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# Factors Associated With Caregivers' Choice of Infant Sleep Position, 1994-1998

## The National Infant Sleep Position Study

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IN THE SPRING OF 1992, THE AMERICAN Academy of Pediatrics (AAP) issued a recommendation promoting nonprone sleep position for healthy infants to reduce risk of sudden infant death syndrome (SIDS).<sup>1</sup> These efforts were expanded in late June 1994, with the initiation of the national public education campaign "Back to Sleep" under joint sponsorship of the US Public Health Service, AAP, SIDS Alliance, and Association of SIDS and Infant Mortality Programs.<sup>2,3</sup> In November 1996, the AAP revised its sleep position statement to emphasize that supine is the preferred position, although lateral is an acceptable alternative since it confers protection relative to prone position.<sup>4</sup>

The adoption of the message and the subsequent declines in the SIDS rate have been rapid in all countries that implemented public education campaigns.<sup>5-9</sup> In the United States, the prevalence of prone sleep position decreased from about 70% in 1992 to about 24% among infants younger than 8 months in 1996, and the SIDS rate declined by 38%.<sup>10</sup>

The mechanism for the increased SIDS risk associated with prone sleeping is unknown. SIDS infants have char-

**Context** The success and simplicity of the 1994 national "Back to Sleep" campaign to reduce sudden infant death syndrome provides an opportunity to study which elements determine whether a behavior will change in the desired direction in response to a public health intervention.

**Objective** To examine sociodemographic characteristics, motivation, and message exposure to ascertain which factors influenced a caregiver's choice of infant sleep position after implementation of the campaign.

**Design** Annual nationally representative telephone surveys conducted between 1994 and 1998.

**Setting** The 48 contiguous United States.

**Participants** Nighttime caregivers of infants born within the 7 months prior to interview between 1994 and 1998. Approximately 1000 interviews were conducted each year.

**Main Outcome Measures** The position the infant was usually placed in for sleep, sleep position recommendations received from specific sources, and reasons reported for position choice.

**Results** Between 1994 and 1998, prone placement declined from 44% to 17% among white infants and from 53% to 32% among black infants. Supine placement increased from 27% to 58% among white infants and from 17% to 31% among black infants. During this period, reports of supine recommendations from at least 1 source doubled from 38% to 79%. From 1995 to 1998, 86% of caregivers who placed the infant prone reported receiving only nonprone recommendations. Infant comfort was given as a reason for prone placement by 82% of these caregivers. In multivariate analysis, physician recommendation of "supine not prone" had the strongest influence and was associated with decreased prone placement (odds ratio [OR], 0.25 [95% confidence interval {CI}, 0.16-0.39]) and increased supine placement (OR, 3.37 [95% CI, 2.38-4.76]). Recommendations from all 4 sources (the physician, neonatal nurse, reading materials, and radio/television) further increased the probability of supine placement (OR, 6.01 [95% CI, 4.57-7.90]). Other factors independently associated with increased prone and decreased supine placement included maternal black race, parity of more than 1, and living in a southern or mid-Atlantic state.

**Conclusions** According to our study, as of 1998, approximately one fifth of infants were still placed prone, and only half were placed supine. Recommendations of supine placement during infancy by physicians at well-baby checks and by neonatal nursery staff and print and broadcast media have increased the proportion of infants placed supine. Caregiver beliefs regarding perceived advantages of prone sleeping should be addressed to attain further reduction in prone placement.

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acteristics that suggest abnormalities in autonomic nervous system function and arousal.<sup>11-15</sup> They are also more likely to be found dead face down in bedding that promotes the rebreathing of expired air rich in carbon dioxide and depleted in oxygen,<sup>16,17</sup> with bedding over their head,<sup>18</sup> or covered with several layers that could create overheating.<sup>19,20</sup> Sleeping supine reduces overheating and rebreathing and increases arousal compared with the prone position.<sup>21,22</sup> Sleeping nonprone may protect infants by eliminating triggers in the SIDS causal pathway.

Defining a SIDS risk reduction strategy that may interfere with the causal pathway is an important first step, but success depends on dissemination of information and appropriate and consistent implementation of the recommended practices. What are the elements that determine whether a behavior will change in the desired direction in response to a public health intervention? The "Back to Sleep" campaign provides the opportunity to examine this question in part because of the success achieved in a short period of time and the simplicity of the intervention. This article, based on the National Infant Sleep Position (NISP) Study,<sup>10</sup> examines the contributions of sociodemographic characteristics, motivation, and message exposure to behavioral change between spring 1994 (immediately prior to the initiation of the campaign) and spring 1998.

## METHODS

### The NISP Sample

Datastat Inc (Ann Arbor, Mich) conducted telephone interviews annually each May, starting in 1992 (before the publication of the AAP recommendation), by randomly sampling households with infants younger than 8 months from a list sample of households obtained from Metromail (Lincoln, Neb).<sup>10</sup> The list is based on public information from birth records, infant photography companies, and infant formula companies and is compiled to have appropriate geographic representation for the 48 coterminous

states based on the number of births in each state. Interviews were completed in households that responded affirmatively to the question: "Is there an infant in this house who was born in the last 7 months; that is on or after (date)?" Interviews were requested and completed with the nighttime caretaker (80%-85% of those interviewed were mothers) of the infant. The target number of households was 1000 per year.

Households where the mother of the infant did not complete high school were oversampled after the national sample was complete to achieve a total of 100 households in this education category. Oversampling for households where the mother had less than a high school education added about 35 infants each year in addition to those in the national sample.

The number of telephone calls (national sample plus the oversample) completed were 1041 in 1994 (1053 infants, since some households had twins), 1043 in 1995 (1052 infants), 1038 in 1996 (1047 infants), 1033 in 1997 (1056 infants), and 1050 in 1998 (1065 infants). The estimated response rates calculated as previously described<sup>10</sup> were 81.6%, 86.4%, 84.8%, 87.5%, and 83.4% for 1994-1998, respectively. The median infant age in the survey sample (1994-1998) was 136 days (10th percentile, 65 days; 90th percentile, 198 days). These did not vary significantly from year to year.

### Measures

The interview was developed specifically for the NISP Study.<sup>10</sup> The results in this report were based on 30 of the 41 questions in the survey. Information was obtained in the following order: (1) infant characteristics and characteristics of the sleep environment; (2) the usual position in which she/he placed the child for sleep at night (stomach, side, or back); (3) reasons for position placement; (4) whether the caregiver received a sleep position recommendation from specific sources, and what positions were recommended; and (5) sociodemographic information about the mother and household.

A telephone survey has the limitation of reaching only those who have a telephone and therefore underrepresents the economically disadvantaged. When compared with the 1996 natality statistics published by the National Center for Health Statistics (NCHS),<sup>23</sup> the NISP survey sample (1994-1998), including the oversample for mothers with less than a high school education, is underrepresented for the following maternal characteristics: black race (NISP, 6.1% vs NCHS, 15.3%), Hispanic ethnicity (5.2% vs 18.0%), age younger than 20 years (7.2% vs 12.9%), and less than 12 years of education (10% vs 22.4%). Both weighted and unweighted analyses were performed to account for the demographic differences between the NCHS natality statistics and NISP Study. Conventional unweighted analyses are presented since weighted analyses revealed only minor differences.

### Statistical Analysis

All analyses were conducted with the combination of the national sample and the oversample for mothers with less than a high school education. Differences in proportions were tested with  $\chi^2$  tests. This article focuses on recommendations and practices since the initiation of the "Back to Sleep" campaign. The baseline year for the analyses is 1994 because the survey was conducted just prior to announcement of the campaign. Trends prior to 1994 are shown in FIGURE 1 and were reported on previously.<sup>10</sup> A revised AAP recommendation, which stated that supine is the preferred sleep position, was published after the 1996 survey, and before the 1997 survey. Empirical analysis of the reported recommendations were similar for 1995 and 1996 and for 1997 and 1998, and the years were combined for the analyses in TABLE 1.

Exposure to recommendations of "supine not prone" (supine only or lateral and supine) were analyzed because they are the "Back to Sleep" campaign messages. Exposure from various sources, survey year, and maternal and infant characteristics were used in univariate

logistic regression modeling to determine their individual influence on the caregivers' choice of sleep position. Odds ratios (ORs) from these analyses were adjusted for confounding by adding to these logistic regressions the demographic characteristics found to be significantly related to the sleep position in which the infant was placed.<sup>24</sup> The same demographic characteristics along with survey year and exposure factors were used in a multivariate logistic regression model for prone or supine placement to determine their indepen-

dent contribution while adjusting for all the other factors. All analyses were conducted on a personal computer with SAS, version 6.12.<sup>25</sup>

**RESULTS**  
**Changes in Infant Sleep Position Since the "Back to Sleep" Campaign**

Prior to the release of the AAP infant sleep position recommendation in 1992, 70% of nighttime caregivers sampled by the NISP Study usually placed the infant to sleep prone, and

only 13% placed the infant supine. In 1994, prior to the initiation of the "Back to Sleep" campaign, 43% of infants were usually placed to sleep prone and 27% supine.<sup>10</sup> By 1998, 17% were placed prone and 56% supine. For those aged 8 to 15 weeks, the group at greatest risk for SIDS, the proportion of infants placed prone declined from 43% to 12% between 1994 and 1998, and those placed supine tripled, from 17% to 51%.

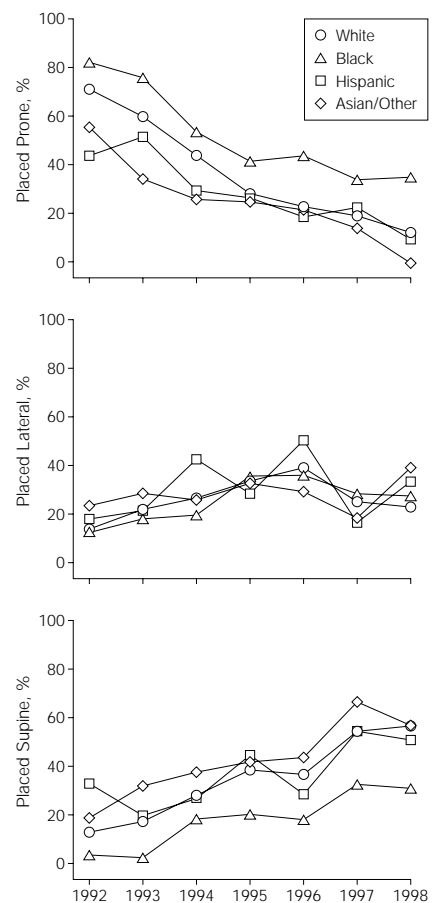
The position in which the infant was placed varied by race/ethnicity, with a greater proportion of infants of black mothers placed prone and a lower proportion placed supine. Lateral placement was similar among the groups (Figure 1). Between 1994 and 1998, prone placement declined from 44% to 17% among infants of white mothers and from 53% to 32% among infants of

**Table 1.** Frequency of Reported Sleep Position Recommendations\*

	1994 (n = 1053)	1995-1996 (n = 2100)	1997-1998 (n = 2126)	P Value†
<b>Recommendation by Hospital Nurse</b>				
Supine only	2.7	3.5	12.5	<.001
Lateral and supine	17.6	36.8	43.2	<.001
Lateral only	34.9	27.6	15.3	<.001
None	34.5	28.9	27.1	<.001
Prone and other	8.2	2.6	1.2	<.001
Prone only	2.2	0.8	0.7	<.001
<b>Recommendation by Infant's Physician</b>				
Supine only	3.5	4.4	16.5	<.001
Supine and lateral	16.3	29.3	33.1	<.001
Lateral only	13.4	14.1	7.7	<.001
None	60.6	49.0	40.7	<.001
Prone and other	4.1	2.3	1.3	<.001
Prone only	2.1	0.9	0.8	.002
<b>Recommendation Read in Magazines or Newspapers</b>				
Supine only	5.5	4.8	19.0	<.001
Supine and lateral	23.6	42.7	44.9	<.001
Lateral only	17.8	17.8	8.5	<.001
None	40.6	29.8	25.9	<.001
Prone and other	10.7	4.2	1.2	<.001
Prone only	1.8	0.8	0.5	<.001
<b>Recommendation Heard on Television or Radio</b>				
Supine only	2.9	2.5	11.3	<.001
Supine and lateral	7.7	15.4	15.3	<.001
Lateral only	4.5	6.2	2.7	<.001
None	83.0	75.0	70.4	<.001
Prone and other	0.8	0.7	0.3	.10
Prone only	1.1	0.0	0.3	<.001
<b>All Sources</b>				
Supine only	4.1	4.5	12.8	<.001
Supine and lateral	34.2	57.9	65.8	<.001
Lateral only	25.2	21.0	10.9	<.001
None	12.0	7.0	5.6	<.001
Prone and other	21.4	10.0	5.1	<.001
Prone only	3.0	0.7	0.7	<.001

\*Data are presented as percentage unless otherwise indicated. Percentages do not sum to 100 because of rounding. †P values determined from  $\chi^2$  test for differences across the 3 time points.

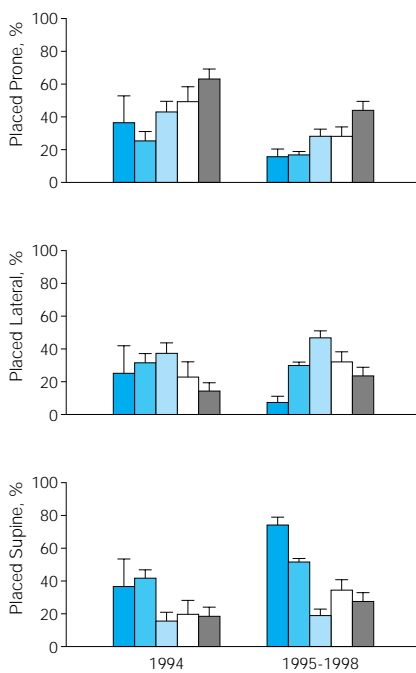
**Figure 1.** Infant Sleep Position According to Mother's Race/Ethnicity, 1992-1998



black mothers. Over this period, supine placement increased from 27% to 58% among infants of white mothers and from 17% to 31% among infants of black mothers. Prone placement was lowest among infants of Hispanic ethnicity or Asian or other origin. In all groups, the proportion placed supine did not increase between 1995 and 1996, but rose in 1997 after the publication of the revised AAP recommendation emphasizing that supine was the preferred position.

**Figure 2.** Infant Sleep Position According to Recommendations Reported by Nighttime Caregiver

Recommendation	No. of Respondents	
	1994	1995-1998
Supine Only	43	344
Supine and Lateral	361	2596
Lateral Only	266	673
None	126	267
Prone and Other	257	346



Supine only indicates recommendation of supine position from at least 1 source and no other position from any other source; supine and lateral, combinations of only supine and lateral; lateral only, recommendation of lateral position from at least 1 source and no other position from any other source; none, no recommendation from any source; and prone and other, combinations of prone and nonprone. Error bars indicate upper limit of 95% confidence interval.

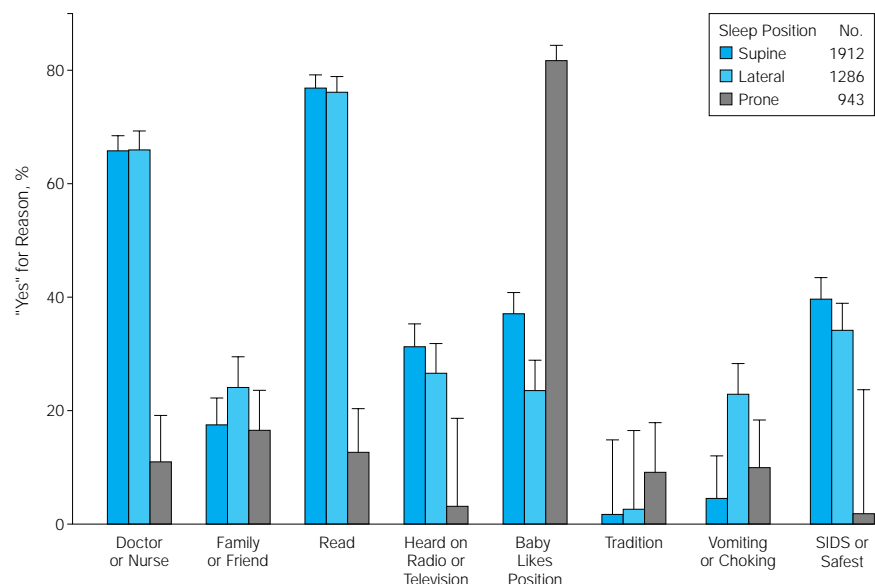
**Exposure to Sleep Position Recommendations**

Starting in 1994, in anticipation of the initiation of the “Back to Sleep” campaign, survey respondents were asked about their exposure to a recommendation for sleep position: “When the baby was born, did the nurses in the newborn nursery recommend a position to place the baby in to sleep?” (yes/no); “What positions did they recommend?” The interviewer listed the positions if necessary, and all responses were recorded. The same questions were asked separately for the infant’s physician, reading a recommendation in magazines or newspaper, or hearing a recommendation on the radio or television. Reports of recommendations from all sources increased significantly between 1994 and 1997-1998 (Table 1). However, in 1997-1998, 40.7% of respondents still reported that the physician did not recommend a sleep position. Also, television or radio was a very infrequent source of recommendations. Recommendations of “supine not prone” (supine only or

supine and lateral) more than doubled from all sources between 1994 and 1997-1998 ( $P<.001$ ). By 1997-1998, 79% of respondents reported receiving a recommendation of supine from at least 1 source vs 38% in 1994. By 1997-1998, only 5.8% reported receiving a recommendation of prone from at least 1 source.

The reported recommendations were further analyzed to determine whether the content of the recommendation influenced the position in which the infant was placed to sleep (FIGURE 2). Prone prevalence decreased and supine prevalence increased in all recommendation categories after 1994. The proportion of infants placed prone was highest for those who reported receiving a recommendation of prone and lowest for those receiving a recommendation of supine. The prevalence of lateral sleep position was highest for those who reported receiving only recommendations for lateral sleep position. Supine placement was highest for those who received a recommendation of supine and lowest for those who re-

**Figure 3.** Reasons Given by Nighttime Caregivers for Choosing Infant Sleep Position



SIDS indicates sudden infant death syndrome. The following reasons were given for placing infant in the specified position: “doctor or nurse suggested it”; “family member or friend suggested it”; “read about it in newspapers, magazines, or baby care books”; “the baby likes it or sleeps better that way”; tradition—“I sleep that way, my other children slept that way”; “afraid of vomiting, choking or spitting up”; “SIDS, SIDS report, safest.” Data are for 1995-1998. Error bars indicate upper limit of 95% confidence interval.

ceived only a recommendation of lateral position. Among those who received only a recommendation of supine position, 74% placed the baby supine in 1995-1998.

**Reasons Cited for Chosen Sleep Position**

Between 1995 and 1998, prone position was rarely recommended (Table 1), and 86% of those who placed the infant prone received only nonprone sleep position recommendations. Therefore, the content of the recommendations does not fully explain the sleep position choice. Respondents were also asked about the reason for placing the infant in the stated sleep position: "Please tell me if each of the following is a reason you put the baby to sleep in this position? (yes/no): your doctor or nurse suggested it; a family member or friend suggested it; you read about it in magazines, newspapers or baby care books; you heard about it on television or radio? What other reasons do you have for putting the baby to sleep in this position?" (all responses were listed).

The pattern of responses did not change significantly over time. The proportion of respondents who replied affirmatively to the 4 listed reasons and the proportion offering the most common categories of other reasons were analyzed according to position placed for years 1995-1998 combined (FIGURE 3). Of caretakers who placed the infant prone, 82% offered the reason that "the baby likes it better and/or sleeps better that way." More than 65% of caregivers who placed the infant supine or lateral cited medical professionals or "reading about it" as a reason. These groups were also 10 times more likely to cite "hearing about it on television or radio" compared with those who placed the infant prone. Caregivers who placed the infant supine or lateral were about 20 times more likely to cite "SIDS, crib death, SIDS report, or safest" as a reason compared with those who placed the infant prone. "Afraid of vomiting, choking, and spitting up" was most common among mothers who

placed their infants in the lateral position compared with those who placed their infant prone or supine.

**Logistic Regression Analysis of Factors Influencing Choice of Infant Sleep Position**

The contributions of exposure to a recommendation of "supine not prone" (the "Back to Sleep" campaign message) from different sources to the choice of sleep position were examined using logistic regression analysis (TABLE 2). A recommendation from the

nurse in the newborn nursery alone did not have a significant influence on whether the infant was placed prone but did contribute to whether an infant was placed supine (OR, 1.41; 95% CI, 1.01-1.96). The other sources had stronger effects on the choice of infant sleep position, with recommendations from the infant's physician being most influential in significantly decreasing the probability of prone placement (OR, 0.25; 95% CI, 0.16-0.39) and increasing the probability of supine (OR, 3.37; 95% CI, 2.38-4.76). If the physician

**Table 2.** Frequencies and Multivariate Odds Ratios for Factors Associated With Placing an Infant to Sleep Prone and Supine, NISP Study, 1994-1998\*

Variable	Frequency, %†	Placed Prone, Multivariate OR (95% CI)‡	P Value§	Placed Supine, Multivariate OR (95% CI)‡	P Value§
<b>Exposure to "Supine Not Prone" Recommendation</b>					
None	32.5	1.00		1.00	
Only 1					
Nurse only	4.8	1.10 (0.81-1.49)		1.41 (1.01-1.96)	
Physician only	3.7	0.25 (0.16-0.39)		3.37 (2.38-4.76)	
Read only	9.1	0.46 (0.36-0.59)		2.86 (2.25-3.62)	
Heard only	1.1	0.31 (0.15-0.62)		2.62 (1.46-4.69)	
Exactly 2					
Nurse and physician	5.5	0.52 (0.37-0.72)		3.45 (2.57-4.63)	
Nurse and read	7.9	0.71 (0.55-0.93)		2.65 (2.05-3.43)	
Nurse and heard	0.5	0.40 (0.15-1.03)	<.001	2.57 (1.14-5.80)	<.001
Physician and read	4.6	0.25 (0.17-0.39)		4.36 (3.18-5.99)	
Physician and heard	0.5	0.44 (0.16-1.25)		3.43 (1.47-8.02)	
Read and heard	3.4	0.39 (0.26-0.60)		3.35 (2.36-4.76)	
Exactly 3					
Nurse, physician, and read	12.0	0.28 (0.21-0.37)		4.64 (3.69-5.82)	
Nurse, physician, and heard	1.0	0.19 (0.07-0.49)		5.05 (2.73-9.34)	
Nurse, read, and heard	3.4	0.42 (0.28-0.64)		3.60 (2.54-5.10)	
Physician, read, and heard	2.5	0.20 (0.11-0.37)		4.56 (3.02-6.88)	
All 4	7.5	0.24 (0.17-0.35)		6.01 (4.57-7.90)	
<b>Year</b>					
1998	20.2	0.36 (0.28-0.46)		2.27 (1.81-2.84)	
1997	20.1	0.44 (0.35-0.55)		1.97 (1.59-2.44)	
1996	19.9	0.45 (0.36-0.56)	<.001	1.25 (1.01-1.55)	<.001
1995	19.9	0.62 (0.51-0.76)		1.24 (1.00-1.53)	
1994	19.9	1.00		1.00	
<b>Maternal Characteristics</b>					
Race/ethnicity					
Black	6.1	1.91 (1.41-2.57)		0.52 (0.37-0.72)	
Hispanic	5.2	0.64 (0.45-0.90)	<.001	1.29 (0.96-1.73)	<.001
Asian/other	3.2	0.65 (0.41-1.03)		1.46 (1.00-2.12)	
White	85.5	1.00		1.00	
Education, y					
<12	10.0	0.99 (0.72-1.35)		0.87 (0.64-1.18)	
12	24.7	1.04 (0.85-1.27)	.94	1.03 (0.86-1.24)	0.69
13-15	27.5	0.98 (0.81-1.18)		0.97 (0.82-1.15)	
≥16	37.9	1.00		1.00	

(continued)

made a recommendation, contributions from other sources did not further decrease the likelihood that an infant would be placed prone. However, there were additive effects of other sources that increased the probability of the choice of supine position. Among those who reported receiving a recommendation from 2 sources, physician plus reading materials made the greatest contribution to supine placement (OR, 4.36; 95% CI, 3.18-5.99). The highest probability of supine placement was observed among those who reported receiving a recommendation from all 4 sources (OR, 6.01; 95% CI, 4.57-7.90). The magnitude of the inde-

pendent contributions of maternal race/ethnicity, maternal age, parity, living in a southern or mid-Atlantic state, infant age, and place where the infant slept to sleep position choice was similar to that previously observed.<sup>10</sup> The univariate ORs for maternal black race, parity, and infant characteristics were similar to those obtained after adjustment for other maternal and infant characteristics and to the multivariate ORs in Table 2. Therefore, the influence of these factors on sleep position choice cannot be accounted for by differences in exposure to a recommendation.

The contribution of exposure to a recommendation of "supine not prone" to

the annual changes in the use of prone or supine sleep position was also examined. Adjustment for maternal and infant characteristics had no effect on the univariate ORs for 1995-1998 relative to 1994. After further adjustment for exposure to "supine not prone," there was a decrease in the contribution of year to the risk of prone or supine placement. The largest changes, between 33% and 38%, were in 1997 and 1998, when supine was recommended in preference to the lateral position.<sup>4</sup>

**COMMENT**

This article analyzes the recommendations received by infant caregivers in the period since the initiation of the "Back to Sleep" campaign. This is the only national study to evaluate the impact of the AAP recommendation. The survey population was a random sample of nighttime caregivers of infants younger than 8 months taken from a purchased list that was based on public information and was limited to households with telephones. Relative to US natality statistics, the survey population overrepresents whites and underrepresents the proportion with low education and young maternal age. However, within each racial/ethnic group, the proportion that are young mothers with less than a high school education are similar to US natality statistics. Analysis based on reweighting of the sample did not alter the results from the unweighted analysis.

Nighttime caregivers reported increases in the recommendations of supine position, which correlated temporally with the recommendations issued by the AAP and the "Back to Sleep" campaign.<sup>2,4</sup> Supine placement was highest for those who reported receiving only a recommendation of supine position. The NISP Study also shows that exposure to a recommendation of supine sleep position from sources available to the mother throughout infancy, primarily the infant's physician, as well as print and broadcast media, strongly influences sleep position choice. Unfortunately, 41% of respondents said that their phy-

**Table 2.** Frequencies and Multivariate Odds Ratios for Factors Associated With Placing an Infant to Sleep Prone and Supine, NISP Study, 1994-1998\* (cont)

Variable	Frequency, %†	Placed Prone, Multivariate OR (95% CI)‡	P Value§	Placed Supine, Multivariate OR (95% CI)‡	P Value§
<b>Maternal Characteristics</b>					
Age, y					
<20	7.2	0.96 (0.66-1.40)	.18	0.83 (0.58-1.17)	.17
20-24	17.7	1.25 (1.00-1.58)		0.78 (0.63-0.97)	
25-29	31.7	1.08 (0.91-1.27)		0.91 (0.78-1.07)	
≥30	43.4	1.00		1.00	
Parity					
>1	48.9	1.62 (1.39-1.89)	<.001	0.71 (0.62-0.82)	<.001
1	51.1	1.00		1.00	
Region					
West	17.2	1.06 (0.85-1.34)	<.001	1.04 (0.85-1.27)	<.001
South	32.2	1.60 (1.34-1.92)		0.63 (0.54-0.75)	
Mid-Atlantic	14.7	1.70 (1.36-2.13)		0.76 (0.62-0.94)	
New England	5.8	1.26 (0.91-1.73)		0.85 (0.64-1.13)	
Midwest	30.0	1.00		1.00	
Household income, \$					
<20 000	18.6	0.94 (0.75-1.18)	.86	0.89 (0.72-1.10)	.50
20 000-24 999	24.0	0.99 (0.83-1.19)		0.93 (0.79-1.10)	
≥25 000	57.4	1.00		1.00	
<b>Infant Characteristics</b>					
Age, wk					
<8	6.4	0.48 (0.34-0.69)	<.001	0.29 (0.21-0.40)	<.001
8-15	29.2	0.74 (0.62-0.87)		0.66 (0.57-0.77)	
≥16	64.4	1.00		1.00	
Sleeping place					
Bassinet	10.9	0.56 (0.43-0.73)	<.001	1.11 (0.88-1.38)	.01
Adult bed	8.5	0.45 (0.34-0.61)		1.52 (1.18-1.94)	
Other	10.0	0.58 (0.45-0.75)		1.06 (0.85-1.32)	
Crib	70.6	1.00		1.00	

\*NISP indicates National Infant Sleep Position; OR, odds ratio; and CI, confidence interval.  
 †Percentage of specified variable in survey responses for 5273 infants, 1994-1998. Percentages do not sum to 100 because of rounding.  
 ‡Odds ratios within variables are expressed relative to a standard level (eg, for survey year, 1994 is the standard with an assigned odds ratio of 1.00).  
 §P value is the significance for the variable in the multiple logistic model based on type III analysis in SAS statistical software program (SAS Institute, Cary, NC).  
 ||Place infant usually slept at night in the last 2 weeks before interview.

sicians had not made a recommendation on sleep position in 1997-1998. Another recent study has demonstrated the need to reinforce the recommendation to caregivers over the first few months of an infant's life when SIDS risk is highest. Approximately 20% of caregivers reported changing from nonprone to prone sleep position when the infant was aged 1 to 3 months.<sup>26</sup>

Annual changes in the prevalence of specific sleep positions since 1994 are not fully accounted for by reports of exposure to a recommendation as measured by the NISP Study. The prevalence of supine placement increased, and the prevalence of prone placement decreased, even among those who reported not receiving a recommendation. Adjustment for exposure to a recommendation of "supine not prone" in multivariate analysis only partially reduced the effect of year. It is likely that the dissemination of the recommendation in the population over time influenced the acceptance of a change in behavior and increased the role of family and friends in supporting the recommendation.

In contrast, within a subgroup of caregivers, there appears to be strong motivation to place the infant prone that overrides the health education message. In the NISP study sample, the majority of those who placed the infant prone were exposed to only nonprone recommendations. The infant sleeping better was the primary motivation for placing the infant prone. Other studies have also found that the infant's comfort or behavior were among the most common reasons for choice of prone position.<sup>26-28</sup> Ponsonby et al<sup>29</sup> suggested that educational efforts include focusing on the use of methods that encourage infants to settle better on their back or side. The responses from the NISP Study suggest that this approach may be valuable.

Fear of vomiting, choking, or spitting up remained a strong influence on choice of sleep position in the years since the "Back to Sleep" campaign was launched, leading some caretakers to choose the lateral or prone sleep position. Concerns regarding infants vom-

iting or choking on aspirated stomach contents while on their backs appear to be unwarranted. Hunt and colleagues<sup>30</sup> analyzed a number of infant health outcomes collected prospectively in the period spanning before and after the initiation of a public health campaign to promote the back sleep position in Avon, England. They observed that there was no increased risk of choking, wheezing, or breathlessness for infants aged 4 to 6 weeks and 6 to 8 months placed on their back compared with those placed prone. On the other hand, infants placed prone were at increased risk of cough and fever compared with those placed on their back. Ponsonby and colleagues,<sup>31</sup> analyzing infant health outcomes from a prospective cohort in Tasmania, Australia, found that infants aged 1 month who slept supine did not experience more episodes of cyanosis, pallor, or breathing problems. On the contrary, risk of cyanosis was greater in infants who slept prone. Hospital admissions for apnea or cyanosis did not differ for those placed supine or prone.

Even with such a simple intervention, there are intermediate steps in the implementation that will need to be targeted to further reduce prevalence of the prone sleeping position. These may include the way the message is delivered, how the cost and risk and benefit are perceived, and how well the caregiver is supported. In the NISP study, the differences in sleep position choice associated with race/ethnicity are independent of whether or not the caregiver reported receiving a recommendation of "supine not prone" or of sociodemographic characteristics such as maternal age, education level, and family income. One possibility is that discontinuous health care among the disadvantaged reduces the opportunity for support of the recommendation throughout infancy. Cultural factors also play a role. While reports of receiving advice in the hospital or at a well-baby checkup were not significantly associated with sleep position choice in a study of a predominantly low-income black population, the presence of a grandmother in the

home increased the risk of prone placement almost 2-fold.<sup>28</sup>

Reductions in prone placement among caregivers of newborns are slowing and the proportion of infants placed to sleep prone is short of the "Back to Sleep" campaign goal of less than 10% for all racial and ethnic groups. The SIDS rate, which declined between 1992 and 1996,<sup>10</sup> also reached a plateau in 1997 at 0.77 per 1000 livebirths.<sup>32</sup> Although some of the decline in the SIDS rate could be accounted for by changes in other factors, such as reduced cigarette smoking among pregnant women, the majority of the decline can be attributed to changes in prone sleep position.<sup>10</sup> Motivation strongly influences the choice of prone position in the current environment; thus, clinicians should discuss the reasons for choice of sleep position with the caregiver. Supine placement is increasing but has not reached desired levels. Findings from the survey suggest that reinforcement of the supine recommendation by the infant's physician, with support from other sources, is the most effective means of influencing adoption of supine placement.

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By reason only can we attain to a correct knowledge of the world and a solution of its great problems. Reason is man's highest gift, the only prerogative that essentially distinguishes him from the lower animals.  
—Ernst Heinrich Haeckel (1834-1919)