

Infant safe sleep practices and adherence to the updated AAP recommendations

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Abstract

Background: The aim of the study was to assess maternal trends and adherence to the expanded guidelines of the American Academy of Pediatrics (AAP) on safe sleep environment for infants.

Methods: A prospective survey of mothers was conducted at a tertiary maternity care center in Athens, Greece. Prior to delivery, all women received a parental guide to neonatal safety. Participants completed a questionnaire postnatally and three months post-delivery regarding sleep environment and practices, type of feeding and transportation. In addition, obstetrical factors predisposing to Sudden Infant Death Syndrome (SIDS) in the present and prior gestations were assessed. Possible associations between maternal characteristics and safety factors were investigated.

Results: At baseline, of 91 enrolled neonates, only 34% were placed properly to sleep, 65% used appropriate bedding and 60% would be restrained in an appropriate rear-faced car seat on the way home post-discharge. These practices improved significantly at the three-month follow-up ($p = 0.01$, $p = 0.006$, $p = 0.01$, respectively). However, smoke exposure increased significantly ($p < 0.0001$) and exclusive breastfeeding as well as the use of a firm and hard surface declined ($p = 0.001$ and $p < 0.0001$, respectively). Placing objects in the crib remained unchanged (60%).

Conclusions: Maternal adherence to the AAP guidelines was poor and may benefit from providing education. In this context, health care professionals should make stronger efforts on discouraging hazardous practices including smoke exposure, placing objects within the crib and early discontinuation of exclusive breastfeeding.

Introduction

According to the Centers for Disease Control and Prevention (CDC), approximately 3.500 sudden, unexpected infant deaths (SUID) occurred in 2014 in the United States [1]. The term SUID refers to any sudden, unexpected death in infancy whether interpreted or not. Of all cases, 44% are reported as sudden infant death syndrome (SIDS), 25% as an accident due to entrapment and/or throttling of infants in the crib (ASSB: Accidental Suffocation and Strangulation in Bed) and 31% remain of undetermined etiology. According to the CDC, since 2000, incidents pertinent to the last two categories are increasing probably due to inadequate adherence of caregivers to infant safety measures including avoidance of wrapping the infant with blankets and removal of all objects/toys from the cradle [2]. Conversely, deaths associated with SIDS have decreased. The American Academy of Pediatrics (AAP) published in October 2016 the revised recommendations for the prevention mainly of SIDS during the first months of life, as well as of other factors that could increase the risk of unexpected death (strangulation with bedding, traffic accident, accidents due to trapping and/or impaction of the baby) [1]. Guidelines focus primarily on a safe environment for the sleeping newborn in order to mitigate the risk of death; included guidelines highlighting infants' safe transportation are also of great importance.

Counseling by the health care professionals plays a major role in the promotion and adherence to the above practices. Therefore, the AAP urges nurses, midwives and pediatricians/neonatologists to encourage the implementation of these recommendations by educating all parents

before their discharge from the maternity hospital on the safety of the newborn/infant at home [1].

The aim of the present study was to evaluate parental knowledge of preventive measures regarding newborn safety during sleep, during transportation at home (use of appropriate rear-facing restraints) as well as to evaluate the level of adherence following an educational intervention. Since data on SUID prevalence and prevention are scarce in our country, results from the present study could eventually endorse strategies for the promotion of safe practices for all newborns.

Methods

Study design: A prospective study was conducted in the Neonatal Department, National and Kapodistrian University of Athens at Aretaieio Hospital from March 9, 2017 until May 31, 2017. Aretaieio Hospital is a Baby Friendly Hospital since 2014. The Neonatal Department provides level I and II neonatal care, while newborns requiring level III neonatal

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care are transferred to Neonatal Intensive Care Units of the Public Sector in Attica. The present study was conceived in collaboration with a pediatric faculty, head of the Child Safety Unit at the 2nd Department of Pediatrics, Children's Hospital "P. & Aglaia Kyriakou", National and Kapodistrian University of Athens. A detailed written parental guide to neonatal and infant safety practices based on the AAP policies had been given upon admission and prior to delivery to all women. A purpose-trained hospital physician interviewed all women who delivered Aretaieio Hospital using a structured 52-item questionnaire based on the 2016 AAP recommendations concerning safe sleep infant practices. Mothers were surveyed longitudinally, prior to discharge and at 3 months postpartum by telephone interview from June 2017 to August 2017. The same physician collected data regarding maternal knowledge of sleep practices, as well as parental attitudes concerning sleep environment in previous children of the family, if any. In addition, at the time of the interview, the physician evaluated neonatal sleep position, the presence of objects within the crib, the use of a pacifier and immediately designated any risky behaviors; hence nursing knowledge of SIDS prevention measures in the Neonatal Department was also audited. Maternal and obstetrical factors enhancing the risk of SIDS like smoking, alcohol consumption and the use of recreational drugs during gestation were investigated, not only in the present but also in previous pregnancies.

At the end of the query, all enrolled mothers were provided once again with the AAP guidelines, and within three months the same physician contacted them by telephone to assess adherence using the same questionnaire. All individuals were informed prior to their participation on the purpose of the study and they were reassured about the confidentiality regarding personal information. The study was approved by the institutional review board of both the General Children's Hospital "P. & A. Kyriakou" and Aretaieio Hospital.

Population study

Inclusion criteria: All mothers of neonates born at Aretaieio Hospital during the study period were enrolled in the survey.

Exclusion criteria: Newborns with congenital or neurodevelopmental disorders and severe respiratory disease requiring level III hospitalization were excluded from the study.

Statistical analysis: Data analysis was performed with the use of SPSS version 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was used for participants' demographics such as maternal age, origin, and educational level. Sleep environment of the neonate, during the first interview and at the 3-months follow-up, was evaluated in relation to the AAP revised recommendations including supine infant positioning, hard and firm bed surface, appropriate bedding during sleep, pacifier use, type of feeding and placement of objects into the bassinet. In parallel, obstetrical factors such as tobacco smoking, alcohol and/or illicit drugs use in this gestation as well as during previous pregnancies were reviewed. Chi-square tests were performed in order to compare the difference, if any, in the maternal behavior towards sleep environment at the time of first interview and afterwards at the time of follow-up. In this way, we were able to assess both maternal adherence to the AAP recommendations and the efficacy of our intervention. We also performed a number of adjusted logistic regression analyses to identify possible relation between maternal social background and adherence to the AAP recommendations. The above associations were reported as odds ratio (OR) and 95% confidence interval (CI). A *p*-value of less than 0.05 was considered statistically significant.

Results

Sample characteristics: Eighty-seven mothers were recruited and interviewed within the first three days postpartum. Forty-nine were multiparous (49/87, 56%). Their 91 neonates (4 sets of twins) were also enrolled in the study. Median maternal age was 34 years old (IQR 9 years old, range 21 - 45 years old). Forty-seven women (47/87, 54%) had a caesarian section (CS), 17% for fetal problems (8/47), 14% for failure to progress in labor (7/47) and 11% for malpresentation (5/47). Seventy-four gestations (74/87, 85%) led to uneventful birth with no perinatal complications. The majority of newborns (59%) were females and younger than 4 days old (89%). Of all neonates, 6 were delivered prematurely (7%), 11 (12%) were low-birth-weight (LBW) and 2 were diagnosed with Intrauterine Growth Restriction (IUGR). In 40 of all cases (40/87, 44%), the index child was the second in the family. Pertinent data of all individuals participating in the study are depicted in Table 1.

Sleep conditions and safety practices: Sixty neonates were found lying on the lateral position during the initial interview (60/91, 66%), although in 49 cases (49/91, 54%), their mothers claimed using both supine and lateral infant positioning. Thirty-one newborns were placed properly in the supine position (31/91, 34%). Of the 49 multiparous women who could recall details on previous children' sleep environment, only 8 (8/49, 16%) stated they used to put them on their back during sleep. With regard to the crib's safety features, 67 mothers (77%) responded they had already purchased a mattress appropriately hard and firm and 40 of all multiparous women (82%) had used one in their older children. As for the risk of suffocation and/or strangulation, at the time of interview 32 newborns (35%) were covered with more than one beddings including blankets and non-fitted sheets. Moreover, in 51 cases (51/91, 56%), mothers considered safe enough to place bumpers and diapers within the crib. Comparing to their index child, 21% of multiparous women had used more than one coverings in their other children too and 50% of them used to leave objects within the crib. The use of a pacifier at naptime was planned in the majority of cases, although 15% of mothers who planned exclusive breastfeeding had improperly introduced one immediately after birth. Room sharing was scheduled for at least 6 months and up to the infant's first birthday in 40 of all interviewed families (46%), whereas 24 mothers (28%) did not intend to keep their baby in the same room after the first 6 months of life. Finally, 55 of all newborns (60%) would be restrained in an appropriate rear-faced car seat on the way back to home after hospital discharge, whereas 24 neonates (26%) would be placed in a basket and 4 mothers (5%) reported they would transfer their baby on their lap. Sleep practices during the first interview are summarized in Table 2.

Maternal and obstetrical factors: In total, 78 women (90%) had adequate prenatal care until delivery and 39% of all reported no gestational complications. Similarly to this pregnancy, the vast majority of women (94%) denied the use of tobacco, alcohol or illicit drugs in prior pregnancies as well. Nine mothers (10%) confirmed active smoking during gestation, another 4 (5%) had been consuming alcohol while a 26-year old woman reported positive urine toxicology for marijuana peripartum (Table 2).

Follow-up at three months: At the time of follow-up, we were able to assess 71 mothers and 74 neonates (3 sets of twins), 82% and 81% of the initial sample, respectively. Current practices at this time as well as difference from initial records after birth are described in Table 2. No incident of infantile death was recorded. In seventeen cases (23%), infants had not been sleeping in cribs; 9 out of them were co-sleeping

either with their parents (5 infants), or with their twin brother/sister (2 pairs of twins). Comparing to the first interview, at 3 months a significant higher number of infants (54%) had been placed on the supine position ($p = 0.01$), covered with an appropriate fitted sheet (84%) during sleep ($p = 0.006$) and had been restrained in an appropriate for their age car seat (78%) while on road ($p = 0.01$). Mothers of nineteen infants (26%) declared using both supine and lateral sleep positions, whereas two mothers (3%) opted for prone positioning. In addition, 51% of infants had been exclusively breastfed at 3 months compared to 75% when at Hospital ($p = 0.001$) and 32% more infants had been exposed to tobacco smoke at 3 months, compared to 11% of maternal gestational smoking ($p < 0.0001$). No difference was recorded in room sharing until 6 months, since in the vast majority (96%), cribs or bassinets were kept in the parents' bedroom, in concordance with their initial intent (Table 2). However, at 3 months, 37% of infants were placed on an appropriate firm and hard surface during sleep compared to 78% of the initial sample ($p < 0.0001$) and 60% of interviewed mothers failed to keep objects (blankets, diapers, toys) out of the baby's bassinet. Finally, all but one children (99%) had initiated routine vaccinations according to the national immunization schedule.

Factors associated with adherence to AAP guidelines: Mothers of Greek origin had slightly greater odds of placing their child in an appropriate position for sleep (OR: 3.2, 95% CI: 1.05-9.46, $p = 0.04$) and were less likely to wrap up their babies in several bedding (OR: 3.1, 95% CI: 1.2-7.9, $p = 0.02$) at the time of first interview. Nevertheless, at the 3-month follow-up, there was no significant difference among mothers of different origin neither in supine infant positioning nor in the appropriate bed covering practices (Table 3). Moreover, with regard to the safe sleep position, it was more probable for women having received a higher level of education to comply with the supine infant positioning immediately after birth (OR: 2.9, 95% CI: 1.1 - 7.6, $p = 0.03$) as well as at the 3-month follow-up (OR: 3.4, 95% CI: 1.3 - 9.3, $p = 0.02$). In addition, passive exposure to tobacco smoke at 3 months post-delivery was associated with three maternal characteristics; age ≤ 35 years old (OR: 0.33, 95% CI: 0.2 - 0.9, $p = 0.04$), non - Greek origin (OR: 3.1, 95% CI: 1.2 - 10.1, $p = 0.02$) and lower level of education (OR: 2.9, 95% CI: 1.1 - 7.8, $p = 0.04$). No association was detected between maternal characteristics and exclusive breastfeeding, appropriate timing of pacifier use or placement of objects within the crib. Moreover, mothers who opted for exclusive breastfeeding had greater odds of infant supine

Table 1. Data of the study population

| Sample | 87 mothers / 91 newborns |
|--|--------------------------|
| Age (years) | |
| a. 20 - 35 | 53 (61%) |
| b. > 35 | 34 (39%) |
| Median age of mothers/ Interquartile range | 34 / 9 years old |
| Multiparous women | 49 (56%) |
| Origin | |
| a. Greek | 59 (68%) |
| b. Non- Greek | 28 (32%) |
| Education level | |
| a. Secondary education | 38 (45%) |
| b. Tertiary education (college) | 46 (55%) |
| Gestational age | |
| a. 34 ⁰⁷ – 36 ⁶⁷ weeks | 6 (7%) |
| b. 37 – 42 weeks | 81 (93%) |
| Type of delivery | |
| a. Vaginal | 40 (46%) |
| b. Caesarian section (CS) | 47 (54%) |
| Number of newborns | 91 |
| M/F ratio of newborns | 0.7 |
| Low-birth weight (LBW) neonates | 11 (12%) |

Table 2. Sleep environment and obstetrical factors at the time of interview or antenatally ($t = 0$) and after 3 months

| Sleep environment | $t = 0$ (%) | $t = 3$ months (%) | .p-value |
|--------------------------------------|-------------|--------------------|----------|
| Supine infant positioning | 31 (34%) | 40 (54%) | 0.01 |
| Hard and firm surface | 71 (78%) | 39 (37%) | < 0.0001 |
| Objects in the crib | 51 (56%) | 44 (60%) | 0.6 |
| Appropriate bedding | 59 (65%) | 62 (84%) | 0.02 |
| Room-sharing | 90 (99%) | | |
| • < 6 months | 26 (29%) | | |
| • 6 months – 1 year | 43 (47%) | 71 (96%) | 0.207 |
| • > 1 year | 9 (10%) | | |
| Factors associated with SIDS | $t = 0$ (%) | $t = 3$ months (%) | .p-value |
| Inadequate prenatal care | 9 (10%) | - | - |
| Alcohol consumption during gestation | 4 (5%) | - | - |
| Illicit drugs use | 1 (1%) | - | - |
| Peripartum complications | 13 (14%) | - | - |
| Exposure to smoking | 10 (11%) | 32 (43%) | < 0.0001 |
| Exclusive breastfeeding | 68 (75%) | 38 (51%) | 0.001 |
| Use of appropriate car seat | 55 (60%) | 58 (78%) | 0.01 |
| Immunizations | - | 73 (99%) | - |

Table 3. Factors affecting sleep infant practices

| Factors | Age of mother | | Origin of mother | | Educational level of mother | |
|-------------------------------------|---------------|-------------------------------------|-------------------------|-----------------------------|-----------------------------|---------------------------------|
| | <i>t</i> = 0 | <i>t</i> = 3 months | <i>t</i> = 0 | <i>t</i> = 3 months | <i>t</i> = 0 | <i>t</i> = 3 months |
| Supine position | p = 0.8 | p = 0.6 | Greek (p = 0.04) | p = 0.07 | College (p = 0.03) | College (p = 0.02) |
| Appropriate bedding | p = 0.7 | p = 0.2 | Greek (p = 0.02) | p = 0.2 | p = 0.4 | p = 0.3 |
| Objects in the crib | p = 0.1 | p = 0.3 | p = 0.9 | p = 0.2 | p = 0.2 | p = 0.2 |
| Exposure to smoke | p = 0.4 | > 35 years old (p = 0.04) | p = 0.5 | Non Greek (p = 0.02) | p = 0.5 | Non - College (p = 0.04) |
| Exclusive breastfeeding | p = 0.6 | p = 1 | p = 0.07 | p = 0.6 | p = 0.8 | p = 0.5 |
| Appropriate pacifier use (> 1month) | p = 0.5 | p = 0.8 | p = 1 | p = 0.8 | p = 0.2 | p = 0.5 |

positioning at 3 months than those who have initiated formula (OR = 5, 95% CI: 1.8 - 13.6, $p = 0.002$). Infant smoke exposure was associated with a decreased likelihood of exclusive breastfeeding at 3 months ($p = 0.02$). Nonetheless, neither the delivery type nor prior feeding habits were correlated with breastfeeding trends in the index infant (s). Finally, there was no association between supine sleep position and exposure to smoking ($p = 0.4$) or appropriate sleep position in previous children ($p = 1$).

Discussion

In this survey, we had the opportunity to assess the adherence of the enrolled mothers to the upgraded recommendations of AAP with regard to SIDS prevention and safe infant transportation, during their stay in the Neonatal Department and subsequently at 3 months. In addition, we evaluated the impact of our intervention on maternal trends in terms of infant sleep environment.

Parents are still reluctant to place their babies in the supine position despite continuous efforts, including training programs and campaigns, on the adverse effects of non-supine location in cerebral oxygenation, cardiac autonomic response and body temperature [1,3,4]. Main reasons for non-compliance are infant's comfort and preference as well as the fear of choking, positional plagiocephaly/torticollis and weakness of the muscles of the back [5,6]. Previous studies demonstrated a significant difference between initial intentions regarding proper infant sleep positioning and actual practices that is reflected in the longitudinal observation of mothers' behavior [7,8]. Intriguingly, in the present study we recorded a significant rise in weighted percentage ($p = 0.01$) of infants that were placed to sleep exclusively on their back at 3 months (54%) compared to the initial operations while being in the Hospital (34%). Nevertheless, a non-negotiable proportion of 26% of mothers was still comfortable with both supine and side positioning considering it as more healthy and pleasant for the baby, despite being aware of the dangers of side sleep placement [1]. Factors implicating infant positioning have been previously investigated; maternal age, origin and education, parity, familial perceptions, compliance to other-sleep related recommendations like smoking abstinence and exclusive breastfeeding as well as pediatricians' guidance could be related to parental choices [6, 7]. In our cohort, exclusively breastfed infants were 5-times more likely to be optimally positioned at sleep ($p = 0.002$) than formula-fed babies. Moreover, mothers of Greek origin had greater odds of using the appropriate position at first encounter ($p = 0.04$); women with education above high-school level were also more likely to keep on positioning babies on their back at the age of 3 months ($p = 0.02$). Tobacco smoking within the household, previous habits in the older children or mother's age, were not significantly associated with supine positioning. Even though SIDS contribution to SUID mortality

declines, infant mortality rate attributed to ASSB has been increasing [9,10] since bedding, irrespective of sleep position, increases SIDS risk fivefold. Proposed mechanisms include suffocation due to overlay when excess or loose bedding are used in infants' sleep area, in addition to possible entrapment or strangulation from objects placed within the crib, particularly bumper pads [10-12]. Furthermore, parents' perception that babies feel uncomfortable on a firm, hard surface along with their concern to prevent injuries, promote the use of blankets or pillows as barriers between the sleep surface and the crib railings [1,10]. In our survey, although a statistically significant 19% greater percentage of infants were covered appropriately during sleep at the age of 3 months compared to the initial encounter ($p = 0.02$), 60% of mothers interviewed at 3 months reported still placing objects within the cot including bumper pads, pillows and wedges. Moreover, even though they had been extensively educated on the risk of ASSB during the first encounter, 10% of all enrolled mothers at the time of follow-up, not only had been using improper bedding, but also insisted on the use of wedges as a safe alternative to keep infant in a safe sleep position. No association was found between maternal social background and adherence to safe sleep-recommendations at 3 months.

Both maternal smoking and substance abuse are associated with impaired responses to hypoxic stress among neonates [13]. Antenatal and postnatal maternal cigarette smoking have been allied to various polymorphisms in genes involved in the detoxification of smoke (GSTT1, CYP1A1) [14], thus resulting in dampened arousability and ventilatory response to hypoxia [13,15]. In our study, 11% of all neonates had been exposed to smoking during gestation; Shannon Lange et al. in their meta-analysis in May 2018 estimated that the mean prevalence of smoking during gestation globally and among European nations was 1.7% and 8.1%, respectively [16]. Moreover, at 3 months of age, a significantly greater proportion of infants (43%) was exposed to cigarette smoke ($p < 0.0001$). In addition, smoking exposure influences SIDS risk by implicating other contributors such as breastfeeding duration and parent-infant co-sleeping [17]; nevertheless, we identified only five infants co-bedding with parents (7%) at 3 months, of which only two were exposed to cigarette smoking. Similarly, four women reported alcohol use (5%), with only a single woman admitted to amphetamine-type stimulants abuse (1%) during gestation. These percentages are lower compared to data of the World Health Organization and that of other national surveys [18-20].

Breastfeeding, especially when exclusive, is a strong determinant of postnatal infant mortality [21,22]. Thompson et al. in a meta-analysis concluded that breastfeeding lasting at least two months, even when not exclusive, halves SIDS risk [23]. In this survey, 75% of neonates were exclusively breastfed until being discharged from the Hospital, and hardly 55% of the initial sample maintained exclusive breastfeeding at

3 months ($p = 0.001$). However, the rate of exclusive breastfeeding at 3 months was significantly higher than the recent national estimation of 27.5% [24]. In contrast to the existing literature [25], we did not find any association between maternal characteristics, mode of delivery and breastfeeding duration. However, in concordance with other published data [25,26] infants' passive exposure to tobacco smoke from household members was a negative contributor to long-term exclusive breastfeeding ($p = 0.02$). Finally, at the time of follow-up, more families (78%) had decided to use an appropriate rear-facing car seat for their infants when compared to their initial intention at the maternity center (60%, $p = 0.01$). Nevertheless, in a recently conducted study regarding the use and distribution of car seats among child groups, we had found that rear-facing car seats were significantly disfavored especially among children aged 0-2 years old (18.2%) [27]. Although this difference may be attributed to educational materials provided to mothers at the maternity hospital, additional studies focusing on infant safe transportation in our country are needed in order to confirm these findings and identify other potential factors. The main limitation of the study was response bias; social desirability effect could have shaped participants' answers. Nonetheless, physicians conducted the survey in a neutral and nonjudgmental way by ensuring all individuals that their responses will remain confidential. In addition, study was designed based on the updated AAP recommendations. Therefore, our data is of interest as it provides a well-documented report on the safe sleep conditions and maternal practices with regard to infant safety.

Conclusion

Summarizing our results, we found that following simple physician instructions within 3 months after delivery, more mothers were persuaded of placing their infants in the crib properly with an appropriate fitted bedding and using a rear-faced car seat. However, we observed poor adherence to other recommendations including avoiding placement of objects within the crib and soft sleep surfaces, maintenance of exclusive breastfeeding beyond the neonatal period and prevention of babies' exposure to smoke. Therefore, health care professionals should lead community efforts in developing effective strategies to discourage parental practices incurring significant hazards for their infants.

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Disclosure

The authors declare no conflict of interest.

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