96) and more likely amongst mothers who breastfed (OR 1.71; 95% CI 1.23–2.37).

## Discussion

A review of infant bed-sharing recommendations in Australia reveals families and health professionals are faced with contradictory messages from ‘remove the risk’ (do not bed share) to ‘minimise the risk’ (address all SUDI risks) (Mitchell and Blair 2012; Fetherson and Leach 2012; McIntosh et al. 2009; Ball 2009). Professional organisations such as Red Nose and the Australian College of Midwives follow UNICEF’s recommend a risk minimisation approach (SIDS and Kids 2014; United Nations International Children’s Emergency Foundation (UNICEF) 2013) while two Australian State Governments have implemented risk elimination policies (Government of South Australia 2011; Dodd 2012). Adding to this

**Table 4** Associations between bed-sharing and maternal and infant variables

| Factors                                  | Bed-sharing [n (%)] | Not bed-sharing [n (%)] | RR     | 95% CI        | p Value |
|--|---------------------|-------------------------|--------|---------------|---------|
| <b>Maternal</b>                          |                     |                         |        |               |         |
| Smoked in pregnancy                      | 23 (44.2)           | 29 (55.8)               | 0.9897 | 0.7241–1.3525 | 0.9480  |
| Smoked since birth                       | 36 (51.4)           | 34 (48.6)               | 1.1629 | 0.9171–1.4747 | 0.2130  |
| Smoked in pregnancy and since birth      | 22 (48.9)           | 23 (51.1)               | 1.1005 | 0.8102–1.4950 | 0.5399  |
| Aboriginal and/or Torres Strait Islander | 6 (40.0)            | 9 (60.0)                | 0.8952 | 0.4800–1.6695 | 0.7276  |
| Mother born overseas                     | 195 (55.4)          | 157 (44.6)              | 1.3921 | 1.2253–1.5817 | <0.0001 |
| Both mothers parents born overseas       | 214 (48.8)          | 224 (51.3)              | 1.1534 | 1.0038–1.3253 | 0.0440  |
| Mother’s mother born overseas            | 245 (47.8)          | 268 (52.2)              | 1.1354 | 0.9972–1.2928 | 0.0552  |
| Health care card holder                  | 146 (49.7)          | 148 (50.3)              | 1.1616 | 1.0101–1.3357 | 0.0356  |
| Education ≤ year 12                      | 105 (41.8)          | 146 (58.2)              | 0.9212 | 0.7826–1.0893 | 0.3235  |
| Income < \$20,799                        | 39 (60.0)           | 26 (40.0)               | 1.2000 | 0.9734–1.4794 | 0.0878  |
| Income > \$104,000                       | 170 (41.8)          | 237 (58.2)              | 0.8436 | 0.7336–0.9701 | 0.0170  |
| Age < 23 years                           | 22 (56.4)           | 17 (43.6)               | 1.2710 | 0.9568–1.6885 | 0.0979  |
| First time mother                        | 232 (43.8)          | 298 (56.2)              | 0.9680 | 0.8488–1.1038 | 0.6272  |
| Alcohol since birth                      | 234 (45.7)          | 278 (54.3)              | 1.0398 | 0.9130–1.1842 | 0.5566  |
| Medications                              | 150 (46.0)          | 176 (54.0)              | 1.0412 | 0.9040–1.1992 | 0.5754  |
| Breastfeeding at 8 weeks                 | 405 (47.5)          | 448 (52.5)              | 1.3156 | 1.1046–1.5669 | 0.0021  |
| <b>Infant/birth</b>                      |                     |                         |        |               |         |
| Male                                     | 248 (44.3)          | 312 (55.7)              | 0.9799 | 0.8604–1.1160 | 0.7592  |
| Premature (<37weeks)                     | 35 (51.5)           | 33 (48.5)               | 1.1567 | 0.9092–1.4714 | 0.2359  |
| Low birth weight (<2500 g)               | 24 (50)             | 24 (50.0)               | 1.1253 | 0.8414–1.5048 | 0.7960  |
| Caesarean                                | 149 (39.3)          | 230 (60.7)              | 0.8264 | 0.7140–0.9564 | 0.0105  |
| Admission to NICU/SCN                    | 60 (40.5)           | 88 (59.5)               | 0.8971 | 0.7293–1.1035 | 0.3040  |
| Multiple birth                           | 7 (53.8)            | 6 (46.2)                | 1.2072 | 0.7267–2.0054 | 0.4672  |
| Two month immunisation completed         | 429 (44.2)          | 541 (55.8)              | 0.8845 | 0.7403–1.0568 | 0.1766  |
| Illness since birth                      | 105 (50.2)          | 104 (49.8)              | 1.1594 | 0.9917–1.3554 | 0.0636  |

mismatch is a lack of clarity of just how families are placing their infants to sleep.

This study described current infant sleeping practices, including bed-sharing, in one Australian State, Victoria. The prevalence of bed-sharing was found to be 44.7%, which aligns closely with 45% in a previous study in the State of Queensland in 2002 and 45.8% among infant sleeping deaths reviewed by the Coroners Court of Victoria in (Bugeja et al. 2015; Young et al. 2007).

In this study, the majority of bed-sharing occurred with mothers, in an adult bed and at night. Bed-sharing frequency varied from every day to just once in the first 8 weeks of life and 245 (48.7%) mothers indicated their infants' bed-shared on average between 1 and 3 h for each occurrence. A much higher proportion of mothers bed-shared by accident in this study, with 390 (77.5%) mothers noting that bed-sharing was not planned. Mothers reported how things did not go to plan after the birth of their infant, with 422 (84%) describing a need for sleep, trying to comfort and settle their infant, and unintentionally falling asleep with their infant. Other studies have found similar differences (Ball 2009; McKenna and Volpe 2007). A total of 331 (78.5%) of these mothers who did not plan to bed-share had one or more known SUDI risk factors present. The difference between 'the plan' and the reality is an important understanding when developing infant safe sleeping messages, as recommendations cannot be led by what parents plan to do (Bugeja et al. 2015).

A concerning finding was that 29 (5.8%) mothers reported bed-sharing with their infants on a sofa/couch and a majority of these mothers (26; 89.7%) reported this was unintended. Falling asleep on a sofa/couch with an infant, whether intended or not, is a considerable risk for SUDI and the risk of death is up to eighteen times higher (United Nations International Children's Emergency Foundation (UNICEF) 2013; Horne et al. 2013). Infants have died in situations where parents have tried to avoid bed-sharing and fallen asleep sitting on a sofa/couch (Blair et al. 2009). Recommendations relating to safe sleeping practices need to go further than just saying do not bed-share on a sofa/couch, but need to consider how to avoid putting families in this situation (Blair et al. 2009).

While bed-sharing on an adult bed may be considered a safer option than on a sofa/couch, it is also with its risks (Beal and Byard 2000). With most adult beds being raised off the floor, bed-sharing on these elevated surfaces adds the risk of infant falls (Beal and Byard 2000). In response, parents have moved the beds against a wall or put their infant between them, which both have increased the risk of SUDI (Beal and Byard 2000). Keeping the mattress on the floor is considered a safer option and in this study 17 (3.4%) infants were reported to be bed-sharing on mattresses on the floor. The recent case series study in Victoria observed no infants

bed-sharing on mattresses placed on the floor (Bugeja et al. 2015).

Of the 17 (3.4%) who reported bed-sharing location as 'other', 10 (58.8%) described the use of a portable sleep space including co sleepers, side sleepers and Pepi-Pod®. The Pepi-Pod® is a low cost, portable infant sleep box transformed into an infant bed that is placed in an adult bed (Cowan et al. 2013). Published research evaluating their use is limited (Red Nose 2017). An evaluation of the Pepi-Pod® program introduced in New Zealand has found it to be acceptable to parents, correctly used and enabled infants to safely bed-share (Cowan et al. 2013). The first Australian trial of Pepi-Pods® is currently underway in Queensland among the Aboriginal and Torres Strait Islander populations (Young et al. 2013; Red Nose 2017).

Infant care practices and ethnicity are closely related and a recent study described how South Asian families living in the United Kingdom had a lower rate of SUDI than white British families (Ball et al. 2012). This previous study found that South Asian families were more likely to bed-share with their infants and their infant care practices were protective by addressing other SUDI risks including maternal smoking, alcohol consumption, drug use and sofa sleeping (Ball et al. 2012). We observed higher infant bed-sharing prevalence among mothers born overseas and mothers whose parents were born overseas. This finding was highly significant in the univariate analyses, however dropped out in the multivariable analyses. Further exploration of parental practices and ethnicity would be beneficial.

Multivariable analyses indicated two variables were significantly associated with bed-sharing. Bed-sharing was found to be less common amongst mothers with an annual household income above \$AUS104,000, with the odds of bed-sharing in these high earners 0.72 times the odds amongst mothers who earned under \$AUS104,000. 226 (95.4%) of these high-income mothers slept their infants in a bassinet and/or cot in this study. Bed-sharing was also observed to be significantly more likely among mothers who breastfed, with breastfeeding mothers 1.71 times higher odds of bed-sharing. This finding is supported in the literature where mothers who breastfed were found to be three times more likely to bed-share than mothers who were formula feeding (Blair 2010). When mothers were asked in this study why they bed-shared, 22.8% (n = 112) responded to facilitate breastfeeding.

Bed-sharing prevalence was also found to be significantly lower among mothers who gave birth via caesarean section (n = 149, 39.3%) compared to mothers that gave birth vaginally (n = 230, 60.7), with a risk ratio of 0.83. Although this association did not remain significant in the multivariate analysis, this finding appears consistent with other studies that describe the mobility limitations of mothers who had a

recent caesarean section and impact on infant care and physical activity (Ball 2009; Tully and Ball 2012).

Observations from this study go beyond the determination of prevalence and circumstances of bed-sharing and provide valuable insight into infant sleeping practices. Swaddling or wrapping is considered a common and traditional practice for settling and soothing the infant (Horne et al. 2013). In this study this is affirmed with 869 (77.2%) of mothers answering yes to the question 'Do you usually wrap your baby'.

Exploration of the infant sleeping environment identified that current and seemingly well-established infant safe sleeping messages are not being fully implemented by families with noted variances in practice in relation of infant sleep position, sleep location and the sleep environment. A pressing priority is to explore further professional and parental investment and understandings of current infant safe sleeping recommendations.

Limitations in this study design, including volunteer and recall bias, need to be considered in the context of these findings (Webb and Bain 2011). The sensitivity of this subject matter may result in participants underreporting the presence of SUDI risk factors. Limitations identified within the survey tool included: the question relating to alcohol consumption, did not align consumption with time of bed-sharing and Aboriginal and Torres Strait Islander status was asked of mothers and not fathers.

## Conclusion

With 44.7% of the families' bed-sharing at least once in the first 8 weeks of life, an open, consistent and evidence-based approach to providing bed-sharing recommendations is critical. Exploration of the circumstances of bed-sharing identified that it is a diverse practice, more prevalent in certain populations, often unplanned and in a majority of times occurs in the presence of other known SUDI risk factors. These findings need to be further explored and considered when reviewing, developing and implementing bed-sharing recommendations. Noted gaps in how families are implementing seemingly well-established safe sleeping recommendations relating to sleep position, location and environment were also identified. Further consideration needs to be given to addressing this gap, aiming to explore reasons such as complacency, conflicting advice and/or a lack of knowledge about safe sleeping practices. Key understandings to ensuring that future infant safe sleeping recommendations are appropriately designed and implemented.

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