Infant Sleep Position

Introduction

Infant sleep position is one of the Healthy People 2010 (HP 2010) objectives focused on improving infant health. Objective 16-13 states by 2010 seventy percent of all healthy, full term infants should be placed on their backs to sleep.[1] The supine (back) sleep position has been found to be an important factor in the reduction of Sudden Infant Death Syndrome (SIDS). In the United States the number of infants sleeping on their stomachs has decreased from more than 70% to approximately 20%, and the rate of SIDS has decreased by more than 40%, since 1992.[2]

Recent evidence indicates a possible genetic link to SIDS, which may lend even greater support for placing infants in the supine (back) position. Patterson et al. found that brain abnormalities may affect an infant's ability to regulate breathing and that these abnormalities may be risk markers for SIDS.[3] Their study suggests that infants with the abnormality who are placed on their stomachs to sleep may be unable to begin breathing again, if they stop.[3]

The American Academy of Pediatrics (AAP) recommends that infants be placed for sleep in a supine position (on the back) for every sleep episode.[2] Side sleeping is not as safe as supine sleeping and is not recommended.[2] Studies in the US, New Zealand and Britain have indicated the probability of an infant rolling to the prone position (sleeping on the stomach) from the side sleep position is significantly greater than rolling to prone from the back.[2,4,5] Therefore, the back position is the safest and most preferred.[2,4,5]

However, sleep position alone cannot reduce the risk of infant mortality.[4-6] Other factors should be considered and evaluated, such as exposure to cigarette smoke and the condition and composition of the sleep environment, including co-sleeping (having an infant sleep in a room with an adult for naps and nighttime), bed-sharing (having an infant share a bed surface with another person), and the type of sleep surface and the infant's bedding.[4-6]

In Oklahoma

- Fifty-six percent of newborns were laid to sleep on their backs most of the time. The Healthy People 2010 goal is 70%.
- Nineteen percent of newborns were laid on their stomachs to sleep.
- Those most likely to place their infants on their backs to sleep were women 35 years of age or older.
- Women who had incomes between 100-184% of federal poverty level, African American women and women with more than one child were those least likely to place their infants on their backs to sleep.

This PRAMSGRAM will examine sleep position in Oklahoma and offer recommendations to increase safe sleep practices for Oklahoma infants.

Methods

This study used data from the Pregnancy Risk Assessment Monitoring System (PRAMS) for the survey years 2000 to 2003. For this period, 9,736 Oklahoma mothers were sent the PRAMS survey. Of these mothers, 7,680 completed the questionnaire, yielding an unweighted overall response rate of 78.9 percent. There were 270 women who answered with more than one response to the sleep position question. Another 694 respondents failed to provide a response to the sleep position question. These sets of records were excluded, leaving 6,716 women (87% of those responding to PRAMS) available for the analysis. Additionally, women 20 years of age or younger (n=947) were removed from the logistic regression modeling analysis due to concerns regarding equal opportunity for educational attainment.

To determine the sleep position used to place infants down to sleep, respondents were asked, "How do you most often lay your baby down to sleep now?" Respondents were instructed to select one response from the options: on his or her side, on his or her back, on his or her stomach. As an outcome variable for the bivariate descriptive analyses, sleep position

retains this original formulation. However, for the logistic regression, a dichotomous outcome variable was constructed with "non-back" representing the side or stomach sleep positions, while the back position remained the same.

Maternal demographic variables included in the analysis were age (<20, 20-24, 25-29, 30-34, ≥35); race (White, African American, American Indian, Other); education (<HS, HS, >HS); marital status (Married, Other); ethnicity (Hispanic, Non-Hispanic); residential setting (Urban, Rural); federal poverty level status (<100%, 100%-184%, ≥185%); and parity (Primiparous, Multiparous). Variables of interest relating to prenatal care included timing of initiation of prenatal care (Late or no care, First trimester care); Medicaid funded prenatal care (Yes/No); and source of prenatal care (Hospital clinic, Health department clinic, Physician's office/HMO clinic, Indian Health Service/Tribal clinic, Community clinic). Attitude and behavior questions included were pregnancy intention (Intended, Unintended); enrollment in WIC program during pregnancy (No/Yes); initiation of breastfeeding (No/Yes); and maternal postpartum smoking (No/Yes). Infant related variables considered in this analysis were infant gender (Male/Female); infant birth weight (<2,500 grams, ≥2,500 grams); and whether the infant had had a well-baby visit (No/Yes).

Due to the PRAMS stratified weighted sample, SUDAAN 9.0.1 was used to perform the statistical analysis. In the descriptive analysis, variables were examined using percentages and confidence intervals. Chi-square tests of significance were used to determine which variables to consider in the multivariate logistic regression. The logistic regression modeling was performed to produce adjusted odds ratios as measures of association between the selected independent variables and sleep position. Variables were considered statistically significant at $p<0.05$.

The Pregnancy Risk Assessment Monitoring System (PRAMS) is an ongoing, population-based study designed to collect information about maternal behaviors and experiences before, during and after pregnancy. On a monthly basis, PRAMS samples between 200 and 250 recent mothers from the Oklahoma live birth registry. Mothers are sent as many as three mail questionnaires seeking their participation, with follow-up phone interviews for non-respondents. A systematic stratified sampling design is used to yield sample sizes sufficient to generate population estimates for groups considered at risk for adverse pregnancy outcomes. Information included in the birth registry is used to develop analysis weights that adjust for probability of selection and non-response.

Results

Overall, for the period 2000 to 2003, 56 percent of women reported using the supine (back) position most often when placing their infants down to sleep, nearly 26 percent reported using the side position and another 19 percent reported using the prone (stomach) position (Figure 1).

Figure 1: Sleep Position in Oklahoma; PRAMS 2000-2003
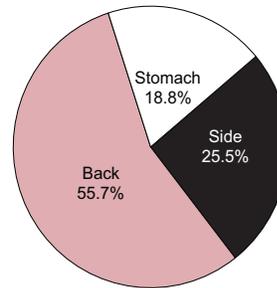
Data shown in Table 1 indicate that there has been a slight rise in the rate of back sleep position use between year 2000 and year 2003, changing from 55.7 percent to 58.4 percent. However, it is premature to state that this is anything more than year-to-year fluctuation. Sleep position was associated with a number of maternal characteristics (Table 2). Maternal age, race and ethnicity, education, marital status, poverty status, and parity were each found to have a significant bivariate relationship to sleep position.

Table 1. Sleep position in Oklahoma; PRAMS 2000-2003					
Sleep Position	2000	2001	2002	2003	2000 - 2003
Side	25.5	26.6	26.5	23.3	25.5
Back	55.7	54.2	54.9	58.4	55.8
Stomach	18.7	19.3	18.6	18.4	18.8

Side Position Teen mothers were significantly more likely to use the side position (30.5%) than were mothers aged 30-34 (20.9%) or 35 or older (19.1%). Mothers not having completed a secondary education had significantly higher rates of side position use (<HS = 33.1% vs. HS = 25.4%, >HS = 21.5%). Hispanic mothers were significantly more likely to use the side position (35.3%) than were Non-Hispanic mothers (24.5%). No differences in the use of the side position were observed by race, marital status, parity, residential setting, or poverty status.

Back Position   Mothers aged 30 or older were significantly more likely than teen mothers to use the back position when placing the infant down to sleep. African American mothers (34.8%) were far less likely to use the back position than were white (57.7%) or American Indian mothers (59.4%). Women with at least some post-secondary education (59.4%) used the back position significantly more often than women with less than a secondary education (49.4%). Nearly 61% of those mothers at or above 185% of the federal poverty level reported most often using the back position when placing their infants down to sleep. This is significantly higher than women in the other poverty status groups (<100% FPL = 52.9%, 100%-184% FPL = 51.3%). No differences in the use of the back sleep position were observed by marital status, ethnicity, parity or residential setting.

Stomach Position   African American mothers (37.2%) were significantly more likely to use the stomach position than were either white (17.6%) or American Indian mothers (19.1%). Non-Hispanic women were more than twice as likely to use the stomach position than were Hispanic women, 19.8% vs. 8.6%, respectively. Multiparous women had significantly higher rates of stomach position use (20.7% vs. 16.1%). Rates of the use of the stomach sleep position did not differ by any other maternal demographic variables.

Upon examination of the data by race and age, Oklahoma mothers least likely to place their infants to sleep in the supine (back) position were African American adolescents (18%, Figure 2). Those women most likely to use the back position were American Indian mothers aged 35 or older (79.2%).
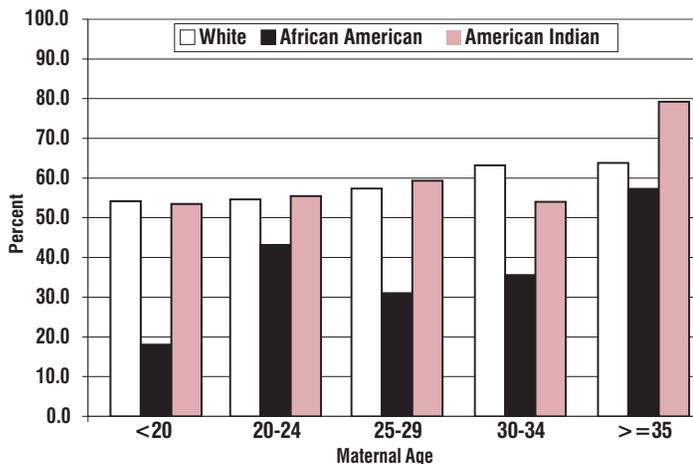
Table 2. Sleep position prevalence by selected maternal characteristics; PRAMS 2000-2003

Characteristic	Side % [1]	Side CI [2]	Back % [1]	Back CI [2]	Stomach % [1]	Stomach CI [2]
Age [†]						
<20	30.5	(26.0, 35.4)	49.2	(44.1, 54.3)	20.3	(16.5, 24.7)
20-24	26.9	(24.0, 29.9)	53.6	(50.3, 56.9)	19.5	(17.0, 22.3)
25-29	26.0	(23.0, 29.2)	56.2	(52.7, 59.6)	17.9	(15.4, 20.7)
30-34	20.9	(17.7, 24.5)	60.5	(56.3, 64.3)	18.6	(15.5, 22.2)
≥35	19.1	(14.7, 24.5)	64.8	(58.7, 70.5)	16.0	(12.0, 21.2)
Race [†]						
White	24.7	(23.0, 26.5)	57.7	(55.7, 59.8)	17.6	(16.0, 19.2)
African American	28.0	(22.5, 34.2)	34.8	(28.8, 41.3)	37.2	(31.1, 43.8)
American Indian	28.1	(19.3, 23.8)	59.4	(56.7, 62.1)	19.1	(17.0, 21.4)
Other	34.8	(23.0, 48.8)	61.5	(47.6, 73.7)	3.8	(1.3, 10.6)
Education [3],[†]						
<HS	33.5	(28.6, 38.8)	51.0	(45.6, 56.3)	15.5	(11.9, 20.0)
HS	24.6	(21.8, 27.6)	56.5	(53.2, 59.8)	18.9	(16.4, 21.7)
>HS	21.7	(19.4, 24.0)	59.1	(56.3, 61.8)	19.3	(17.1, 21.6)
Marital Status [†]						
Married	25.3	(23.3, 27.4)	57.6	(55.2, 59.9)	17.2	(15.5, 19.0)
Other	25.5	(22.9, 28.2)	53.4	(50.3, 56.4)	21.2	(18.8, 23.8)
Ethnicity [†]						
Hispanic	35.3	(29.5, 41.7)	56.1	(49.7, 62.3)	8.6	(5.7, 12.8)
Non-Hispanic	24.5	(22.9, 26.2)	55.8	(53.8, 57.7)	19.8	(18.3, 21.4)
Poverty status [4],[†]						
<100% FPL	28.5	(24.9, 32.3)	52.9	(48.8, 57.0)	18.6	(15.6, 22.1)
100%-184% FPL	27.7	(24.3, 31.3)	51.3	(47.4, 55.2)	21.0	(18.0, 24.4)
≥185% FPL	22.4	(20.0, 25.1)	60.6	(57.6, 63.5)	17.0	(14.8, 19.3)
Residential setting						
Urban	25.5	(23.4, 27.7)	54.3	(51.9, 56.8)	20.1	(18.2, 22.2)
Rural	25.4	(23.0, 27.9)	57.8	(55.0, 60.6)	16.9	(14.8, 19.1)
Parity [†]						
Primiparous	26.3	(23.7, 29.0)	57.6	(54.6, 60.5)	16.1	(14.1, 18.4)
Multiparous	25.0	(22.9, 27.1)	54.4	(52.0, 56.7)	20.7	(18.8, 22.7)

[1] Weighted relative frequency   [2] 95% confidence interval   [3] Excludes women ages <20
[4] FPL = federal poverty level   [†] Chi-Square test of independence, $p < 0.05$

Maternal intention of pregnancy, having received WIC benefits during pregnancy, having ever breastfed, and infant birth weight were found to be associated with sleep position (Table 3). Mothers who reported having intended their pregnancy had higher rates of using the back sleep position than mothers reporting their pregnancy as unintended (58.4% vs. 52.7%), and they were significantly less likely to report using the stomach position (16.6% vs. 21.3%). Mothers receiving WIC support (28.1%) were more likely to report using the side position than were non-WIC mothers (22.6%). Those mothers that had initiated breastfeeding used the back position more often (58.0% vs. 51.1%) and used the stomach position less often (16.9% vs. 23.0%) than did those mothers who did not breastfeed their infants. Timing of prenatal care initiation, Medicaid status, maternal postpartum smoking, source of prenatal care, infant gender, or whether the infant had received a well-baby visit were not found to be associated with sleep position.

Those variables identified as significantly related to sleep position in the bivariate analysis were included in

Figure 2: Percent Using Back Sleep Position by Race and Age; Oklahoma PRAMS 2000-2003

the multivariable logistic regression modeling. Table 4 displays crude odds ratios from univariate logistic regression models for each of these variables. It also displays multivariable results from a full model, which included all variables initially found to be associated with the outcome, as well as a final model that includes only those variables found by reverse stepwise logistic regression to be significantly related to sleep position. A number of variables found to be significant in the univariate models lost their significance in the multivariate model. Maternal age, maternal race, poverty level status, and parity were shown to be associated with sleep position. Mothers found to be significantly more likely to use the back sleep position were those aged 35 or older (AOR 1.49, 95%CI 1.07-2.07). Conversely, those women least likely to report using the supine (back) sleep position were African

American women (AOR 0.48, 95%CI 0.33-0.70), women between 100% and 184% of the federal poverty level (AOR 0.79, 95%CI 0.63-0.98), and multiparous women (AOR 0.77, 95%CI 0.63-0.94).

Table 4. Logistic regression modeling back sleep position; PRAMS 2000-2003.

Characteristic	Univariate Logistic Regression		Multivariate Logistic Regression (Model 1)		Multivariate Logistic Regression (Model 2)	
	OR[1]	CI[2]	AOR[3]	CI[2]	AOR[3]	CI[2]
Age						
20-24	0.90	(0.74, 1.10)	0.92	(0.72, 1.16)	0.94	(0.75, 1.17)
25-29	1.00	referent	1.00	referent	1.00	Referent
30-34	1.20	(0.96, 1.50)	1.20	(0.93, 1.55)	1.20	(0.93, 1.54)
≥35	1.44	(1.07, 1.94)	1.55	(1.10, 2.17)	1.49	(1.07, 2.07)
Race						
White	1.00	referent	1.00	referent	1.00	referent
African American	0.47	(0.34, 0.65)	0.49	(0.33, 0.73)	0.48	(0.33, 0.70)
American Indian	0.97	(0.72, 1.29)	0.93	(0.67, 1.30)	0.96	(0.69, 1.33)
Other	1.23	(0.69, 2.19)	1.51	(0.71, 3.20)	1.71	(0.82, 3.59)
Education						
<HS	0.72	(0.56, 0.92)	0.99	(0.70, 1.40)		
HS	0.90	(0.75, 1.07)	1.14	(0.92, 1.43)		
>HS	1.00	referent	1.00	referent		
Marital Status						
Married	1.00	referent	1.00	referent		
Other	0.93	(0.78, 1.10)	1.07	(0.84, 1.36)		
Ethnicity						
Hispanic	0.90	(0.67, 1.20)	1.01	(0.70, 1.45)		
Non-Hispanic	1.00	referent	1.00	referent		
Poverty Status						
<100% FPL	0.73	(0.59, 0.92)	0.92	(0.69, 1.24)	0.85	(0.67, 1.09)
100%-184% FPL	0.70	(0.57, 0.86)	0.82	(0.64, 1.05)	0.79	(0.63, 0.98)
≥185% FPL	1.00	referent	1.00	referent	1.00	referent
Parity						
Primiparous	1.00	referent	1.00	referent	1.00	referent
Multiparous	0.76	(0.64, 0.91)	0.79	(0.64, 0.98)	0.77	(0.63, 0.94)
Intention of pregnancy						
Intended	1.00	referent	1.00	referent		
Unintended	0.82	(0.69, 0.96)	0.94	(0.76, 1.15)		
WIC during pregnancy						
No	1.00	referent	1.00	referent		
Yes	0.84	(0.72, 0.99)	1.04	(0.82, 1.31)		
Ever breastfed						
No	0.79	(0.66, 0.94)	0.82	(0.66, 1.02)		
Yes	1.00	referent	1.00	referent		
Infant birth weight						
<2,500 grams	0.81	(0.72, 0.91)	0.91	(0.79, 1.05)		
≥2,500 grams	1.00	referent	1.00	referent		

[1]*Unadjusted crude odds ratio*   [2]*95% confidence interval*   [3]*Adjusted odds ratio*

Table 3. Sleep position prevalence by selected prenatal care, attitude and behavior, and infant characteristics; Oklahoma PRAMS 2000-2003

Characteristic	Side %[1]	Side CI[2]	Back %[1]	Back CI[2]	Stomach %[1]	Stomach CI[2]
Timing of initiation of prenatal care						
Late or no care	26.4	(23.2, 30.0)	53.2	(49.3, 57.0)	20.4	(17.4, 23.7)
First trimester care	25.2	(23.4, 27.1)	56.4	(54.3, 58.5)	18.4	(16.8, 20.1)
Medicaid-funded prenatal care						
Yes	26.6	(24.2, 29.1)	53.7	(51.0, 56.4)	19.7	(17.6, 22.0)
No	24.1	(22.0, 26.4)	57.8	(55.3, 60.4)	18.0	(16.2, 20.1)
Source of prenatal care						
Hospital clinic	26.8	(22.3, 31.7)	53.7	(48.4, 58.9)	19.6	(15.7, 24.0)
Health department clinic	28.3	(21.0, 36.8)	57.4	(48.5, 65.9)	14.4	(9.0, 22.1)
Private doctor's office or HMO clinic	24.3	(22.4, 26.3)	57.0	(54.7, 59.2)	18.7	(17.0, 20.6)
Indian Health Service or Tribal clinic	30.7	(23.8, 38.6)	50.8	(42.9, 58.6)	18.5	(13.1, 25.6)
Community clinic	27.7	(21.2, 35.3)	53.2	(45.2, 61.0)	19.1	(13.6, 26.3)
Other	28.2	(19.1, 39.5)	47.2	(36.0, 58.8)	24.6	(15.8, 36.1)
Intention of pregnancy[†]						
Intended	25.0	(22.8, 27.3)	58.4	(55.8, 60.9)	16.6	(14.8, 18.6)
Unintended	26.0	(23.7, 28.5)	52.7	(49.9, 55.4)	21.3	(19.1, 23.6)
On WIC during pregnancy[†]						
Yes	28.1	(25.8, 30.5)	53.3	(50.7, 56.0)	18.6	(16.6, 20.8)
No	22.6	(20.5, 24.9)	58.6	(56.0, 61.2)	18.8	(16.9, 20.9)
Ever breastfed[†]						
Yes	25.1	(23.2, 27.1)	58.0	(55.8, 60.2)	16.9	(15.3, 18.6)
No	25.8	(23.0, 28.9)	51.1	(47.7, 54.5)	23.0	(20.3, 26.1)
Postpartum Smoking						
Yes	23.8	(20.8, 27.2)	57.8	(54.1, 61.5)	18.3	(15.6, 21.5)
No	25.9	(24.1, 27.9)	55.2	(53.0, 57.3)	18.9	(17.3, 20.7)
Infant gender						
Male	25.8	(23.6, 28.1)	54.5	(51.9, 57.0)	19.8	(17.8, 21.9)
Female	25.1	(22.9, 27.5)	57.2	(54.5, 59.8)	17.7	(15.7, 19.8)
Infant birth weight[†]						
<2,500 grams	29.2	(27.6, 30.9)	50.9	(49.0, 52.7)	19.9	(18.5, 21.5)
≥2,500 grams	25.2	(23.5, 27.0)	56.1	(54.2, 58.1)	18.7	(17.2, 20.3)
Infant had well-baby visit						
Yes	25.5	(23.8, 27.2)	56.0	(54.1, 57.9)	18.6	(17.1, 20.1)
No	24.4	(16.8, 34.1)	48.6	(38.6, 58.8)	27.0	(18.8, 37.1)

[1]*Weighted relative frequency*   [2]*95% confidence interval*   [†]*Chi-Square test of independence, p<0.05*

Discussion

All infants should be placed upon their backs to sleep unless medically contraindicated. Approximately 44% of Oklahoma infants 2-6 months old were not placed on their backs to sleep during the study period, 2000-2003. Among those women least likely to place their baby in the supine (back) position were African American mothers. Rates for prone (stomach) sleeping among

African American women in Oklahoma are higher than those for African American women nationwide (37% vs. 20%), indicating a strong need for targeted interventions in the African American community, especially for mothers under the age of twenty and members of their households.[7]

The two other groups of Oklahoma women least likely to place their infants in the back position were those living between 100-184% FPL and those with more than one child. Women older than 35 comprised the only group positively associated with placing their infants on their backs to sleep most of the time. All other demographic variables showed no statistical significance in the positioning of the infant for sleep.

Overall, the issue of incorrect sleep position is pervasive among all maternal groups in Oklahoma. Significant differences were only present for a few variables (African American race, poverty status and maternal age), indicating a strong need for a consistent message on sleep position for all Oklahoma parents and grandparents.

Information is needed on the reasons why Oklahoma women choose to place their infants on their stomachs or sides to sleep and who influences the decisions mothers make about sleep position. One study found that the most common barriers to supine (back) sleep position were a lack of correct information about how to reduce the risk of SIDS, a fear of infant choking, lack of correct advice or incorrect advice from family members or a provider, lack of trust in their health provider, and concern for the comfort of their infant.[7] These barriers are an area of research that must be explored in order to develop effective interventions that increase the prevalence of safe sleep in Oklahoma.

This study is subject to several limitations. Oklahoma PRAMS does not collect information on the sleep environment, such as bedding materials and bed sharing, and it does not ask why mothers may choose to not place their infants in the supine (back) position. This study is limited to only those women with a living infant at the time the survey was administered, as deceased babies are excluded from the sleep position question. Responses are subject to social desirability bias, as all data on sleep position are self-reported.

Recommendations

1. During preconception and prenatal care visits, give expectant mothers, fathers and their families accurate information on the risks associated with sleep position and safe sleep environments, including smoke exposure, bed sharing, and bed surface and bedding. Continue to provide this message at the delivery facility and at pediatric visits until the infant is at least one year of age.

2. Provide safe sleep environment education during all childbirth and breastfeeding classes for new and expectant parents.

3. Focus interventions for sleep position and safe-sleep environments on those cultural groups least likely to place their infants on their backs to sleep.

4. Target safe sleep education for women who smoke or have family members who smoke and provide them with the Oklahoma Tobacco Helpline number 1-800- QUIT-NOW (1-800- 784-8669).

5. Include fathers and other caregivers in discussions about safe sleeping environments.

6. Create a state policy on the importance of safe infant sleeping environments. Institute a statewide safe sleep campaign in Oklahoma for the reduction of infant mortality.

7. Train all postpartum, newborn nursery and neonatal intensive care unit medical and nursing staff on how to effectively model and discuss safe sleep practices in the hospital.

8. Develop hospital policies on safe sleep practices that mandate staff to place all infants on their backs to sleep, unless medically contraindicated.

9. Advocate for stores and media outlets to depict safe sleeping environments in their marketing.

10. Strengthen existing death scene investigations by utilizing a tool such as the Sudden Unexplained Infant Death Investigation Report Form, developed by the CDC, if an infant death

occurs. This will assist investigators in examining and describing the death scene in detail. A copy is available at http://www.cdc.gov/epo/dphsi/mecisp/forms/suidirf3.96.pdf. This process would allow more accurate research on sleep position and environment, as it relates to the prevention of future infant deaths. For more information on this, please contact the Oklahoma Child Death Review Board at (405) 271-8858.

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