Using a pacifier to decrease sudden infant death syndrome: An emergency department educational intervention

**Background:** Pacifier use decreases the risk of sudden infant death syndrome (SIDS). An emergency department (ED) visit may provide an opportunistic ‘teachable moment’ for parents. **Objectives:** To test the hypotheses (1) that caregivers were less familiar with the role of pacifiers in sudden infant death (SIDS) prevention than other recommendations, and (2) that an ED educational intervention would increase pacifier use in infants younger than six months, and (3) that otitis media would not occur more frequently in pacifier users. **Methods:** An intervention-group-only longitudinal study in a county hospital ED. We measured pacifier use infants and baseline knowledge of SIDs prevention recommendations in caregivers. We followed up three months later to determine pacifier use, and 12 months later to determine episodes of otitis media. **Results:** We analyzed data for 780 infants. Parents knew of advice against co-sleeping in 469/780 (60%), smoking in 660/776 (85%), and prone sleeping in 613/780 (79%). Only 268/777 (35%) knew the recommendation to offer a pacifier at bedtime. At enrollment 449/780 (58%) did not use a pacifier. Of 210/338 infants aged less than 6 months followed up 41/112 (37%) non-users had started using a pacifier at bedtime (NNT 3). Over the same period, 37/98 (38%) users had discontinued their pacifier. Otitis media did not differ between users and non-users at 12 months. **Conclusion:** Caregiver knowledge of the role of pacifiers in SIDS prevention was less than for other recommendations. Our educational intervention appeared to increase pacifier use. Pacifier use was not associated with increased otitis media.
Title: Using a pacifier to decrease sudden infant death syndrome: An emergency department educational intervention.

Corresponding Author: Paul Walsh, University of California Davis, Department of Emergency Medicine, 4150 V Street #PSSB 2100, Sacramento, CA 95817. Email: pfwalsh@ucdavis.edu

Telephone 1 916 271 1954

Authors:

Paul Walsh (1,2)
Teri Vieth, (2)
Carolina Rodriguez (2)
Nicole Lona (2)
Rogelio Molina (2)
Emnet Habebo (2)
Enrique Caldera (2)
Cynthia Garcia (2)
Gregory Veazey (2)

Affiliations

(1) University of California Davis, Department of Emergency Medicine, 4150 V Street #PSSB 2100, Sacramento, CA 95817.

(2) Kern Medical Center, 1700 Mt Vernon Avenue, Bakersfield, CA 93306

KEYWORDS: Sudden infant death syndrome; pacifier; emergency department; parental education;

INTRODUCTION
In 2005 the American Academy of Pediatrics recommended that caregivers should offer infants between one and six months of age a pacifier (dummy, soother, binky) when putting them down to sleep. The recommendation was based on studies (De-Kun et al. 2005, Fleming et al. 1999, Arnestad et al. 1997, Fleming et al. 1996, Hauck et al. 2003) showing pacifier use is associated with decreased risk of sudden infant death syndrome (SIDS). Pacifier use also mitigates the SIDS risk associated with soft bedding and prone sleeping position. (Task Force on Sudden Infant Death 2005) Our clinical experience suggested that relatively few parents knew the role of pacifiers in SIDS prevention; on the contrary they feared pacifiers increased ear infections or dental problems.

Alcohol abuse and injury prevention research suggest that emergency department (ED) visits represent ‘teachable moments’ during which educational interventions may be disproportionately effective. (Johnson et al. 2007, Williams et al. 2005) In this case, a potentially effective intervention in the ED could be to recommend offering a pacifier at bed time. Although a randomized controlled trial would be ideal, we felt it unethical to randomize some infants’ parents to receive knowledge that could prevent SIDS while withholding it from others.

Instead, we performed an intervention only trial in which we associated new pacifier use with (but could not attribute it to) our intervention and controlled for other variables. We conceptualized the conversion of non-user to user as a combination of infant and family factors, our intervention, overall community knowledge (which could vary with time), and knowledge dissemination as a direct result of our intervention.

We hypothesized (1) that infant caregivers were less familiar with the role of pacifiers in SIDS prevention than other recommendations, (2) that an ED educational intervention would increase
pacifier use in infants aged between one and six months, and (3) that otitis media would not
occur more frequently in infants using pacifiers.

METHODS

Objectives

Primary objective
To compare self-reported primary caregiver knowledge of the recommendation that pacifier use
is associated with decreased SIDS risk with self-reported primary caregiver knowledge of the
recommendations that infants should sleep on their backs.

Secondary objectives
To compare knowledge of the pacifier recommendation with other SIDS prevention
recommendations; namely that infants should not co sleep with parents, should not have
additional blankets or toys in the crib, and that baby should not be exposed to second hand
tobacco smoke.

To determine what proportion of primary caregivers who received the intervention introduced a
pacifier if their infant was aged one to six months and not already using one.

To determine if the occurrence of otitis media, or recurrent otitis media differed between pacifier
users and nonusers during the 12 months following enrollment.

To identify possible associations between caregiver and infant characteristics and knowledge of
the pacifier recommendation.

To identify possible associations between caregiver and infant characteristics and conversion
from pacifier nonuser to user and vice-versa.

Design
We conducted a longitudinal study of an educational intervention between 11/26/2008 and 8/1/2011 including a 12 month period of follow up without additional patient accrual.

**Setting**

The study site was a teaching county hospital with emergency medicine, family practice and OBGGYN residencies serving a mixed rural, suburban and urban population.

**Subjects**

**Inclusion criteria**

All infants younger than 12 months of age and their primary caregivers were eligible. Research assistants (RA) worked four or eight hour shifts including nights, weekends and holidays. Because of potentially non-random gaps in RA coverage we considered our sampling to be convenience rather than consecutive.

**Exclusion Criteria**

Subjects were excluded for refusal of consent, being in foster care or custody.

**Study definitions**

Pacifier use was defined as parentally reported use of the pacifier when the infant was being put down to sleep. Knowledge of a particular recommendation was defined as the primary caregiver affirming that they were aware of the recommendation when specifically asked. When parents were uncertain whether or not they knew about a recommendation the answer was classified as missing. We defined early pacifier discontinuation as discontinuation of pacifier use before six months of age in an infant was a pacifier user at enrollment. Otitis media was defined as parental report of a health care provider diagnosing otitis media. Recurrent otitis media was defined as three or more such episodes.
**Outcome measures**

Our primary outcome measure was the percentage of primary caregivers who reported knowing that offering infants between one and six months of age a pacifier at bedtime decreases the risk of SIDS. Our secondary outcome measures included the percentage of primary caregivers with knowledge of the other SIDS prevention recommendations, the percentage of caregivers who started offering their infant a pacifier, (if that infant was aged one to six months and was not already a pacifier user) and parentally reported occurrences of otitis media at 12 months following enrollment. Our outcome measures for associations between caregiver and infant characteristics and knowledge of the pacifier recommendation and conversion from pacifier nonuser to user were odds ratios (OR).

**Intervention**

The survey and educational intervention were administered by an RA or investigator. The initial survey inquired about pacifier use, parental knowledge of SIDS prevention strategies, household characteristics, and other demographic characteristics. The key SIDS-prevention strategies inquired after were: (a) infants should not sleep in the same bed as their parents; (b) infants should sleep on their back, not prone; (c) stuffed toys, comforters, blankets etc. should not be in the crib; (d) parents should not smoke; and (e) infants between one and six months of age should be offered a pacifier when being put down to sleep. This baseline survey was conducted face to face with the primary caregiver and is included as *Appendix 1*. Prior to implementation, we tested pilot versions to reduce ambiguity.

The educational intervention consisted of the RA discussing SIDS prevention with the parents by explaining the contents of a printed color one-page brochure. Spanish speakers or a telephone
translation service was used for Spanish speaking caregivers. This brochure is shown in Appendix 2. After the intervention, the brochure was given to the parents. RAs were trained with two hours of didactic lectures about SIDS and SIDS prevention. They were also trained in study enrollment procedures using scripts, role play sessions, and by observation of a study investigator. RA training was repeated and reinforced regularly during the study.

Follow-up telephone calls were made at three and 12 months after enrollment. Five attempts at telephone contact were made on different days and at different times for each subject at each time point. If follow-up failed we checked the coroner’s records for vital status. Spanish and English speaking RAs made the follow-up calls. During the three-month follow-up telephone-call, we questioned caregivers about pacifier use and about how many other people they had told of the intervention. At 12-months follow-up, we inquired about the number of episodes of otitis media with which the child had been diagnosed. The initial survey was collected with pen and paper and keyed into a customized Filemaker-pro database (Filemaker Inc, Santa Clara, CA) by RAs. The investigators reviewed all cases for data entry errors. Follow-up data was entered directly into the database during the telephone call.

**Statistical methods**

**Primary outcome**

We compared knowledge of the pacifier recommendation with the back to sleep and other SIDS prevention recommendations using Fishers exact test.

**Secondary outcomes**

We attempted to identify infant, caregiver and household characteristics factors associated with pacifier use. We performed univariate analysis of the variables he variables pacifier use started in
the hospital, NICU stay, primary care provider, primary caregiver, self-described primary
caregiver race/ethnicity, caregiver age, recollection of prior clinic and discharge education,
medical insurance type, number of bedrooms, number of siblings, and their interactions.
Variables with a $p$ value of <0.20 were considered for multivariable modeling. We ultimately
retained only those with a $p$-value of ≤0.05. We used the same approach to identifying factors
associated with knowledge of the pacifier and other recommendations.

We expected that conversion from pacifier non-user to user between one and six months of age
would be a function of (a) infant, caregiver and household characteristics, (listed above) (b)
overall community knowledge of the role of pacifiers which could vary with time (a secular
trend), (c) knowledge spread among caregivers as a direct result of the intervention and (d) our
intervention. We could not directly measure the effect of our intervention without withholding it.
We therefore adjusted for the other factors in the same manner as when attempting to identify and
associated the remaining effect with our intervention.

**Secular trends in overall community knowledge**

We addressed community knowledge by measuring awareness of the role of pacifiers in SIDS
prevention in infants up to 12 months of age and comparing the baseline knowledge of newly
enrolled caregivers in each four month period of recruitment for each recommendation.

**Physical proximity**

We addressed physical proximity by creating two proximity measures defined as the number of
prior participants living within five and 20 minutes driving time. Times were calculated using
Google maps.(Ozimek and Miles 2011)

**Social Proximity**
We addressed the effect of social proximity, as a proxy for social proximity itself, by asking caregivers at follow-up with how many other people had shared the pacifier recommendations. We included the number of people prior subjects reported telling as a variable in our model.

SIDS by definition occurs up to 12 months of age. We included infants up to 12 months of age because we were assessing knowledge of recommendations to prevent SIDS. Because the pacifier recommendation applies only up to six months of age, we limited intervention effect estimates to infants aged less than six months. We included all infants when estimating the effect of pacifier use on the incidence of otitis media.

We calculated the efficacy of the intervention as the proportion of non-users who became users and who were younger than six months old at first follow-up. We performed an intention to treat analysis for those successfully followed up, but whom because of delays in successfully contacting the caregiver, were actually over six months of age at follow-up and a treatment received analysis including those only who were actually under 6 months of age at this follow-up.

We used published estimates of the numbers needed to treat (pacifier use) (NNT) to prevent one death from SIDS to estimate of the number of infants whose caregivers would need to be educated to prevent one death from SIDS.(Hauck et al. 2003)

We compared the prevalence of parent-reported diagnoses of otitis media, and recurrent otitis media (defined as three or more episodes) between pacifier users and never-users with Fisher’s exact test. Some have argued that pacifier use increases the risk for otitis media.(Uhari et al. 1996) Our clinical experience also suggested that this was a concern for some parents. Therefore we felt it important to collect data on otitis media despite the fact that it tends to be more common in children over two years of age than in infants.
We compared the characteristics between those in whom follow up was successful and those in whom it was not. We performed post hoc exploratory analysis of factors associated with conversion from pacifier user to nonuser using univariate analysis and logistic regression.

We managed and analyzed study data using Stata 12 (Statacorp LLP, College Station TX). Kern Medical Center’s institutional review board approved the study. Written informed consent was obtained from the available adult with nearest next of kin.

RESULTS

We enrolled 799 infants. Nineteen patients were excluded for repeated enrollment. One infant died of SIDS and one of pneumonia. Both were pacifier users at baseline. The primary caregiver was usually the mother or grandmother. The median age of mothers (who were sole caregivers) was 24 (IQR 10); grandmothers were in their 40s-50s (median and mean 50 IQR14). Sample characteristics and baseline pacifier use are detailed in Table 1. Patient flow through the study is shown in Figure 1.

Baseline knowledge of SIDS prevention recommendations

Caregiver knowledge of recommendations is in Table 2. Pacifier use was the least well known recommendation, 268/777 (35%), compared with 613/780 (79%) for supine sleeping ($p < 0.001$). Pacifier was also significantly less well known than any other recommendation ($p < 0.001$). African-Americans had consistently poorer baseline knowledge of the recommendations but made up only 8% of the sample. Knowledge of one recommendation was associated with knowledge of the pacifier in univariate analysis. This effect was smaller for advice against smoking which appeared to be known to parents regardless of knowledge of other SIDS prevention strategies. All of these effects were weaker in multivariable analysis. These are shown in Appendices 3 and 4.
Pacifier use

At baseline 331/780 (42%) used a pacifier. Among infants aged less than three and 3-6 months pacifier use was 166/338 (49%) and 71/171 (42%) respectively. Pacifier use was more frequent among younger infants of younger mothers and among those who been given a pacifier in the hospital.

The initiation of pacifier use in the newborn nursery and parental knowledge that pacifiers decrease SIDS were the strongest predictors of pacifier use at enrollment. This suggests that initiating pacifier use in the newborn nursery and telling parents that pacifiers decrease SIDS at that time could be an effective strategy. Increasing infant age decreased the odds of pacifier use (9% per month of life). Older caregivers were also less likely to offer a pacifier (odds decrease 3% for each additional year of age or 26% for each additional 10 years of age). These associations with baseline pacifier use are shown in Table 3. Parents also indicated that advice given personally by a physician was highly influential.

Effect of the intervention

We completed three-month follow-up in 496/780 (64%) patients. The characteristics of those in whom three month follow up failed and was successful are described in Table 5. Those who failed follow up had caregivers who were slightly older and who were less likely to recall being counseled in SIDS prevention strategies either at discharge following birth or in the clinic. These effects disappeared in multivariable analysis. Twelve month follow-up was successful in 391/780 (50%) infants. Follow up tended to be less successful in younger children and with older parents but these effects disappeared in multivariable analysis. Overall pacifier use at three-month follow
up was 192/496 (39%); this comprised younger infants starting and older infants discontinuing pacifier use (Figure 2).

**Intention to treat analysis**

Three month follow-up was successful in 210/338 infants who were aged less than three months at enrollment (i.e. aged less than 6 months at follow-up). We contacted 112 /172 (65%) of previous non users and 98/166 (59%) baseline pacifier users. Of the nonusers 41 (37%) had started using a pacifier at bedtime. Over the same time period, 37/98 (38%) users younger than three months had discontinued their pacifier.

**Treatment received analysis**

Sixty-two infants who were expected to be less than six months of age at three-month follow up were in fact older than six months because of delays in successfully completing follow up. Excluding these infants at three-month follow up; 70/148 (47%) were pacifier users at enrollment. Following the intervention 33/78 (42%) of nonusers has started using a pacifier and 20/70 (29%) had discontinued pacifier use.

Assuming that none of the nonusers would have spontaneously become users without the intervention, and ignoring any reduction in early pacifier discontinuation attributable to the intervention, we estimate the number of non-pacifier-using infants needed to treat (educate caregiver for infants aged <3 months) to gain an additional user is 3, (95% CI 2, 4). The NNT for pacifier use to prevent one case of SIDS was 2,733, yielding an NNT (educational intervention) to prevent one SIDS case of 8,199.(Hauck et al. 2003)
Only infant age was significantly associated with starting pacifier use after the intervention OR 0.77 (95% CI 0.63, 0.94) i.e. the odds of adoption of a pacifier decreased by 23% for each additional month of age. Participants reported telling a total of 947 (median 1, IQR 3), other individuals about the pacifier recommendation. The number of people told by prior participants did not affect any outcome. We were able to calculate physical proximity for 281,250 participant dyads. We found no association between physical distance between a subject and prior participants and pacifier adoption. We found no effect for secular trend measured in four month intervals. None of the other infant, caregiver or household variables tested had any impact on pacifier adoption.

Increasing age was not associated with change in sleeping position but did decrease pacifier uptake.

Factors associated with discontinuing pacifier use were infant age, male gender and not initiating pacifier use in the hospital. (Table 6) Because of the small numbers in this subgroup only two of these three simultaneously maintained a p value of less than 0.05 in multivariable analysis. The models however had similar characteristics and are reported in Table 7. Interestingly, starting a pacifier in the hospital prior to discharge was associated with both with a higher rate of pacifier use, (OR 1.75) and less early discontinuation of the pacifier (OR 0.36) This does suggest an easy intervention, namely starting pacifiers in the hospital. While this may not hinder breast feeding in motivated parents, this may not be the case for less motivated mothers and so this decision may need to be individualized.

At one year follow up parents reported 156 episodes of otitis media in 391 infants (40%) with 35 (9%) having three or more infections and eight parents reporting six or more episodes. Overall,
the prevalence of parent-reported otitis media in ‘never-users’ was indistinguishable from pacifier
users. (Fishers exact test $p = 0.808$). Among never-users there were 18/156 infants with recurrent
(three or more episodes of) otitis media compared with 17/112 among any time pacifier users
(Fishers exact test $p = 0.471$). Multivariable regression of the number of episodes similarly
showed no significant relationships between any variable tested.

**DISCUSSION**

Parental knowledge of the role of pacifiers in SIDS reduction was much less than for other SIDS
prevention recommendations. Our educational intervention appeared to increase pacifier use. We
did not see an association between parent-reported otitis media and pacifier use.

Our subjects’ knowledge of other parenting practices known to reduce SIDS was at least as good
as that reported elsewhere among professional child minders and parents. (Moon and Oden 2003,
Moon et al. 2010) Perhaps it is unsurprising that parental knowledge of the role of pacifiers was
less than for the other recommendations; the same is true of health care providers. (Moon et al.
2007, Eron et al. 2011) The better known recommendations substantially predate the
recommendation to use a pacifier. Unlike recommendations against smoking and non-supine
sleeping positions; the pacifier recommendation has been controversial. (Fleming et al. 2006)
Recommendations to use a pacifier compete with some mothers’ and dentists’ fears that pacifiers
will harm infants’ developing mandibles, (Pansy et al. 2008, Vazquez-Nava et al. 2006, Warren et
al. 2005) impair breast feeding, (Howard et al. 2003, Scott et al. 2006) or increase otitis media.
(Uhari et al. 1996)

Educational interventions addressing bed sharing, smoking, and sleeping position have been
shown to be effective in changing parental behavior, (Rasinski et al. 2003, Gibson et al. 2000,
Moon et al. (2004) and epidemiological studies show community-wide education decreases SIDS deaths. (Davidson-Rada et al. 1995, Kiechl-Kohlendorfer et al. 2001) The effect size of our intervention on pacifier use was comparable to that of other educational interventions designed to decrease prone sleeping and bed sharing. (Moon et al. 2004) This is encouraging because the change in behavior occurred in the absence of the expansive multi-pronged approach of other successful SIDS prevention interventions. (Davidson-Rada et al. 1995) Moreover the marginal cost of healthcare providers educating parents during their ED visit is low and is feasible in any setting.

Implementing an intervention such as ours is not a trivial exercise. The very high NNT to prevent one SIDS case reflects the rarity of SIDS. Consistent with studies of the ‘Back to Sleep’ campaign, we found during our discussions with parents that they especially value physicians’ advice. Further study to determine the efficacy and costs of an opportunistic targeted approach by emergency physicians is warranted. (Willinger et al. 2000) We speculate that individual emergency physicians discussing SIDS prevention strategies, and specifically discussing the role for pacifiers during the history taking, would incur minimal marginal cost and would be much more efficient. This does not detract from the role of primary care providers in instructing parents regarding SIDS prevention strategies.

Limitations

This study has limitations. We assumed new pacifier use was a result of our intervention and discounted delayed pacifier discontinuance that might have resulted from our intervention. This assumes that parents would not discontinue pacifier use as a result of our intervention. We feel...
that this is a reasonable assumption. The ideal approach would be to randomize parents to receive this SIDS risk reduction information or not. We felt that withholding information that is known to decrease SIDS to measure the effectiveness of our intervention would be unethical. Even if we were to accept that not providing this information amounted to ‘usual care’ we would still have had to obtain consent from ‘usual care’ patients in order to perform the initial and follow-up surveys. Parents might well inquire why pacifier use was being asked after; and would likely be unimpressed if they were being assigned to ‘usual care’, and that we that intended to withhold lesser known but consistently effective pacifier recommendations to prevent SIDS. It is difficult to conceive how a study design that willfully withheld such information from parents would not damage the trust between researchers and their community. This would be particularly the case should a SIDS case occur in a non-pacifier using infant in the control group. We addressed this limitation as best we could by controlling for other factors that may affect caregiver knowledge.

Our analysis of factors associated with adoption and early discontinuation of pacifier was limited by small numbers despite our large overall sample size. Nonetheless our findings that older age decreases pacifier uptake and increases pacifier discontinuation seems reasonable. Moreover we also identified a modifiable risk factor for early discontinuation which was the same as for actual use suggesting internal consistency in our findings. We accepted parental reports as being accurate. However we had no way to verify the veracity of their statements or of actual pacifier use or actual otitis media. We also did not quantify beyond “yes” or “no” for knowledge of each SIDS prevention recommendation. These would however tend to bias our comparisons of caregiver knowledge of different recommendations to the null.

We standardized the time to follow-up rather than choosing to follow-up when the child was aged six months. This facilitated assessment of the intervention but was less patient centered. We relied on caregiver reporting and recall of outcomes. Because we used only a single site, external
validity is unproven. Nonetheless our finding that parental knowledge of other SIDS recommendations was similar to that reported by other investigators supports the external validity of our findings. (Gibson et al. 2000) Our study was powered to demonstrate increased pacifier adoption not a decreased SIDS rate. We did not measure changes in the adoption of other recommendations. Collecting this additional comparative data would have lengthened the interview process and potentially decreased caregiver cooperation. We also had difficulty completing follow-up, a common difficulty in patient populations such as ours. There were some differences between those in whom follow up succeeded and failed. Caregivers in whom follow up failed were less likely to recall receiving SIDS prevention education in either the clinic or the hospital; they were also slightly older. However these differences did not persist in multivariable analysis. Finally, we had to rely on a simple pamphlet without the benefit of language optimization which could have increased efficacy. (Buller et al. 2000)

CONCLUSION

Parental knowledge of the role of pacifiers in SIDS prevention was modest and much less than for other recommendations. Starting a pacifier during prior to hospital discharge after birth was associated with greater use and lower discontinuation rates in the following year. Our broadly targeted ED-based educational intervention was labor intensive but appeared successful in increasing pacifier use. Pacifier use was not associated with increased otitis media.
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Figure 1

Patient flow through the study.
Figure 2

Pacifier uptake and discontinuance rates by age group.
Table 1 (on next page)

All tables in single file to prevent separation of tables titles and legends
| Age | Total sample (in months) | Number | (%) | Median | IQR |
|-----|--------------------------|--------|-----|--------|-----|
| Age | Total sample (in months) | 780 | 3.9 | 6.28 |
| Primary Caregiver | | | | |
| Mother Alone | 608 | 78 |
| Mother & Father | 29 | 4 |
| Grandmother Alone | 15 | 2 |
| Grandmother & Mother | 90 | 11 |
| Other | 38 | 5 |
| Father alone | 0 | 0 |
| Insurance | | | | |
| Medi-Cal | 656 | 84 |
| Private | 22 | 3 |
| Uninsured | 32 | 4 |
| Declined to answer | 70 | 9 |
| Pacifier use | (Younger 6 months at enrollment) | 509 | 65 |
| Uses Pacifier when sleeping | | | | |
| Never | 271 | 53 |
| Sometimes | 166 | 33 |
| Usually | 30 | 6 |
| Always | 42 | 8 |

**Table 1.** Description of infants, caregivers and their households. Description of infants, caregivers and their households. Medi-Cal is Medic-Aid in California.
| Recommendation                        | Overall | First Child | ≥3 children | Carer ≤35 y | Carer >35y |
|--------------------------------------|---------|-------------|-------------|-------------|------------|
|                                      | n       | (%)         | n (%)       | n (%)       | n (%)      |
| Not to sleep in same bed as an adult | 469/780 | 60          | 116/185     | 124/21458   | 339/660    | 80/119     | 67 |
| Infant to sleep on his back          | 613/780 | 79          | 143/185     | 166/21478   | 518/661    | 95/119     | 80 |
| No blankets, stuffed toys            | 589/776 | 76          | 136/184     | 158/21374   | 500/657    | 89/119     | 75 |
| Caregivers should not smoke          | 660/776 | 85          | 166/183     | 178/21384   | 566/657    | 96/119     | 81 |
| Offer infant pacifier to sleep       | 268/777 | 35          | 64/184      | 76/21336    | 223/658    | 45/119     | 38 |

Table 2. Baseline knowledge of recommendations by primary caregivers.
| Variable                                           | Odds Ratio (95% CI) |
|---------------------------------------------------|----------------------|
| Infants’ age (per month)                          | 0.91 (95% CI 0.87 - 0.95)** |
| Caregivers’ age (per year)                        | 0.97 (95% CI 0.95 - 0.99)** |
| Ratio of bedrooms to children                     | 1.28 (95% CI 1.08 - 1.53)** |
| Given pacifier in the hospital                    | 1.75 (95% CI 1.28 - 2.40)** |
| Knew pacifier recommendation                      | 1.39 (95% CI 1.01 - 1.92)* |

**Table 3.** Factors associated with pacifier use at enrollment *p<0.05 **p<0.01. CI, confidence interval. Ratio of bedrooms to children includes primary caregiver’s bedroom
| Factor                        | Level                  | Follow up failed | Followed up | p  |
|------------------------------|------------------------|------------------|-------------|----|
| Male                         |                        | 284              | 496         |    |
| Age, median (IQR)            | months                 | 3.9 (1.2, 7.0)   | 3.91 (1.2, 8.0) | 0.29 |
| Method of feeding at enrollment | bottle                 | 163 (65.7%)      | 302 (61.8%) | 0.66 |
|                              | bottle & solids        | 1 (0.4%)         | 2 (0.4%)    |    |
|                              | breast                 | 29 (11.7%)       | 53 (10.8%)  |    |
|                              | breast and bottle      | 55 (22.2%)       | 131 (26.8%) |    |
| Had NICU stay                |                        | 48 (19.3%)       | 106 (21.5%) | 0.47 |
| Number of bedrooms, median (IQR) | 2.5 (2, 3)            | 2.5 (2, 3)       |            | 0.20 |
| Number of siblings, median (IQR) | 1 (1, 3)              | 1 (1, 3)         |            | 0.37 |
| Pacifier started in the hospital | No                    | 155 (55.0%)      | 260 (52.6%) | 0.53 |
|                              | Yes                    | 127 (45.0%)      | 234 (47.4%) |    |
| Caregiver age, median (IQR)  | years                  | 23 (20, 30)      | 26 (21, 31)| 0.011 |
| SIDS counseling at discharge | No                     | 134 (47.2%)      | 272 (54.8%) | <0.001 |
|                              | Yes                    | 111 (39.1%)      | 206 (41.5%) |    |
|                              | Missing                | 39 (13.7%)       | 18 (3.6%)   |    |
| SIDS counseling at well baby clinic | No                  | 150 (60.7%)      | 354 (72.5%) | 0.001 |
|                              | Yes                    | 97 (39.3%)       | 134 (27.5%) |    |
| Pacifier user at enrollment  | No                     | 155 (54.6%)      | 294 (59.3%) | 0.200 |
|                              | Yes                    | 129 (45.4%)      | 202 (40.7%) |    |

**Table 4.** Comparison of characteristics of those in whom 3 month follow up was successful and those in whom it failed. NICU; Neonatal intensive, SIDS; Sudden infant death syndrome, IQR; interquartile range. SIDS counseling at discharge; refers to discharge after child birth.
| Factor                                      | Did not stop | Stopped using pacifier | p    |
|--------------------------------------------|--------------|------------------------|------|
| N                                          | 61           | 37                     |      |
| Male                                       | 30 (49%)     | 27 (73%)               | 0.021|
| Age, median (IQR)                          | 1.02 (0.56, 1.69) | 1.32 (0.93, 1.92) | 0.340|
| Age at follow up (months), median (IQR)     | 4.69 (4.10, 5.75) | 5.95 (4.63, 6.71) | 0.008|
| Method of feeding at enrollment            |              |                        |      |
| bottle                                     | 32 (53%)     | 20 (54%)               | 0.980|
| breast                                     | 9 (15%)      | 5 (14%)                |      |
| breast and bottle                          | 19 (32%)     | 12 (32%)               |      |
| Had a NICU stay                            |              |                        |      |
| No                                         | 29 (48%)     | 26 (70%)               | 0.028|
| Yes                                        | 32 (52%)     | 11 (30%)               |      |
| Number of bedrooms, median (IQR)           |              |                        |      |
| No                                         | 3 (2, 3)     | 3 (2, 3)               | 0.750|
| Yes                                        | 2 (0, 3)     | 1 (1, 3)               | 0.930|
| Pacifier initiated in hospital             |              |                        |      |
| No                                         |              |                        |      |
| Yes                                        |              |                        |      |
| Caregiver age, median (IQR)                |              |                        |      |
| No                                         | 24 (20, 30)  | 22 (20, 28)            | 0.480|
| Yes                                        |              |                        |      |
| Missing                                    |              |                        |      |
| No                                         | 22 (36%)     | 12 (32%)               |      |
| Yes                                        | 2 (3%)       | 1 (3%)                 |      |
| SIDS counseling at discharge               |              |                        |      |
| No                                         | 37 (61%)     | 24 (65%)               | 0.910|
| Yes                                        | 22 (36%)     | 12 (32%)               |      |
| Missing                                    | 2 (3%)       | 1 (3%)                 |      |
| SIDS counseling at well baby clinic        |              |                        |      |
| No                                         | 45 (75%)     | 29 (83%)               | 0.370|
| Yes                                        | 15 (25%)     | 6 (17%)                |      |
| Number of bedrooms, median (IQR)           |              |                        |      |
| No                                         | 3 (2, 3)     | 3 (2, 3)               | 0.750|
| Yes                                        |              |                        |      |
| Fed by bottle only (at enrollment)         |              |                        |      |
| 0                                          | 28 (47%)     | 17 (46%)               | 0.940|
| 1                                          | 32 (53%)     | 20 (54%)               |      |

**Table 5.** Comparison of pacifier users who did and did not discontinue use before six months of age. NICU; Neonatal intensive, SIDS; Sudden infant death syndrome, IQR; interquartile range. SIDS counseling at discharge; refers to discharge after child birth.
| Factor                        | OR (95% CI) | p   | OR (95% CI) | p   | OR (95% CI) | p   |
|-------------------------------|-------------|-----|-------------|-----|-------------|-----|
| Pacifier started in hospital  | 0.43 (0.16, 1.10) | 0.079 | 0.362 (0.15, 0.90) | 0.028 | 0.362 (0.15, 0.90) | 0.028 |
| Male                          | 2.50 (0.97, 6.43) | 0.058 | 2.96 (1.17, 7.44) | 0.021 | 2.96 (1.17, 7.44) | 0.021 |
| Age at follow up              | 1.28 (1.04, 1.58) | 0.019 | 1.27 (1.04, 1.55) | 0.017 | 1.27 (1.04, 1.55) | 0.017 |
| Model                         |             |     |             |     |             |     |
| Pseudo R²                     | 0.1228      | 0.002 | 0.094       | 0.002 | 0.098       | 0.002 |
| AIC                           | 1.250       |     | 1.262       |     | 1.256       |     |
| BIC                           | -316.507    |     | -317.854    |     | -318.441    |     |

Table 6. Multivariable models of factors associated with early discontinuation of pacifier. The differences between these models is slight. OR; odds ratio, AIC; Akaike information criteria, BIC; Bayesian information criteria
## Initial Questionnaire

### Primary Caregiver?
- [ ] Mother
- [ ] Father
- [ ] Grandmother
- [ ] Other

### Age of primary caregiver?

### Race of primary caregiver?

### Insurance type

### How many other children in home

### Number of bedrooms

### Baby's birth date (from other screen)

### Clinic Name

### Did baby stay in NICU?
- [ ] yes
- [ ] no
- [ ] missing

### Did nurse/doctor discuss SIDS at discharge?
- [ ] yes
- [ ] no
- [ ] doesn't remember
- [ ] missing

### Has doctor discussed SIDS at checkups?
- [ ] yes
- [ ] no
- [ ] doesn't remember
- [ ] missing

### Which of the following were recommended:

- (4) Baby not sleep with adults?
- (5) Place baby on back?
- (6) No loose blankets?
- (7) No smoking?
- (8) Place pacifier in mouth to sleep?

### Given a pacifier by hospital or doctor?
- [ ] yes
- [ ] no
- [ ] missing

### Does baby have pacifier?
- [ ] yes
- [ ] no
- [ ] missing

### Does baby sleep with pacifier?

### If pacifier used, why?

### If pacifier not used, why?

### How is baby fed?

### RA Entering data

### RA who did the survey
Hello, my name is <your name> and I am a research assistant at Kern Medical Center.
I am trying to reach: .

If person is not reached:
Thank you for your time. We will try another day

If person is reached:
Hi I just had a few questions regarding your last visit to the er with (insert child's name) on . When you came one of our Research Assistants talked to you about Sudden Infant Death Syndrome. I just wanted to know (proceed to ask questions):

(1) How many people did you tell about pacifier use to prevent Sudden Infant Death Syndrome? 
(2) Does your baby use a pacifier now?
(3) If a pacifier is not used during sleep, which of the following is the reason?
   If other, please specify:
(4) Does your baby sleep on its back?

All 5 follow up phone calls failed? [ ] yes [ ] no [ ] missing
Follow up letter sent date: 
Is 3 month follow up successful? [ ] yes [ ] no [ ] missing
Follow up call 1 date RA Name call 1
Follow up call 2 date RA Name call 2
Follow up call 3 date RA Name call 3
Follow up call 4 date RA Name call 4
Follow up call 5 date RA Name call 5
One year Follow Up Phone Survey

Hello, my name is <your name> and I am a research assistant at Kern Medical Center.
I am trying to reach: 

If person is not reached:
Thank you for your time. We will try another day

If person is reached:
Hello, we are calling to thank you for filling in the survey about Sudden Infant Death Syndrome on [date]. This call is to get an update on the information you received. Do you mind taking the time to answer a few more questions?

(1) How many ear infections has your child had?

(2) Did your baby have any episodes of turning blue or stopped breathing since we first told you about the study?

(3) Did your baby die of SIDS?

(4) Has your baby any other medical problems?

   What are they?

(5) How is your child doing overall?

All 5 follow up phone calls failed? 

Follow up letter sent date: 

Is one year follow up successful?

Follow up call 1 date      RA Name call 1
Follow up call 2 date      RA Name call 2
Follow up call 3 date      RA Name call 3
Follow up call 4 date      RA Name call 4
Follow up call 5 date      RA Name call 5

follow_up_questions_one_year

pacifier_f_call_q5_year


• Don’t force your infant to suck on the pacifier
• If you child is being breast fed, wait until he/she reaches one month of age before giving them a pacifier.

Los Chupones y SIDS

Estudios han demostrado que el uso de chupones para bebés 12 meses y menores disminuido el riesgo de SIDS (Síndrome de Muerte Súbita Infantil). Se recomienda altamente que le dé un chupón a su bebé antes de dormir. Pero, no ponga el chupón en la boca de su bebé si ya está dormido son él.

Cosas que se Deben de Observar:
• Use un chupón limpio
• Cambie el chupón regularmente
• No le ponga nada dulce al chupón
• No forcé el chupón en la boca de su bebé
• Espera que su bebé cumpla un mes para usar el chupón si es que le esta dando pecho

Kern Medical Center's Emergency Department research staff tries to educate their patients and the public about ways to reduce Sudden Infant Death Syndrome (SIDS). Please help save the lives of our children by spreading the word about SIDS prevention. Thank you…

El Centro Medico de Emergencia de el Conado de Kern está tratando de educar a pacientes y al publico las maneras de cómo reducir el riesgo de Síndrome de Muerted Súbita Infantil (SIDS). Por favor ayúdenos a salvar la vida de nuestros niños pasando esta información a los demás. Muchas gracias…

Website/Pagina de Internet: www.kmcemmed.edu
What is Sudden Infant Death Syndrome?

Sudden Infant Death Syndrome (SIDS) occurs when an infant younger than one of age suddenly dies from an unknown cause.

¿Que es el Sídrome de Muerte Súbita Infantil?

El Síndrome de Muerte Súbita Infantil (SIDS), también conocido como la muerte de cuna, es cuando un infante de 12 meses de edad ó menos muere repentinamente de causa desconocida.

Sleeping Positions & SIDS Prevention

One of the most important things you can do to help reduce the risk of SIDS is to lay your healthy baby on his or her back when putting him or her to sleep. Do this when your baby is being put down for a nap or to bed for the night. You may also turn your baby’s head to either side.

The American Academy of Pediatrics recommends that babies sleep on their backs unless your doctor instructs you otherwise.

Other ways to reduce the risk of SIDS include:
• Use a crib
• Don’t use props, pillows, or anything else to hold baby in crib
• Avoid overdressing or overheating baby
• Avoid having your baby sleep with you if you are using drugs, alcohol, or cigarettes
• Avoid smoking around baby
• Don’t use alcohol or drugs
* Be sure that anyone caring for you baby knows these guidelines.

Posición Para Dormir y Prevención del SIDS

Una de las cosas mas importantes que usted puede hacer para reducir el riesgo de SIDS es colocar a su bebé sano para dormir boca arriba. Cóloquelo de esta manera cada vez que ponga a su bebé a la cuna para dormir una siesta ó por la noche. Usted puede doblar la cabeza del bebé hacia uno de los lados.

La Academia Americana de Pediatría recomienda que los bebés duerman de esta manera, a no ser que su medico le haya dado otras instrucciones.

Otros modos de reducir el riesgo de SIDS son:
• Use una cuna
• No use almohadas, reclinadores, ó cualquier otra cosa para sujetar al bebé dentro de la cuna
• Evite vestir ó calendar desmasiado al bebé
• Evite que el bebé duerma con usted si usa drogas, alcohol, ó fuma
• No fume cerca de el bebé
• No use drogas ó alcohol
* Asegúrese que todas las personas que cuidan a su bebé sigan estas direcciones.

Best Sleep Position

Make sure your baby goes to sleep on his or her back, as this provides the BEST protection against SIDS.

La Mejor Posición

Asegúrese que su bebé duerma boca arriba. Esto provee la mejor protección contra el SIDS.

Pacifiers & SIDS

Studies have shown that the use of pacifiers for babies 12 months and younger has decreased the rate of SIDS (Sudden Infant Death Syndrome). It his highly recommended that you give your infant a pacifier before a nap or sleep. Do not place the pacifier into your baby’s mouth if they are already asleep without one.

Things to Watch Out For:
• Make sure to use a clean pacifier
• Replace pacifier on a regular basis
• Don’t dip the pacifier into/onto anything sweet
Appendix 3

Univariate analysis of factors associated with primary caregiver knowledge of each of five pacifier prevention recommendations.

**Infant should sleep on his back**

| Factor                              | Did not know | Knew   | p-value |
|-------------------------------------|--------------|--------|---------|
| N                                   | 167          | 613    |         |
| Male                                | 94 (56.3%)   | 337 (55.0%) | 0.76   |
| Age, median (IQR)                   | 3.0 (0.8, 67) | 4.1 (1.3, 7.7) | 0.015  |
| Age of primary caregiver, median (IQR)| 25 (21, 31) | 25 (20, 31) | 0.33    |
| Primary Caregiver >35 years         | 24 (14.4%)   | 95 (15.5%) | 0.72    |
| Started pacifier in the hospital    | 57 (34.1%)   | 304 (49.9%) | <0.001 |
| SIDS counseling at discharge        | 41 (26.8%)   | 276 (48.4%) | <0.001 |
| SIDS counseling in the clinic       | 27 (17.1%)   | 204 (35.4%) | <0.001 |
| Number of bedrooms at home median (IQR) | 2 (2, 3)  | 3 (2, 3) | 0.13    |
| Number of other children, median (IQR)| 1 (0, 3)  | 2 (1, 3) | 0.63    |
| Pacifier user at enrollment         | 63 (37.7%)   | 268 (43.7%) | 0.16    |

**Other recommendations known**

|                          | Did not know | Knew   | p-value |
|--------------------------|--------------|--------|---------|
| Not in bed with adult    | 50 (29.9%)   | 419 (89.3%) | <0.001 |
| No blankets, stuffed animals | 73 (43.7%) | 516 (84.7%) | <0.001 |
| No smoking               | 110 (66.7%)  | 550 (90.0%) | <0.001 |
| Pacifier when sleeping   | 38 (22.8%)   | 230 (37.7%) | <0.001 |

**Infant should not cosleep with an adult**

| Factor                              | Did not know | Knew   | p-value |
|-------------------------------------|--------------|--------|---------|
| N                                   | 310          | 469    |         |
| Male                                | 173 (55.5%)  | 257 (54.8%) | 0.78   |
| Age, median (IQR)                   | 3.4 (1.0, 7.2) | 4.2 (1.4, 7.85) | 0.075  |
| Age of primary caregiver, median (IQR)| 25 (21, 30) | 25 (21, 31) | 0.60    |
| Primary Caregiver >35 years         | 39 (12.6%)   | 80 (17.1%) | 0.089   |
| Started pacifier in the hospital    | 118 (38.2%)  | 242 (51.9%) | <0.001  |
| SIDS counseling at discharge        | 88 (30.1%)   | 228 (53.0%) | <0.001  |
| SIDS counseling in the clinic       | 57 (19.3%)   | 174 (39.6%) | <0.001  |
| Number of bedrooms at home median (IQR) | 3 (2, 3)  | 3 (2, 3) | 0.059   |
| Number of other children, median (IQR)| 1 (1, 3)  | 1 (1, 3) | 0.47    |
| Pacifier user at enrollment         | 130 (41.9%)  | 201 (42.9%) | 0.80    |

**Other recommendations known**

|                          | Did not know | Knew   | p-value |
|--------------------------|--------------|--------|---------|
| Sleeps on back           | 193 (62.3%)  | 419 (89.3%) | <0.001  |
| No blankets, stuffed animals | 183 (59.2%) | 405 (86.9%) | <0.001  |
| No smoking               | 237 (77.2%)  | 422 (90.2%) | <0.001  |
| Pacifier when sleeping   | 78 (25.2%)   | 189 (40.5%) | <0.001  |
### No blankets/stuffed toys in crib

| Factor                                           | Did not know | Knew   | p-value |
|--------------------------------------------------|--------------|--------|---------|
| N                                                | 187          | 589    | 0.34    |
| Male                                             | 98 (52.4%)   | 332 (56.4%) | 0.34    |
| Age, median (IQR) months                         | 3.6 (1.0, 7.1) | 4.0 (1.3, 7.6) | 0.35    |
| Age of primary caregiver, median (IQR) years     | 25 (21, 31)  | 25 (21, 31) | 0.87    |
| Primary Caregiver >35 years                      | 30 (16.0%)   | 89 (15.1%) | 0.76    |
| Started pacifier in the hospital                 | 63 (33.9%)   | 296 (50.5%) | <0.001 |
| SIDS counseling at discharge                     | 46 (26.4%)   | 270 (49.5%) | <0.001 |
| SIDS counseling in the clinic                     | 39 (22.3%)   | 191 (34.4%) | 0.003   |
| Number of bedrooms at home median (IQR)          | 3 (2, 3)     | 3 (2, 3) | 0.97    |
| Number of other children, median (IQR)           | 1 (0, 3)     | 2 (1, 3) | 0.72    |
| Pacifier user at enrollment                      | 64 (34.2%)   | 266 (45.2%) | 0.008   |

### Other recommendations known

| Factor                                           | Did not know | Knew   | p-value |
|--------------------------------------------------|--------------|--------|---------|
| Not in bed with adult                            | 61 (32.6%)   | 405 (68.9%) | <0.001 |
| Sleeps on back                                   | 93 (49.7%)   | 516 (87.6%) | <0.001 |
| No smoking                                       | 99 (53.2%)   | 557 (95.1%) | <0.001 |
| Pacifier when sleeping                           | 38 (20.3%)   | 230 (39.2%) | <0.001 |

### Caregivers should not smoke

| Factor                                           | Did not know | Knew   | p-value |
|--------------------------------------------------|--------------|--------|---------|
| N                                                | 116          | 660    | 0.43    |
| Male                                             | 68 (58.6%)   | 361 (54.7%) | 0.43    |
| Age, median (IQR) months                         | 3.4 (1.0, 6.7) | 4.0 (1.3, 7.6) | 0.23    |
| Age of primary caregiver, median (IQR) years     | 26 (21, 33)  | 25 (20, 31) | 0.064   |
| Primary Caregiver >35 years                      | 23 (19.8%)   | 96 (14.5%) | 0.15    |
| Started pacifier in the hospital                 | 47 (40.9%)   | 311 (47.3%) | 0.20    |
| SIDS counseling at discharge                     | 28 (26.4%)   | 289 (47.1%) | <0.001 |
| SIDS counseling in the clinic                     | 24 (22.0%)   | 207 (33.3%) | 0.020   |
| Number of bedrooms at home median(IQR)           | 3 (2, 3)     | 3 (2, 3) | 0.38    |
| Number of other children, median (IQR)           | 2 (1, 3)     | 1 (0, 3) | 0.21    |
| Pacifier user at enrollment                      | 45 (38.8%)   | 282 (42.7%) | 0.43    |

### Other recommendations known

| Factor                                           | Did not know | Knew   | p-value |
|--------------------------------------------------|--------------|--------|---------|
| Not in bed with adult                            | 46 (39.7%)   | 422 (64.0%) | <0.001 |
| Sleeps on back                                   | 61 (52.6%)   | 550 (83.3%) | <0.001 |
| No smoking                                       | 0 (0.0%)     | 660 (100.0%) | <0.001 |
| Pacifier when sleeping                           | 19 (16.4%)   | 246 (37.4%) | <0.001 |
**Offer a pacifier when putting to sleep**

| Factor                              | Did not know | Knew        | p-value |
|-------------------------------------|--------------|-------------|---------|
| N                                   | 509          | 268         |         |
| Male                                | 272 (53.4%)  | 156 (58.2%) | 0.20    |
| Age, median (IQR) month             | 3.4 (1.0, 7.0)| 5.0 (1.6, 8.3)| 0.001  |
| Age of primary caregiver, median (IQR) years | 25 (21, 30) | 26 (21, 31) | 0.19    |
| Primary Caregiver >35 years         | 74 (14.5%)   | 45 (16.8%)  | 0.41    |
| Started pacifier in the hospital    | 210 (41.5%)  | 151 (56.3%) | <0.001  |
| SIDS counseling at discharge        | 183 (38.4%)  | 133 (54.7%) | <0.001  |
| SIDS counseling in the clinic       | 121 (25.2%)  | 109 (43.3%) | <0.001  |
| Number of bedrooms at home median(IQR) | 3 (2, 3)    | 2 (2, 3)    | 0.17    |
| Number of other children, median (IQR) | 1 (1, 3)    | 2 (1, 3)    | 0.70    |
| Pacifier user at enrollment         | 204 (40.1%)  | 125 (46.6%) | 0.078   |

**Other recommendations known**

| Recommendation                          | Did not know | Knew        | p-value |
|-----------------------------------------|--------------|-------------|---------|
| Not in bed with adult                   | 278 (54.6%)  | 189 (70.8%) | <0.001  |
| Sleeps on back                          | 380 (74.7%)  | 230 (85.8%) | <0.001  |
| No smoking                              | 411 (80.9%)  | 246 (92.8%) | <0.001  |
| No blankets, stuffed animals             | 356 (70.5%)  | 230 (85.8%) | <0.001  |
### Appendix 4. Multivariate analysis of the factors from Appendix 3

| Recommendation known | SIDS counselling at discharge (95% CI) | SIDS counselling at clinic (95% CI) | Started pacifier in hospital (95% CI) | Pacifier user at entry (95% CI) | Effect per bed (95% CI) | Knew Recommendation (A) (95% CI) | (B) (95% CI) | (C) (95% CI) | (D) (95% CI) | (E) (95% CI) |
|----------------------|----------------------------------------|-------------------------------------|--------------------------------------|-------------------------------|------------------------|----------------------------------|------------|------------|------------|------------|
| (A) No cosleeping with adult | 1.57 (1.08, 2.29) | 1.84 (1.21, 2.80) | NS | NS | 1.19 (1.00, 1.41) | Referent | 3.31 (2.14, 5.12) | 2.63 (1.74, 3.98) | NS | 1.45 (1.01, 2.10) |
| (B) Infant to sleep on back | NS | 1.83 (1.11, 3.00) | NS | NS | NS | NS | 3.13 (2.05, 4.76) | Referent | 4.22 (2.67, 6.67) | 1.82 (1.08, 3.10) | NS |
| (C) No stuffed toys/blankets in crib | NS | NS | 1.61 (1.04, 2.49) | 1.60 (1.03, 2.46) | NS | NS | 2.90 (1.88, 4.46) | 3.92 (2.49, 6.18) | Referent | 14.81 (8.73, 25.13) | NS |
| (D) No caregiver smoking | NS | NS | NS | NS | NS | NS | NS | 15.30 (9.51, 24.62) | Referent | 2.10 (1.19, 3.72) | Referent |
| (E) Offer a pacifier when sleeping | 1.53 (1.10, 2.13) | NS | 1.57 (1.14, 2.17) | NS | NS | 1.55 (1.08, 2.21) | NS | 1.78 (1.16, 2.74) | NS | Referent |

Factors with p value <0.2 in univariate analysis were entered into logistic regression models. Ultimately only items with a p value <0.5 and models with satisfactory goodness of fit, acceptable variance inflation factors, and without collinearity were retained.