



Bedsharing and Oral Health-related Feeding Behaviors Among Zero- to Three-year-old Children

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Abstract: Purpose: The purpose of this study was to investigate the association between bedsharing and oral health-related feeding behaviors among zero- to three-year-old children. **Methods:** Data were collected from records of children attending the University of Iowa's Infant Oral Health Program (1998 to 2009), including maternal demographics, children's nighttime dietary practices, bedsharing habits, methods to help children sleep, and clinical evidence of plaque and caries. Statistical analyses utilized bivariate and logistic regression analyses. **Results:** Mother-child dyads (n equals 629) who either bedshared every night (n equals 273) or did not bedshare (n equals 356) were included. Of the 629 children (mean±standard deviation [SD] age equals 21.6±12.1 months), 51 percent were male, 50 percent were nonwhite, and 72 percent lived with both parents. Logistic regression analysis revealed that children who bedshared were more likely to be healthy (OR equals 6.78; $P=.008$), older (OR equals 1.56; $P=.007$), nonwhite (OR equals 2.96; $P<.001$), live with a single mother (OR equals 3.41; $P<.001$), breastfed throughout the night (OR equals 4.33; $P<.001$), and bottle-fed and breastfed to help them sleep (OR equals 2.34; $P=.03$; OR equals 3.27; $P=.03$, respectively). Moreover, these children were more likely to be in the high caries-risk category (OR equals 2.19; $P=.01$). **Conclusions:** Bedsharing was significantly associated with the child's health status, age, race, nighttime feeding habits, and high caries-risk and with whom the child lived. Caries preventive measures should be targeted to mother-child dyads who bedshare. (*Pediatr Dent* 2016;38(7):477-83) Received December 28, 2015 | Last Revision July 11, 2016 | Accepted July 18, 2016

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According to the American Academy of Pediatrics (AAP), co-sleeping and bedsharing are often used synonymously.¹ Co-sleeping is defined as a parent and an infant/child sleeping in close proximity to each other, while bedsharing is defined as a form of co-sleeping where the parent and the infant/child share the same surface while sleeping.¹ Co-sleeping has been a controversial issue, especially in the U.S., for the past several decades.¹ The AAP promotes room sharing, but not bedsharing for the safety of the infant and prevention of sudden infant death syndrome (SIDS).¹ Bedsharing increases the risk for infant suffocation, strangulation, entrapment, overheating, rebreathing expired air from parents, and SIDS.¹ There is evidence to support that avoiding bedsharing reduces SIDS risk by 50 percent.¹ The AAP sleep guidelines recommend “using a separate but proximate sleeping environment for infants” to reduce SIDS risk and other sleep-related deaths.²

Despite AAP recommendations, bedsharing trends in the U.S. have increased. According to the National Infant Sleep Position Study (NISP), bedsharing rates doubled from 1993 (6.5 percent) to 2010 (13.5 percent).³ This study also found that 11.2 percent of parents reported this as a usual practice.³

The Infant Practices Study II reported even higher rates of bedsharing: 42 percent at two weeks old, 34 percent at three months old, and 27 percent at 12 months old.⁴ According to the NISP study, increased bedsharing was associated with: (1) a maternal education level less than high school compared to

college or greater; (2) African American, Hispanic, or other than Caucasian maternal race; (3) household annual income less than \$50,000; (4) families living in the West or South compared to Midwest; (5) infants younger than 15 weeks versus infants 16 weeks or older; and (6) premature infants compared to full-term infants.³ Parents, particularly mothers, choose to bedshare and co-sleep for many reasons, including to facilitate breastfeeding, comfort a fussy infant, help the mother and infant sleep better, promote bonding, and keep the infant warm.^{1,4-6} After nighttime breastfeeding, the AAP recommends that the infant should return to a crib or other sleeping surface.¹

There is an association between bedsharing and breastfeeding, but data cannot provide the evidence of a temporal relationship.¹ According to McKenna, infants who routinely bedshared breastfed three times longer during the night than those who slept separately.⁷ Episodes of breastfeeding were significantly larger in number and longer in duration on bedsharing nights than on nights when children and mothers were sleeping separately.⁷ Huang found that longer duration of bedsharing was associated with longer duration of breastfeeding.⁸ A review completed by Horsley et al. also found that studies suggest an increased duration of breastfeeding when the mother and infant bedshare.⁹

The AAP recommends exclusive breastfeeding for the first six months of life, with continued breastfeeding past 12 months if the mother and child desire.¹⁰ Breastfeeding rates in 2011 in the U.S. were as follows: 73 percent of mothers initiate breastfeeding; 42 percent were breastfeeding at six months; and 21 percent were still breastfeeding at 12 months.¹ Rates for these time periods varied among races, with Asian/Pacific Islanders having the highest rates and non-Hispanic African American mothers having the lowest rates.¹ Breastfeeding duration was longer for women who were Caucasian, had higher education,

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had previous breastfeeding experience, planned to breastfeed, and did not return to work within the first year postpartum.⁸ According to Buswell, breastfeeding rates were higher for women in Oregon and Washington.⁶

While research exists on the association between breastfeeding and bedsharing, there is minimal research on bedsharing and other nighttime feeding behaviors. The American Academy of Pediatric Dentistry (AAPD) recommends “ad libitum breastfeeding should be avoided after the first primary tooth begins to erupt and other dietary carbohydrates are introduced.”¹¹

Knowing that nighttime feeding habits may increase the risk to children of developing early childhood caries (ECC), the purpose of this study was to investigate the relationship between bedsharing and oral health related-feeding behaviors of zero- to three-year-olds and their mothers.

Methods

This retrospective chart review study was approved by the Institutional Review Board of the University of Iowa, Iowa City, Iowa, USA. Study subjects were selected from 954 records of zero- to three-year-old children who were patients of the University of Iowa’s Infant Oral Health Program (IOHP) located at the Johnson County Department of Public Health’s Women, Infants and Children (WIC) clinic from September 1998 to November 2009. The habit of bedsharing, as reported by the mother, was dichotomized into two categories: (1) bedsharing—mother sleeping with her child every night during either the breastfeeding and/or bottle-feeding period; and (2) no bedsharing. Records (*N* equals 325) were excluded for mother-child dyads who reported bedsharing one to six nights per week to avoid the effects of confounding variables in the mixed behavior of bedsharing. No other inclusion/exclusion criteria were employed.

Data obtained from the child’s first visit included maternal report of child demographics (age, sex, race, whom the child lives with, who took care of the child during the day, birth order, birth maturity, medical problems, and child temperament, as defined by Sptiz et al.¹²), and mother demographics (previous knowledge of early childhood caries, education level, and health problems during pregnancy). The data also included information on nighttime methods to comfort children to sleep (pacifier use, bottle-feeding, breastfeeding, rocking and comforting, and other methods), as well as nighttime feeding behaviors (breastfed to sleep and/or throughout the night, bottle-fed to sleep and/or throughout the night, and contents of the bottle including formula, milk, juice, water, or other).

This particular study focused on the following question: “During the bottle- or breastfeeding period, how many nights per week did/does the child sleep in bed with the mother?”

Along with the data from the questionnaires, clinical evidence of cavitated and noncavitated lesions and plaque on maxillary incisors was also obtained. The presence of dental plaque was inspected by the naked eye or with the aid of a dental explorer and without disclosing solution on each facial surface of the child’s primary maxillary incisors. Dental plaque was assessed using the following dichotomized categorization: (1) no plaque on the facial surfaces of the maxillary incisors; and (2) plaque on at least one facial surface of the maxillary incisors. Dental caries was recorded as either cavitated or noncavitated lesions. Dental examinations were performed by different examiners from the Department of Pediatric Dentistry, College of Dentistry, University of Iowa, who were trained and

familiar with both plaque and dental caries scoring criteria. Caries risk assessment was reported as low- or high-risk based on medical and dental health histories, clinical evaluation of the child’s oral health, and examiner’s overall impression, as described by Weber-Gasparoni et al. in a previous publication.¹³

Descriptive statistics were conducted to depict the variables of interest in the study. Bivariate analyses were performed to evaluate the factors associated with mother-child habits of bedsharing. The standard chi-square test, Fisher’s exact test, and nonparametric Wilcoxon rank-sum test were used for the bivariate analysis. Multiple logistic regression analysis was used to identify the significant predictors related to mother-child habits of bedsharing, adjusting for potential confounding effects of other covariates. A *P*-value of less than .05 was used to determine statistical significance, and $.05 \leq P < .10$ was used as a criterion for marginal significance. Statistical analysis was performed using the SAS System 9.4 statistical software (SAS Institute Inc., Cary, N.C., USA).

Results

A total of 629 mother-child dyads were included in the study who either bedshared every night (*N* equals 273) or did not bedshare at all (*N* equals 356). The mean±standard deviation (SD) age of the children was 21.6±12.1 months. Fifty-one percent of the children were males, 50 percent were nonwhite, 72 percent lived with both parents, 65 percent were cared for by their mothers during the day, 16 percent were premature, and 90 percent were healthy (no reported health problems). Child temperament, as perceived by the mothers, showed that 54 percent were calm, 46 percent were happy, 27 percent were easy, 24 percent were stubborn, 23 percent were demanding, 11 percent were fussy, and nine percent were crying. Mother demographics showed that 83 percent did not have health problems during pregnancy, 72 percent had previous knowledge of ECC, and 42 percent had a high school diploma as their highest education level.

Children’s clinical findings at their first visit showed that 11 percent had cavitated carious lesions, 14 percent had noncavitated carious lesions, 19 percent had plaque on maxillary incisors, and 29 percent were determined to be in the high caries-risk category. Breastfeeding to sleep was the most common nighttime feeding behavior among the study population (63 percent). Bottles contained mainly formula (76 percent); however 29 percent of bottle contents was juice. Twelve percent of children were bottlefed, and eight percent were breastfed to help the child sleep. Table 1 provides demographic characteristics of the study participants and relevant characteristics for nighttime and oral health related-feeding behaviors and methods to help the child sleep.

Table 2 presents the bivariate (unadjusted) results for those variables that showed significance in the bivariate analysis and then were considered as candidates to develop the final logistic regression model. When compared to their analog counterparts, children who bedshared every night were significantly or marginally significantly more likely to be: healthy (45 percent versus 28 percent, *P*=.01); older in age (23.3 versus 20.2 months, *P*<.001); of nonwhite racial background (60 percent versus 26 percent, *P*<.001); living with a single mother (57 percent versus 38 percent, *P*<.001); perceived as having a demanding temperament (49 percent versus 41 percent, *P*=0.10); and a child who was not calm (47 percent versus 40 percent, *P*=0.09). Nighttime feeding habits of children who bedshared every night revealed that these children were significantly more

likely to be: breastfed to sleep (48 percent versus 34 percent, $P=.002$); breastfed throughout the night (60 percent versus 23

percent, $P<.001$); bottle-fed to sleep (48 percent versus 39 percent, $P=.03$); and bottle-fed throughout the night (50 percent versus 37 percent, $P=.002$).

Contents of the bottle were also significantly different between the two groups. Children who bedshared every night were more likely to have milk (49 percent versus 38 percent, $P=.01$) and juice in the bottle (49 percent versus 39 percent, $P=.03$). Moreover, mothers who bedshared every night were significantly more likely to help their children sleep by bottle-feeding (55 percent versus 42 percent, $P=.03$) and breastfeeding (72 percent versus 41 percent, $P<.001$). Bivariate analysis results, however, revealed that mother's educational level and premature birth were not significantly associated with bedsharing (data not shown in tables).

During the first dental examination for our participants, 61 percent of children who bedshared every night were reported to be in the high caries-risk category versus 36 percent of children who were in the low caries-risk category ($P<.001$).

Table 1. DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS AND ORAL HEALTH RELATED-FEEDING BEHAVIORS (N=629*)	
Variable	Frequency (%)
A. Demographic characteristics of participants*†	
<i>Age group (ys)*</i>	
<1	147 (23)
1	239 (38)
2	137 (22)
3	106 (17)
<i>Sex*</i>	
Female	302 (49)
Male	320 (51)
<i>Race*</i>	
Caucasian	285 (50)
Nonwhite	113 (50)
<i>Child lives with*</i>	
Both parents	447 (72)
Mother	163 (26)
Father	4 (1)
Other	4 (1)
>1 of above	4 (1)
<i>Who takes care of the child during the day*</i>	
Mother	407 (65)
Grandmother	30 (5)
Baby-sitter	50 (8)
Child at day-care	62 (10)
Other	35 (6)
>1 of above	38 (6)
<i>Child maturity classification at birth*</i>	
Premature	89 (16)
Full-term	482 (84)
<i>Child has medical problems*</i>	
Yes	57 (9)
No	561 (90)
Not sure	7 (1)
<i>Child temperament (checked all that applied)†</i>	
Calm	339 (54)
Happy	95 (46)
Demanding	144 (23)
Easy	56 (27)
Fussy	68 (11)
Stubborn	151 (24)
Crying	54 (9)
<i>Highest level of mother's education*</i>	
8 th grade or less	3 (2)
Some high school but did not graduate	17 (13)
High school diploma or GED	55 (42)
2-year college degree	8 (6)
4-year college degree	33 (25)
Graduate degree	14 (11)

Table 1. CONTINUED	
Variable	Frequency (%)
A. Demographic characteristics of participants*†	
<i>Maternal previous awareness of early childhood caries*</i>	
Yes	445 (72)
No	155 (25)
Not sure	20 (3)
<i>Mother had health problems during pregnancy*</i>	
Yes	103 (16)
No	516 (83)
Not sure	6 (1)
B. Oral health related-feeding behaviors†	
<i>Nighttime feeding behaviors†</i>	
Child breastfed to sleep	353 (63)
Child breastfed throughout the night	303 (53)
Child bottle-fed to sleep	222 (39)
Child bottle-fed throughout the night	255 (44)
<i>Bottle contents†</i>	
Formula	420 (76)
Milk	241 (44)
Water	212 (39)
Juice	156 (29)
Other	42 (8)
<i>Methods to help child sleep†</i>	
Pacifier	69 (11)
Bottle-feed	75 (12)
Rock and comfort	205 (33)
Breastfeed	50 (8)
Do nothing	35 (6)
Other methods	98 (16)
Child has no problems sleeping	245 (39)

* Due to missing data, not all variables add up to the total sample size population of 629.

† Numbers represent subjects who responded "yes" to the question. Respondents were allowed to check "yes" to all choices that applied.

Table 2. SIGNIFICANT FACTORS ASSOCIATED WITH MOTHER-CHILD HABITS OF BEDSHARING (N=629)*

Variables	Mother-child bedsharing habits		
	No bedsharing N=356 N (%)	Bedsharing every night N=273 N (%)	P-value
A. Demographic characteristics of participants			
<i>Child has medical problems</i>			
Yes	41 (72)	16 (28)	.01†
No	308 (55)	252 (45)	
<i>Child's age</i>			
Mean (mos)	20.2	23.3	<.001‡
<i>Race</i>			
Caucasian	211 (74)	74 (26)	<.001†
Nonwhite	117 (40)	172 (60)	
<i>Who child lives with</i>			
Both parents	277 (62)	170 (38)	<.001†
Single mother	75 (43)	100 (57)	
<i>Demanding temperament</i>			
Yes	73 (51)	71 (49)	.10§
No	281 (59)	199 (41)	
<i>Calm temperament</i>			
Yes	203 (60)	136 (40)	.09§
No	151 (53)	133 (47)	
B. Nighttime feeding behaviors			
<i>Breastfed to sleep</i>			
Yes	185 (52)	168 (48)	.002†
No	134 (66)	70 (34)	
<i>Breastfed throughout the night</i>			
Yes	121 (40)	182 (60)	<.001†
No	200 (77)	60 (23)	
<i>Bottle-fed to sleep</i>			
Yes	116 (52)	106 (48)	.03†
No	217 (61)	137 (39)	
<i>Bottle-fed throughout the night</i>			
Yes	128 (50)	127 (50)	.002†
No	205 (63)	120 (37)	
C. Bottle contents			
<i>Milk</i>			
Yes	124 (51)	117 (49)	.01†
No	193 (62)	119 (38)	
<i>Water</i>			
Yes	112 (53)	100 (47)	.06§
No	200 (61)	127 (39)	
<i>Juice</i>			
Yes	79 (51)	77 (49)	.03†
No	230 (61)	147 (39)	

In particular, children who bedshared with their mothers were more likely to have plaque on maxillary incisors (63 percent versus 39 percent, $P<.001$), noncavitated carious lesions (68 percent versus 40 percent, $P<.001$), and cavitated carious lesions (72 percent versus 41 percent, $P<.001$) compared to their corresponding counterparts.

Table 2. CONTINUED

Variables	Mother-child bedsharing habits		
	No bedsharing N=356 N (%)	Bedsharing every night N=273 N (%)	P-value
D. Methods to help child sleep			
<i>Bottle-feed to help child sleep</i>			
Yes	34 (45)	41 (55)	.03†
No	322 (58)	231 (42)	
<i>Breastfeed to help child sleep</i>			
Yes	14 (28)	36 (72)	<.001†
No	342 (59)	236 (41)	
<i>Child has no problems sleeping</i>			
Yes	161 (66)	84 (34)	<.001†
No	195 (51)	188 (49)	
E. Dental evaluation			
<i>Presence of plaque on maxillary incisors at first visit</i>			
Yes	40 (37)	68 (63)	<.001†
No	274 (61)	175 (39)	
<i>Presence of noncavitated lesions at first visit</i>			
Yes	24 (32)	52 (68)	<.001†
No	291 (60)	192 (40)	
<i>Presence of cavitated lesions at first visit</i>			
Yes	17 (28)	44 (72)	<.001†
No	301 (59)	205 (41)	
<i>Caries risk category at first visit</i>			
Low	280 (64)	158 (36)	<.001†
High	70 (39)	110 (61)	

* Note: Statistical analyses were conducted based on all nonmissing values.
 † Statistically significant ($P<.05$) using chi-square test.
 ‡ Statistically significant ($P<.05$) using nonparametric Wilcoxon rank-sum test.
 § Marginally statistically significant ($.05\leq P<.10$) using chi-square test.

Table 3 displays results from the final forward stepwise logistic regression model verified using backward elimination, which explored significant factors associated with bedsharing. Logistic regression analysis revealed that statistically significant predictor variables were child's age ($P=.007$), race ($P<.001$), health status ($P=.008$), person the child lived with ($P<.001$), and child's temperament ($P=.03$). Significant dietary predictors were breastfed throughout the night ($P<.001$) and bottle-fed or breastfed to help the child sleep ($P=.03$, $P=.03$, respectively). Caries risk category at first visit was also a significant predictor ($P=.01$).

The adjusted odds ratios from the multiple logistic regression analysis were reported in Table 3. It was noted that the odd ratio for bedsharing every night increased 56 percent for every month that the child's age increased. Compared to the corresponding counterparts, the children from a nonwhite racial background who were healthy and perceived as not having a calm temperament or who lived with a single mother were 2.96, 6.78, 1.89, and 3.41 times more likely to bedshare every night. Moreover, the odds of bedsharing every night

Table 3. MULTIPLE LOGISTIC REGRESSION FOR FACTORS ASSOCIATED WITH MOTHER-CHILD BEDSHARING HABITS (NO BEDSHARING VERSUS BEDSHARING EVERY NIGHT; N=629)

Variable	Odds ratio* (95% Wald confidence limits)	P-value†
Child's age (ys)	1.56 (1.13, 2.16)	.007
Child race		
Nonwhite	2.96 (1.71, 5.12)	<.001
Caucasian	1.00	
Child with medical problems		
No	6.78 (1.64, 28.05)	.008
Yes	1.00	
Who child lives with		
Single mother	3.41 (1.84, 6.34)	<.001
Both parents	1.00	
Breastfed to help the child sleep		
Yes	3.27 (1.11, 9.61)	.03
No	1.00	
Breastfed throughout the night		
Yes	4.33 (2.43, 7.70)	<.001
No	1.00	
Bottle-fed to help the child sleep		
Yes	2.34 (1.08, 5.08)	.03
No	1.00	
Child with calm temperament		
No	1.89 (1.07, 3.33)	.03
Yes	1.00	
Caries risk category at first visit		
High	2.19 (1.21, 3.97)	.01
Low	1.00	

* The odds ratio estimate is the estimated change in the odds ratio resulting from an increase of 1 unit in the corresponding independent variable, assuming that all other variables in the model remain unchanged.

† P-values from the logistic regression analysis of variables associated with mother-child bedsharing habits.

among the children who were breastfed throughout the night, bottle-fed, and breastfed to help fall asleep were 4.33, 2.34, and 3.27 times that of children who didn't have those nighttime feeding behaviors. Children who were in the high caries-risk category were 2.19 times more likely to bedshare every night compared with those in the low caries-risk category.

Discussion

This present study demonstrated a high prevalence of bedsharing among WIC-enrolled children attending the IOHP who were nonwhite (60 percent). This finding was in agreement with published literature.^{3,14,15} The NISP³ found that increased bedsharing was associated with African American, Hispanic, or maternal race other than Caucasian. Lozoff et al. reported that regular co-sleeping (at least two to three nights per week) was common among African American families, regardless of socioeconomic status (SES).¹⁴ Colson et al. also reported that African Americans, Hispanics, or children from a mater-

nal ethnic race other than Caucasian had increased bedsharing compared to Caucasians.³ Lahr et al. also found that Hispanics, African Americans, and Asian/Pacific Islanders were more likely to bedshare frequently.¹⁵

Although the current study did not investigate the association of SES and bedsharing, Lozoff et al. showed that low SES Caucasian families were more likely to co-sleep regularly compared to Caucasian families of higher SES.¹⁴ The study also found that low SES African American families reported more regular co-sleeping than low SES Caucasian families.¹⁴

Our study indicated that 51 percent of children two to three years old were reported to bedshare compared to 38.6 percent of children younger than two years old (data not shown in tables). While there is an abundance of literature that reports infants co-sleeping with their mothers, there are fewer studies that have investigated children older than age two. According to NISP, increased bedsharing was associated with infants younger than 15 weeks compared to infants 16 weeks or older.³ The difference from our study can be explained by the difference in study sample age categories where the NISP only investigated infants seven months or younger.²

An interesting finding was that bedsharing children were more likely to be healthy, as reported by their mothers. However, these results should be interpreted with caution, because medical problems were not categorized according to their severity and they may not be representative of children with special health care needs. Our study also showed that prematurity at birth was not significantly associated with bedsharing habits. This finding was consistent with recently published studies.^{3,16}

Colson et al. found conflicting results that premature infants were more likely to bedshare compared to full-term infants.³ Moreover, Iglowstein et al. found no significant differences in sleep behavior, including bedsharing between preterm and full-term children over the first decade of life.¹⁶

Children in this study were more likely to bedshare with single mothers. The study completed by Lahr et al. also found that women most likely to bedshare were single and nonwhite, had lower incomes, and breastfed.¹⁵ These findings are consistent with the Plunket National Child Health Study from 1990 to 1991, which reported that 22 percent of unmarried women without a partner (single mothers) have the child sleep in their bed compared to nine percent of married mothers who bedshare.¹⁷ A plausible explanation might be that mothers may find bedsharing comforting, and it helps promote bonding between the infant and themselves.^{1,4-6}

Results from the logistic regression analysis suggest that children whose mothers did not perceive them as calm were almost twice as likely to bedshare as those who were perceived as having a calm temperament. A child's temperament can have an effect on parenting behaviors. Spitz et al. reported that children who were perceived as difficult were more likely to be bottle-fed to sleep.¹² According to Santos and Quinonez, children who were easily soothed were less likely to get sweetened liquids, indicating that temperament may be associated with feeding practices.¹⁸ Also, ECC children were more likely to show temperaments of fear, frustration, sadness, and shyness; however, temporal relationship could not be determined.¹⁸ These studies indicate that a child's temperament can have an effect on nighttime feeding practices, which may consequently influence the child's caries risk. Shantinath et al. reported that sleep problems among young children are a behavioral risk factor for nighttime bottle use and ECC.¹⁹ These studies indicate that a child's temperament can have an effect on nighttime

feeding practices, which may consequently influence the child's caries risk.

When we explored the relationship between bedsharing and clinical variables, we found that presence of cavitated and noncavitated lesions and plaque on the maxillary incisors were significantly associated at the bivariate level. Moreover, children who bedshared with their mothers were more likely to be in the high caries-risk category at both bivariate and logistic regression levels. These findings should be interpreted with caution, since several other risk factors, such as oral hygiene and dietary habits, were considered during the child's caries risk assessment and could have contributed to the clinician's impression of increased risk. However, it is plausible to assume that the children in this study who bedshare presented with other ECC-risk factors, in addition to nighttime feeding practices, that contributed to being in a higher caries risk category.

This study was subject to the inherent limitations of survey studies that rely on self-reported data collection and retrospective secondary data analysis. Although the questions used in the study were carefully created to avoid leading answers, response bias cannot be controlled. This study population may not be entirely representative of the U.S. population, as it is over-representing low-income mother-child dyads from the Midwest. Another limitation is that bottle contents were queried in our questionnaire, but they did not specify if they were nighttime bottle contents only. Therefore, results for bottle contents should be interpreted with caution. The strengths of this study include ethnically diverse families attending the Johnson County WIC program. Also, our sample is balanced between those who bedshared every night and those who reported no bedsharing. This provides valid information on the association between bedsharing, demographics, and nighttime feeding practices.

The numerous relationships among the variables provide a blueprint to discuss future action. In summary, this study showed that children who bedshare with their mothers every night are more likely to be nonwhite, older, healthy, living with a single mother, not perceived to be calm, breastfed throughout the night, and breastfed or bottle fed to help them sleep. This study is important, as it reports certain practices that are associated with bedsharing and concurrently place the child at a higher risk for caries. Therefore, clinicians should inquire about young children's feeding habits as well as sleeping practices in order to better educate mothers and hopefully improve preventive strategies to target mothers and children who engage in bedsharing.

Conclusions

Based on this study's results, the following conclusions can be made for Women, Infants and Children-enrolled zero- to three-year-olds attending the University of Iowa's Infant Oral Health Program:

1. Bedsharing is significantly associated with children who are of nonwhite racial background, older, healthy, and live with a single mother.
2. Bedsharing appears to be associated with increased nighttime breastfeeding and bottle-feeding habits.
3. Bedsharing appears to be associated with a high caries-risk category among children.
4. Maternal reports of bedsharing may be one factor associated with some high caries-risk behaviors for which preventive interventions should be considered.

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References

1. American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome. SIDS and other sleep-related infant deaths: expansion of recommendations for a safe infant sleeping environment. *Pediatrics* 2011;128:e1341-e1367.
2. American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome. The changing concept of sudden infant death syndrome: diagnostic coding shifts, controversies regarding the sleep environment, and new variables to consider in reducing risk. *Pediatrics* 2005;116:1245-55.
3. Colson ER, Willinger M, Rybin D, et al. Trends and factors associated with infant bed sharing, 1993-2010: the National Infant Sleep Position Study. *JAMA Pediatr* 2013;167:1032-7.
4. Hauck FR, Signore C, Fein SB, Raju TN. Infant sleeping arrangements and practices during the first year of life. *Pediatrics* 2008;122:113-20.
5. Baddock SA, Galland BC, Taylor BJ, Bolton DP. Sleep arrangements and behavior of bed-sharing families in the home setting. *Pediatrics* 2007;119:200-7.
6. Buswell SD, Spatz DL. Parent-infant co-sleeping and its relationship to breastfeeding. *J Pediatr Health Care* 2007;21:22-8.
7. McKenna JJ, Mosko SS, Richard CA. Bedsharing promotes breastfeeding. *Pediatrics* 1997;100:214-9.
8. Huang Y, Hauck FR, Signore C, et al. Influence of bed-sharing activity on breastfeeding duration among U.S. mothers. *JAMA Pediatr* 2013;167:1038-44.
9. Horsley T, Clifford T, Barrowman N, et al. Benefits and harms associated with the practice of bed sharing: a systematic review. *Arch Pediatr Adolesc Med* 2007;161:237-45.
10. American Academy of Pediatrics. Breastfeeding and the use of human milk. *Pediatrics* 2012;129:e827-e841.
11. American Academy of Pediatric Dentistry. Policy on early childhood caries (ECC): classifications, consequences, and preventive strategies. *Pediatr Dent* 2014;36(special issue):50-2.
12. Spitz AS, Weber-Gasparoni K, Kanellis MJ, Qian F. Child temperament and risk factors for early childhood caries. *J Dent Child* 2006;73:98-104.
13. Weber-Gasparoni K, Kanellis MJ, Qian F. Iowa's public health-based infant oral health program: a decade of experience. *J Dent Educ* 2010;74:363-71.
14. Lozoff B, Askew GL, Wolf AW. Cosleeping and early childhood sleep problems: effects of ethnicity and socioeconomic status. *J Dev Behav Pediatr* 1996;17:9-15.
15. Lahr MB, Rosenberg KD, Lapidus JA. Maternal-infant bedsharing: risk factors for bedsharing in a population-based survey of new mothers and implications for SIDS risk reduction. *Matern Child Health J* 2007;11:277-86.
16. Iglowstein I, Hajnal BL, Molinari L, Largo RH, Jenni OG. Sleep behavior in preterm children from birth to age 10 years: a longitudinal study. *Acta Paediatr* 2007;95:1691-3.

17. Tuohy PG, Counsell AM, Geddis DC. Sociodemographic factors associated with sleeping position and location. *Arch Dis Child* 1993;69:664-6.
18. Santos RG, Quinonez R. Child temperament is as strongly associated with early childhood caries (ECC) as poor feeding practices: positive temperament appears protective, negative temperament may increase ECC risk. *J Evid Based Dent Pract* 2014;14:85-8.
19. Shantinath SD, Breiger D, Williams BJ, Hasazi JE. The relationship of sleep problems and sleep-associated feeding to nursing caries. *Pediatr Dent* 1996;18:375-8.