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## GRANDMOTHERS' BELIEFS AND PRACTICES IN INFANT SAFE SLEEP

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### Abstract

**Background**—Sudden infant death syndrome (SIDS) and suffocation are leading causes of infant mortality. Supine sleep position and use of appropriate sleep surfaces reduce SIDS risk but are not universally practiced. Mothers' decisions about sleep position and environment may be influenced by guidance provided by infants' grandmothers and other caregivers.

**Methods**—A survey was conducted of a convenience sample of grandmothers aged 30–70 years who provide care at least weekly for an infant grandchild <6 months old. The survey was distributed through community partners of a university-based research team. Respondents received home safety items as compensation. Analyses focused on the relationship of grandmother demographic characteristics and beliefs on their reported practices related to infant sleep.

**Results**—Among the 239 grandmothers, 45% reported placing infants to sleep supine on an appropriate sleep surface at the grandmother's house, while 58 % reported doing so when the infant was sleeping in the mother's house. After adjusting for other factors, respondents were less likely to adhere to recommended guidelines when they believed supine position increased choking risk (OR 0.34, 95% CI 0.18 to 0.62) or believed infants are more comfortable or sleep longer when on their stomachs (OR 0.51, 95% CI 0.28 to 0.93).

**Conclusions**—Grandmothers do not universally observe evidence-based safe sleep practices, particularly if the infant is not sleeping in the home of the parent. Interventions for senior caregivers focused on perceived choking risk, infant comfort in the supine position, and other recent changes in recommended safety practices are warranted.

### Keywords

infant mortality; infant; sleep; SIDS; SUID; grandmothers

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## BACKGROUND

The infant mortality rate (IMR) in the United States (US) is 5.96 per 1000 (2013)—a rate higher than most other developed countries.<sup>1,2</sup> Sudden Infant Death Syndrome (SIDS) and suffocation account for more than half of all Sudden Unexpected Infant Deaths (SUID) and are among the leading causes of post neonatal infant death in the US.<sup>3,4</sup> The pathophysiology of SIDS is incompletely understood, and is currently framed as a result of multiple risk factors: an intersection between a period of critical newborn development, underlying and often invisible vulnerability in the infant, and external stressors and triggers.<sup>5</sup>

Given the uncertainty about *intrinsic* SIDS risk factors among infants, current risk reduction measures focus on *extrinsic* variables caregivers can control. The American Academy of Pediatrics (AAP) first released a policy recommendation that infants be placed supine to sleep in 1992,<sup>6</sup> and the National Institute of Child Health and Human Development (NICHD) promoted that recommendation with a national “Back to Sleep” (BTS) campaign.<sup>7,8</sup> The SIDS rate fell dramatically over the decade following the BTS campaign<sup>9</sup> but that reduction has since plateaued, and it is unusual for an infant to die of SIDS without known risk factors, reinforcing the need to educate families on multiple strategies to reduce SIDS risk.<sup>10</sup> In addition, many SIDS risk factors are linked to other SUIDs occurring during sleep, including suffocation and entrapment. Thus, in 2011, the AAP expanded its policy to encompass a variety of safe sleep practices that can reduce risk for sleep-related infant death. Recommendations discouraged bed sharing and smoking, and endorsed use of the supine position and appropriate surfaces for all sleep, breastfeeding, and adequate prenatal care.<sup>11</sup> The “Safe to Sleep” (STS) campaign launched in 2012 by NICHD incorporates this expanded perspective on SIDS reduction.<sup>12</sup>

Risk factors for SIDS are complicated by social and economic factors. In the United States, young, poor, and minority women are at elevated risk for SIDS. Lack of prenatal care, low socioeconomic status, smoking, and low birthweight are also associated with increased risk.<sup>13–17</sup> Other factors, including community norms and cultural practices, also impact infant sleep practices. Regardless of the age of a new mother, intergenerational transmission of childrearing practices is common.<sup>18</sup> For economic and other reasons, mothers of newborns often rely on their own mother or other relatives for information and assistance with child care. Several studies have demonstrated the important role of grandmothers and other adult relatives on maternal behavior related to a variety health issues including infant safety and breastfeeding.<sup>19,20</sup> The infant’s grandmother or other caregivers can influence a mother’s decision on sleep position and mother’s beliefs about infant comfort and other myths may also risk reduction.<sup>21, 22</sup>

Given the complexity in these intergenerational relationships, it is important to understand the influence of senior female caregivers. This study seeks to expand knowledge about the factors that shape the decisions and reported behaviors of grandmothers around sleep-related practices for infants. Our approach is grounded in the Theory of Reasoned Action, recognizing that health decision-making is based on a complex interplay of knowledge, attitudes, and beliefs, both personal and normative, related to intent to change behavior and the action itself.<sup>23</sup> We focus on a subset of safe sleep behaviors, specifically

recommendations about supine sleep and sleep location. We were particularly interested in differences between grandmothers' behavior in their own homes compared to the home of the parent, along with whether safe sleep practices were associated with beliefs in common myths about sleep safety.

## **METHODS**

### **Study Design and Population**

We conducted a prospective survey of self-reported behaviors and beliefs about infant sleep. Subjects were eligible for the study if they were current grandmothers aged 30 to 70 years who read English, resided in Arkansas, and were regular (at least once per week) caregivers to a grandchild aged 6 months or younger.

### **Procedures**

After the study protocol was approved by the UAMS institutional review board, we engaged with community partners serving young, low income families for help in distributing study surveys and other materials. These community groups included local health departments, home visiting programs, and health educators in hospitals and clinics in a small city and surrounding county. We mailed each community partner a packet containing flyers to advertise the study, copies of the survey and instructions on providing study materials to potential participants. We also launched an identical online version of the survey using REDCap (hosted at the University of Arkansas for Medical Sciences) which was advertised using the flyers by the community partners and via social media that included websites and Facebook pages.<sup>24</sup> In total, 260 surveys were collected over a 9-month period, of which 102 (39%) were completed on paper and 158 (61%) online. Participants were provided with a home safety kit (cabinet latches, electric outlet covers, door knob covers, home safety literature, etc.) valued at approximately \$20 as compensation for completing in the survey.

### **Measures**

The 36-item survey, which took about 10 minutes to complete, collected demographic information on grandmother, her family characteristics and relationships, the frequency and typical duration of childcare provided, location of the care, and home environment. The surveys also included key data about grandmothers' infant sleep practices when caring for their grandchildren, including usual sleep environment and position, and whether or not grandmother and mother agree on such practices. Additional items were included to determine knowledge about recommended safe sleep practices by both the mother (perceived) and grandmother, and respondent attitudes and beliefs about safe sleep practices, including perceived comfort and choking risk.

### **Data Analysis**

Categorical data were summarized as frequency and percent. Responses about beliefs and opinions were collected on a 4 point Likert scale, dichotomized into disagree (strongly disagree, disagree) vs. agree (agree, strongly agree) for analyses. The association between beliefs, opinions, and family demographics with following sleep position and sleep location recommendations at the grandmother's own home and at the mother's house was analyzed

using a Chi-squared test. Effects were summarized as differences between groups of interest in proportion of grandmothers following recommendations, along with 95% confidence intervals (CI). For predictors with more than two levels, confidence intervals for differences were obtained with respect to the reference group and multiple comparisons were adjusted using the Bonferroni method.

Two separate logistic regression models, one for infant sleeping at the grandmother's house, and one for infant sleeping at the mother's house, were fit to test the simultaneous effect of several predictors on grandmothers following the position and location guidelines.

Associations and beliefs that were significantly associated with safe sleep practices in univariate comparisons were considered for the multivariate model. In addition, the analyses were adjusted for age, race, and education of the grandmother. Income was significantly associated with education and was not included in the multivariate models. The final logistic regression models included the following predictors: grandmother's age (30 to 49 years vs. 50 to 70 years), race (white vs. others), education (high school or below vs. some college or above), grandmother's beliefs about babies choking on their backs, whether babies sleeping on their back are more comfortable or sleep longer, whether they perceive that infant sleep guidelines have changed since they raised children, timeframe of last sleep (nap vs. all night), grandmother's and mother's sleep location. Models were cross-validated using bootstrap resampling to check for overfitting. Then regression coefficients were shrunk after obtaining the optimum penalty factor using penalized maximum likelihood estimation. Effects from the logistic regression models are presented as odds ratios (OR) and 95% confidence intervals. All analyses were performed using the statistical software package R (R Development Core Team, Austria, Vienna).<sup>25, 26</sup> Logistic regression models and validation and shrinkage of models were done using the *rms* package in R.<sup>26</sup> All tests were two sided assuming a significance level of 5%. Tests were adjusted for multiple comparisons wherever appropriate.

## RESULTS

A total of 260 grandmothers (GM) responded to the survey, but 4 responses were deleted due to missing data on multiple predictors. Responses for the primary safe sleep outcome were complete for 239 respondents reporting data about caring for the infant in their own home and 194 respondents reporting about caring for the infant in the mother's home. Missing data were less than 3% for each predictor and responses with missing data on either predictors or outcome were deleted from the multivariate models, resulting in only 222 (grandmother's home) and 178 (mother's home) cases being included in the final regression model.

Table 1 summarizes demographic and family characteristics for the 256 respondents. More than half (58%) of the GM were between 50 and 70 years of age, 61% were of white race, and 30% reported a household income of less than \$30,000 annually. The majority (69%) live in a different house than the grandchild all the time, and most reported caring for the infant fewer than 24 hours a week. Table 2 presents information about sleep location and position, demonstrating that grandmothers report placing infants on adult beds and other surfaces more often (34% of the time) when they are in their own homes rather than at the

home of the infant's mother (9% of the time). There was little difference in sleep position (back, side, or stomach) reported by location of care. There was considerable perceived agreement with the infants' mothers on sleep-related behaviors, with 202 (79%) grandmothers reporting agreement. and 34 (13%) reporting that they had not discussed this issue.

The primary purpose of the study was to determine any association between grandmothers' beliefs/opinions and family demographic characteristics with following key AAP-recommended sleep guidelines when bedding the infant at the grandmother's house and at the mother's house. For purposes of this analysis, the grandmother was considered to be following safe sleep guidelines only if the baby was put to sleep in a crib, portable crib, bassinet, or play yard *and* on his/her back. As shown in Table 2, among 239 grandmothers who reported caring for the infant in their own homes, 107 (44.8%) of grandmothers followed safe sleep guidelines. Among 194 grandmothers who reported caring for the baby in the mother's house, 112 (57.7%) followed these guidelines. While co-sleeping behavior was not addressed directly, 26% of grandmothers reported placing an infant to sleep on an adult bed in their own home, compared to 8% in the mother's home.

The beliefs of the grandmothers also had an effect on their behavior, as shown in Table 3. Grandmothers who believed that babies were more likely to choke while on their backs were significantly less likely to follow safe sleep guidelines compared to other grandmothers. Further, GM who believed infants were more comfortable when sleeping prone were also less likely to comply with recommendations compared to those without this belief. Grandmothers who believed babies sleep longer on their stomach were more likely to follow safe sleep guidelines in either location. There was no significant association between sleep-related behaviors in either location and beliefs about smoking risks and SIDS, bed sharing, and use of blankets in the crib.

Few associations were found between family characteristics and following safe sleep guidelines at grandmother's house and at mother's house. Grandmothers of white race were more likely to follow the recommendations (at GM home: white vs. others, 56% vs. 28%,  $p < 0.001$ ) at mother's home: white vs. others, 67% vs. 41%,  $p < 0.001$ ). No other family characteristics were associated with differences in compliance, including GM educational level, household income, and amount of time the GM cares for the infant.

The results from the multivariate model predicting safe sleep behavior at the grandmother's house are shown in Table 4. The C statistic was 0.79 for both logistic regression models. After adjusting for age, race, education and other beliefs, GM who believe that babies are more likely to choke on their backs are less likely to follow safe sleep guidelines (OR 0.34, CI 0.18 to 0.62). Further, GM who believe that babies sleep more comfortably or longer on their bellies are less likely to follow guidelines when bedding infant at their house (OR 0.51, CI 0.28 to 0.93). Also, GM of white race demonstrated more than twice the odds of following guidelines than those from other racial categories (OR 2.32, CI 1.28 to 4.22). Other predictors were not significantly associated with following guidelines when bedding the infant at the grandmother's house.

Similarly, grandmothers who believe babies choke on their back are significantly less likely to follow guidelines (OR 0.25, CI 0.13 to 0.48) at the mother's house. Also, white grandmothers were twice as likely to follow guidelines when placing their grandchild to sleep at the mother's house (OR = 2.04, CI 1.03 to 4.04). Although GM who believe that babies sleep more comfortably or longer on their bellies were marginally less likely to follow safe sleep guidelines when the infant sleeps at the mother's house, this association was not statistically significant (OR 0.54, CI 0.28 to 1.04).

## DISCUSSION

Although SIDS rates have decreased, sleep-related causes continue to contribute heavily to infant mortality. Use of a supine infant sleep position and appropriate sleep environment for infants has not been universally adopted. In addition to Safe to Sleep and other large scale campaigns, other interventions have been designed to reduce sleep-related deaths among high risk groups. A brief educational intervention delivered to small groups of parents was associated with self-reported safe sleep practices that were sustained through 6 months of life.<sup>27</sup> Other studies in child care settings and intensive home visitation programs have been found effective in addressing some associated risk factors for SIDS, including increasing breast feeding and reducing low birth weight.<sup>28–31</sup> While these programs are effective, they may also be very costly, and lower cost interventions are needed, particularly targeting populations at high risk of SIDS.

Older female caregivers, especially grandmothers, are key sources of influence on the behavior of mothers, and the proportion of children being reared by their grandparents is increasing.<sup>32</sup> It is therefore also important to develop interventions that target this influential group to ensure they are aware of and adherent to the recently changed guidelines. Our exploratory study sought to increase understanding of infant safe sleep-related knowledge, attitudes, and practices of grandmothers.

Our sample of grandmothers who care at least weekly for a grandchild under 6 months of age reported a number of concerning sleep-related behaviors. Fewer than half of the survey respondents reported both use of supine sleep position and an appropriate sleep environment for the infant grandchildren in their care when they were caring for those infants in their own homes, and only 58% did so in the homes of the infants' mothers. Alarming, a quarter of grandmothers placed their grandchildren in adult beds for sleep when caring for the infants in their own homes. The reasons for the lower use of appropriate bed surfaces in the grandmother's own homes may be related to lack of an appropriate crib or bassinette, or may be due to incomplete understanding or adoption of the newer recommendations. This finding merits further review of barriers to having an appropriate sleep surface in any home an infant visits regularly enough to nap or sleep.

In this study, we use logistic regression analyses to test for factors which simultaneously predict grandmothers' following safe sleep guidelines. Failure to adhere to safe sleep recommendations was associated with belief in common myths associated with infant sleep, namely concern over choking in the supine position and perceived infant discomfort with supine sleeping. After adjusting for other factors, grandmothers who worried about choking

were significantly less likely to comply with the recommendations for safe sleep as defined in this study. Those concerned about infant discomfort when on their backs were about half as likely to do so. This is consistent with previous study of mother's decision-making,<sup>22</sup> reinforcing the need for educational interventions to specifically address these and other misconceptions to increase adoption of supine sleep position.

Some demographic groups were also less likely to follow the safe sleep guidelines. White grandmothers had more than twice the odds of compliance when compared to non-white grandmothers. While all mothers and grandmothers need education on this topic, tailored interventions for African-American populations is indicated by our findings and by the higher rates of SIDS and SUID in black infants. Compliance did not vary by family income or education in this analysis.

Our study has a number of limitations. First, we did not consider all of the current AAP recommendations to define a safe sleep environment, but only self-reported sleep position and sleep location. Further study is required to fully characterize the sleep environments used among both high risk and general populations of infants with all facets of the recommended behaviors, particularly with regard to co-sleeping, which has emerged as an important and increasing risk factor for sleep-related death.<sup>33</sup> Additional study validating our survey instrument with observed behaviors is needed and ongoing. Caregivers unable to read English were excluded, leaving better understanding of infant sleep beliefs and behaviors among low-literacy and non-English-speaking infant caregivers undetermined. Another key area this study did not address specifically was barriers to use of safe cribs and other sleep environments for the grandmothers. Missing data limited the number of useful surveys for analysis. Finally, our small, geographically localized, convenience sample may not be generalizable to other populations.

Despite these limitations, our study provides useful hypothesis-generating information to inform planning for safe sleep interventions targeting younger parents who may depend on grandparents for regular care. Intergenerational education tailored to learning styles of older caregivers is also indicated. Further, education should specifically address and dispel common myths about choking and comfort that reduce adoption of supine sleep position. Finally, assessing grandparents' access to safe sleep environments is needed in light of differing sleep practices in the homes of grandparents rather than the primary homes of the mothers.

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**What is already known on this subject**

- Safe sleep guidelines designed to reduce the risk of sleep related infant mortality are not universally followed.
- Grandmothers have strong influence on mothers' decisions regarding safe sleep.

**What this study adds**

- Grandmothers who regularly care for infant grandchildren report low compliance with safe sleep recommendations, particularly when caring for infants in their own, rather than the mother's home.
- Grandmothers with concerns about infant choking or comfort were less likely to comply with recommendations.
- Educational efforts directed at grandmothers are warranted and should focus on both general education about evidence-based guidelines and dispelling myths that may decrease uptake of key messages.

**Table 1**

Demographic characteristics of survey respondents.

<b>Demographics (n=256)</b>	<b>Number (%)</b>
Age (years)	
30–49	104 (42%)
50–70	146 (58%)
Race	
White/Caucasian	156 (62%)
Black/African-American	86 (34%)
Other	8 (3%)
Education	
High school graduate or below	66 (26%)
Some college or above	185 (74%)
Household income (\$)	
< 30,000	61 (30%)
30,000	143(70%)
Lives with Grandchild	
Same house all the time	50 (20%)
Same house some of time	30 (12%)
Different house all the time	175 (68%)
Cares for Grandchild (hours/week)	
1–8	106 (42%)
9–24	62 (24%)
24–48	43 (17%)
> 48	43 (17%)

**Table 2**

Reported sleep-related behavior of grandmothers when infant sleeps at the grandmother's house and at the mother's house.

Reported sleep-related behavior	Number (%)	
	Infant sleeping at Grandmother's house (n=239)	Infant sleeping at Mother's house (n=194)
Sleep location by Grandmother		
Adult bed	63 (25%)	15 (7%)
Crib, portable crib, playpen, play yard	160 (66%)	184 (90%)
Couch or chair	9 (4%)	2 (1%)
Other	11 (5%)	3 (2%)
Sleep position by Grandmother		
On Back	144 (60%)	120 (62%)
On Side	58 (24%)	45 (23%)
On Stomach	40 (17%)	29(14%)
Meets safe sleep criteria <sup>†</sup>	107 (44.8%)	112 (57.7%)

<sup>†</sup>Safe sleep was defined for purposes of this study as infant sleeping in a crib, portable crib, playpen, play yard *and* on his/her back.

**Table 3**Proportion of respondents reporting compliance with safe sleep criteria <sup>†</sup> by beliefs of grandmother

Grandmother's Belief	Proportion meeting safe sleep criteria	
	Infant sleeping at Grandmother's house N (%)	Infant sleeping at Mother's house N (%)
Dangerous for babies to bed share		
Disagree	14 (41%)	15 (62%)
Agree	93 (46%)	97 (58%)
Babies sleep more comfortably/longer on back <sup>**</sup>		
Disagree	87 (56%)	88 (70%)
Agree	20 (24%)	24 (35%)
Babies likely to choke on back <sup>**</sup>		
Disagree	90 (58%)	93 (73%)
Agree	16 (20%)	18 (28%)

<sup>†</sup> Safe sleep was defined for purposes of this study as infant sleeping in a crib, portable crib, playpen, play yard and on his/her back.

\* p = 0.05

\*\* p < 0.001

**Table 4**

Multivariate logistic regression analyses predicting grandmother following safe sleep practices<sup>†</sup> when infant sleeping at grandmother's and mother's house.

Predictor	Safe sleep practices followed At Grandmother's house (n=222)	Safe sleep practices followed At Mother's house (n=178)
	OR (95% CI)	OR (95% CI)
Characteristics of Grandmother		
Age (years)		
30 to 49	–	–
50 to 70	1.18 (0.68, 2.05)	1.35 (0.71, 2.55)
Race		
Others	–	–
White	2.32 (1.28, 4.22) <sup>*</sup>	2.04 (1.03, 4.04) <sup>**</sup>
Education		
High school graduate or below	–	–
Some college or above	1.16 (0.62, 2.15)	0.99 (0.5, 1.95)
Lives with grandchild		
Same house all of the time	–	–
Same house some of the time	0.68 (0.35, 1.32)	0.66 (0.31, 1.43)
Separate houses all of the time	0.53 (0.24, 1.18)	0.45 (0.18, 1.12)
Baby sleep timeframe		
For a nap	–	–
For the night	1.07 (0.58, 1.97)	0.84 (0.42, 1.67)
Beliefs of Grandmother		
Babies likely to choke on back		
Disagree	–	–
Agree	0.34 (0.18, 0.62) <sup>*</sup>	0.25 (0.13, 0.48) <sup>*</sup>
Babies sleep more comfortably or longer on back		
Disagree	–	–
Agree	0.51 (0.28, 0.93) <sup>**</sup>	0.54 (0.28, 1.04)
Safety practices have changed since she raised children		
Disagree	–	–
Agree	0.84 (0.47, 1.5)	0.97 (0.5, 1.87)

Abbreviations: OR – Odds Ratio; CI – Confidence Interval

<sup>†</sup>Safe sleep was defined for purposes of this study as infant sleeping in a crib, portable crib, playpen, play yard *and* on his/her back.

<sup>\*</sup> p 0.05

<sup>\*\*</sup> p < 0.001