# Pacifier Use and Morbidity in the First Six Months of Life

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# Pacifier Use and Morbidity in the First Six Months of Life

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**ABSTRACT.** *Objective.* **To assess the prevalence of pacifier use and whether this habit adversely affects the health of 6-month-old infants.**

*Design.* **Data collected via self-completion questionnaires from mothers forming part of the prospective, population-based Avon Longitudinal Study of Pregnancy and Childhood.**

*Methods.* **The mothers of 10 950 infants gave information on their child's use of a pacifier at 4 weeks and 6 months of age and the presence of specific health symptoms. Adjusted logistic regression was performed to identify any associations between pacifier use and ill health.**

*Results.* **Two thirds of the sample had been given a pacifier at some point, with 42% being reported as having one at both ages. Younger, lower educated mothers, mothers who smoked, those living in council and overcrowded accommodation, and those reporting financial difficulties were significantly more likely to give their infant a pacifier. Pacifier use was associated significantly with a higher risk of symptoms such as wheezing, earache, vomiting, fever, diarrhea, and colic as well as with the general practitioner being called to the home and hospital admission.**

*Conclusions.* **Although significant differences exist in the risk of experiencing several health symptoms between infants who do and infants who do not use a pacifier, stronger and more detailed evidence is required before recommendations can be made to discourage the use of pacifiers based purely on reducing occurrences of these symptoms.** *Pediatrics* **1999;103(3). URL: http://www.pediatrics.org/cgi/content/full/103/3/e34;** ***pacifier use, morbidity, infants.***

ABBREVIATIONS. ALSPAC, Avon Longitudinal Study of Pregnancy and Childhood; SCBU, special care baby unit; OR, odds ratio; CI, confidence interval.

Recently, the prevalence of pacifier use has been widely reported in Scandinavian countries;[1–8] however, there has been little investigation in England. The Scandinavian studies have examined primarily the effects of pacifier use on the child's dentition. There has been no substantial research on the effects that pacifier use may have on the general health of infants. Two studies that have been conducted in England published limited data, but both refer to births occurring >50 years ago. The first, by Spence and co-workers[9] performed in 1947, was part of an inquiry into the health and development of infants to 1 year of age. They reported that 62% of their sample had the pacifier habit at some time during the first year of life, however, they found no significant relationships between the habit and infantile infection. The second study, by Gale and Martyn, related pacifier use to child health in a sample of Hertfordshire infants from 1911 to 1930.[10] During this period, 30% were reported as having used a pacifier. A higher proportion of pacifier users had suffered from bronchitis/pneumonia, thrush, anemia and malnutrition, although the absolute differences were barely significant.

The purpose of this study is to report the prevalence of pacifier use and the relationships between the habit and several features of health, in a population sample of almost 11 000 children who form part of the Avon Longitudinal Study of Pregnancy and Childhood (ALSPAC).

## MATERIALS AND METHODS

Data for this study were obtained from ALSPAC, which is an ongoing longitudinal study designed to investigate environmental and other influences on the health and development of children. Pregnant women who were resident in the three Bristol-based health districts of Avon, having an estimated date of delivery between April 1, 1991 and December 31, 1992, were invited to take part in the study, and an estimated 85% of the population enrolled. Detailed information is obtained from the mothers via self-completion questionnaires administered at several time points during pregnancy (8, 18, and 32 weeks' gestation) and at various ages of the child.

Pacifier use was asked about in questionnaires administered at both 4 weeks and 6 months after the infant's birth. At 4 weeks, the mother was asked, "Does your baby have a pacifier a) at night?, and b) during the day?" She was given the options 1) usually, 2) often, 3) sometimes, and 4) never for each of a) and b). From the answers given, a variable, "Baby ever uses a pacifier at 4 weeks of age" was derived, categorized as yes if the mother answered usually, often, or sometimes to either (a) or (b), and no if she answered never to both.

"Is the baby given a pacifier?" was the question posed in the 6-month questionnaire. The alternatives, 1) at night time only, 2) most of the time, 3) sometimes, and 4) never, were given. Again, a new variable was generated: "Infant ever uses a pacifier at 6 months of age". If the mother answered at night, most of the time, or sometimes, the new variable was put to yes, otherwise to no.

From the information gathered above, a third variable was created, categorized as 1) never used a pacifier, 2) used a pacifier at 4 weeks but not at 6 months, 3) used a pacifier at 6 months but not at 4 weeks, and 4) used a pacifier continuously. From this, short- and longer-term effects of pacifier use on the health of infants may be investigated.

The health outcomes considered were included in the questionnaire administered at 6 months; these concerned the health of the infants since birth.

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Excluded from the analysis were mothers who had failed to complete the 4-week and 6-month questionnaires and those who did not answer the questions concerning pacifier use. From the study sample of 14 318 surviving children, 10 950 (77.5%) met inclusion criteria.

Twelve confounding factors including demographic, socioeconomic, and lifestyle factors were considered as possibly being related to the health outcomes. The following were obtained from the questions answered by the mother 8 weeks into her pregnancy: overcrowding (defined as more than 1 person per room in the home); the presence of dampness or mold in the home (as a result of condensation, leaking pipes, or rising through the brick or stone); and the type of housing the mother lived in (owner-occupied, council (public) housing, rented/other). Maternal smoking was investigated when the infant was 8 weeks old. The degree of financial difficulties experienced was determined at 32 weeks' gestation. Whether the infant was exposed to environmental tobacco smoke (defined as being in a room where people were smoking for at least 1 hour per day) was asked at 6 months. The other factors investigated were sex of the infant, maternal age, number of older siblings, duration of breastfeeding, the mothers highest educational level, and whether the infant had been admitted to a special care baby unit (SCBU). The position in which the infant was put to sleep also was investigated, because this has been found to be associated with various health symptoms within the ALSPAC sample.[11]

$\chi^2$ Analysis was performed to examine the relationships between the various confounding factors and pacifier use. Logistic regression was used to assess the effects of pacifier use on the health of the study sample at 6 months of age. Initial unadjusted analysis was performed and then adjustment was made for the 12 possible confounding factors. Odds ratios (ORs) and 95% confidence intervals (CIs) were obtained for both analyses, using the group of infants who had never used a pacifier as the baseline group.

## RESULTS

### Pacifier Use

From Table 1, it can be determined that 6396 (58.4%) infants were reported as having used a pacifier at 4 weeks of age. Of these, 4627 (72.3%) still were using a pacifier at 6 months. The overall number of infants using a pacifier at 6 months was 5352 (48.9%); the majority of these (86.5%) had used a pacifier at 4 weeks. One third of the infants in the study sample (3829) had never been given a pacifier.

Table 2 presents the variations among those infants having a pacifier and those not with the various confounding factors. Among the demographic factors, pacifier users were significantly more likely to be boys ($P < .0001$), to have the youngest mothers ($P < .0001$), and to have no older siblings ($P < .0001$).

There were significant relationships between the socioeconomic factors and the use of pacifiers in the age range. Mothers with minimal educational qualifications (Certificate of Secondary Education [CSE] or less) were more than twice as likely to give their infant a pacifier at both time points compared with those with a university degree ($P < .0001$). Children living in publicly owned (council) ($P < .0001$) and overcrowded ($P < .0001$) accommodation were significantly more likely to be given a pacifier, as were those whose mothers experienced many financial difficulties ($P < .0001$). Mothers, however, who reported dampness in the house were slightly less likely to have given their infant a pacifier ($P < .01$).

Continuous pacifier use was highly prevalent among infants who were never breastfed or who had been breastfed for <4 weeks ($P < .0001$), those who were exposed to environmental tobacco smoke ($P < .0001$), and those whose mothers smoked postnatally ($P < .0001$). A significant difference existed between admission to an SCBU and the use of a pacifier; children who had been admitted to an SCBU were significantly less likely to have been given a pacifier by 4 weeks of age (54.0% vs 58.9%). However, by 6 months of age the trend had changed, with more SCBU infants having a pacifier (51.9%) than the rest of the population (48.8%). Infants who were put to sleep in the prone position were significantly less likely to have been given a pacifier compared with the rest of the population ($P < .0001$).

**TABLE 1.** Pacifier Use at 4 Weeks and 6 Months of Age ($\chi^2 = 3388.9$; $P < .0001$)

| Given a Pacifier at 4 Wk | Given a Pacifier at 6 Mo | | |
|---|---|---|---|
| | Yes | No | Total |
| Yes | 4627 (42.3%) | 1769 (16.2%) | 6396 (58.4%) |
| No | 725 (6.6%) | 3829 (34.9%) | 4554 (41.6%) |
| Total | 5352 (48.9%) | 5598 (51.1%) | 10950 (100%) |

### Health of the Child

*Markers of Ill Health*

When the child was 6 months old, the mother was asked about the health of her infant in the past few months. The following options were given: 1) very healthy, no problems; 2) healthy, but a few minor problems; 3) sometimes quite ill; and 4) almost always unwell. The answers to this question were categorized as very healthy (option 1) or not very healthy (all other options). From Table 3 it can be determined that a higher proportion of mothers (45.8%) who had given their infant a pacifier at 6 months only reported that their infants were not very healthy compared with the other three groups. Adjustment for all variables showed that the infants in this group were at a significantly higher risk of being reported as not very healthy, with an OR of 1.41 (95% CI: 1.18, 1.70). The association with pacifier use at both time points also was elevated (OR, 1.19; 95% CI: 1.07, 1.32).

Children using a pacifier continuously were significantly more likely to have been treated at home by a doctor. Unadjusted analysis showed a high OR for all three groups of infants having a pacifier at either time point. After adjustments had been made, these OR measures were reduced but still statistically significant in comparison with the group never having a pacifier. A similar pattern was found for the proportion of infants who had been taken to see their doctor for a health problem, although the ORs were not as high. Children were significantly more likely to have been admitted to hospital if they used a pacifier at both 4 weeks and 6 months of age (OR, 1.31; 95% CI: 1.10, 1.56).

*Respiratory Symptoms*

Table 4 presents the relationships between respiratory symptom and the use of a pacifier. There was no significant association between an infant having a cold, holding breath while asleep, snoring, or having

**TABLE 2.** Pacifier Use by Demographic, Socioeconomic, and Lifestyle Factors

| Confounding Variable (%) | Never (34.9%) | Y, at 4 Wk Only (16.2%) | Y, at 6 Mo Only (6.6%) | Both (42.3%) | $\chi^2$ |
|---|---|---|---|---|---|
| Demographic characteristics | | | | | |
| Sex of child ($n$ = 10 950) | | | | | |
| Boy (51.5%) | 32.1 | 17.2 | 6.5 | 44.2 | 39.7 |
| Girl (48.5%) | 37.6 | 15.2 | 6.8 | 40.4 | **** |
| Maternal age ($n$ = 10 933) | | | | | |
| <25 (19.4%) | 19.8 | 15.4 | 6.9 | 57.8 | |
| 25–29 (39.7%) | 32.5 | 16.3 | 6.8 | 44.4 | 465.7 |
| 30+ (40.9%) | 44.0 | 16.5 | 6.3 | 33.2 | **** |
| No. of older siblings ($n$ = 10 412) | | | | | |
| None (45.3%) | 30.7 | 18.3 | 7.4 | 43.6 | |
| One (35.5%) | 38.8 | 15.2 | 6.4 | 39.5 | 88.2 |
| Two or more (19.2%) | 38.9 | 13.5 | 5.6 | 41.9 | **** |
| Socioeconomic factors | | | | | |
| Mother's education ($n$ = 10 586) | | | | | |
| None or CSE (18.0%) | 23.0 | 14.6 | 7.0 | 55.4 | |
| Vocational (9.4%) | 23.8 | 15.7 | 6.7 | 53.9 | |
| O level (35.2%) | 30.8 | 16.2 | 6.3 | 46.7 | |
| A level (23.6%) | 42.8 | 17.4 | 6.9 | 32.9 | 699.7 |
| Degree (13.8%) | 55.8 | 16.3 | 7.1 | 20.9 | **** |
| Housing tenure ($n$ = 10 634) | | | | | |
| Owned (78.0%) | 37.5 | 16.7 | 6.6 | 39.2 | |
| Public (council) rented (11.1%) | 20.4 | 14.4 | 6.2 | 59.1 | 202.7 |
| Private rented (10.9%) | 31.5 | 14.3 | 7.3 | 47.0 | **** |
| Financial difficulties ($n$ = 10 153) | | | | | |
| None (38.0%) | 39.8 | 16.1 | 6.4 | 37.7 | |
| Some (38.0%) | 33.2 | 19.8 | 6.7 | 43.2 | 76.3 |
| Many (24.0%) | 30.8 | 15.2 | 7.1 | 46.9 | **** |
| Overcrowding ($n$ = 10 512) | | | | | |
| No (94.7%) | 35.4 | 16.3 | 6.7 | 41.6 | 20.1 |
| Yes (5.3%) | 28.3 | 14.9 | 5.7 | 51.1 | *** |
| Damp in home ($n$ = 10 620) | | | | | |
| No (52.3%) | 33.2 | 16.8 | 6.7 | 43.4 | 15.8 |
| Yes (47.7%) | 36.8 | 15.5 | 6.7 | 41.0 | ** |
| Lifestyle factors | | | | | |
| Maternal smoking (8 wk; $n$ = 10 533) | | | | | |
| No (81.8%) | 37.7 | 16.5 | 6.5 | 39.3 | 187.1 |
| Yes (18.2%) | 23.3 | 5.0 | 6.7 | 55.0 | **** |
| Passive smoking ($n$ = 10 950) | | | | | |
| No (61.1%) | 40.4 | 17.0 | 6.4 | 36.2 | 244.8 |
| Yes (38.8%) | 26.0 | 15.0 | 7.0 | 52.0 | **** |
| Ever breastfed ($n$ = 10 950) | | | | | |
| Never (20.9%) | 17.0 | 16.1 | 6.0 | 60.8 | |
| Yes, stopped by 4 wk (23.2%) | 18.6 | 17.5 | 4.5 | 59.3 | 1372.2 |
| Yes and still at 4 wk (55.9%) | 48.1 | 15.7 | 7.7 | 28.5 | **** |
| Baby admitted to SCBU ($n$ = 10 861) | | | | | |
| Yes (6.5%) | 31.1 | 17.1 | 15.0 | 36.9 | 87.5 |
| No (93.5%) | 35.0 | 16.1 | 6.0 | 42.8 | **** |
| Position child put to sleep ($n$ = 10 826) | | | | | |
| Back (19.5%) | 36.8 | 17.1 | 4.7 | 41.4 | |
| Side (68.3%) | 33.5 | 15.8 | 7.1 | 43.6 | |
| Front (3.6%) | 44.8 | 18.4 | 5.4 | 31.5 | 49.29 |
| Varies (8.6%) | 35.7 | 16.3 | 6.1 | 41.8 | **** |

**** $P < .0001$; *** $P < .001$; ** $P < 0.01$.

a regular sleeping routine and whether the infant had ever used a pacifier. However, infants using a pacifier at both 4 weeks and 6 months were slightly more likely to have a cough; after adjustment ($P < .01$), the OR was 1.16 (95% CI: 1.04, 1.29). The relationship was not significant overall for prolonged coughing (at least 2 days), although the odds in the group who had a pacifier throughout was significantly elevated. This group also was more likely to have a wheezing attack; after adjustment for all factors, the OR was 1.23 (95% CI: 1.08, 1.42). Breathlessness was more likely to be experienced by continuous pacifier users, although the OR was not significant after adjustment. This also was the case for breathing through the mouth and for prolonged snoring. Episodes of stopping breathing (apnea) were more likely to be reported if the infant had had a pacifier at 4 weeks.

### *Ear Problems*

Problems with ears and hearing are presented in Table 5. Infants who used a pacifier were at a significantly greater risk of suffering earache, particularly those using them continuously. This latter group had an OR of 1.37 (95% CI: 1.14, 1.63). There were no significant relationships between ear discharge and deteriorated hearing after a cold and the use of a pacifier.

**TABLE 3.** Markers of Ill Health in the First 6 Months by Pacifier Use

| | Never | Y, at 4 Wk | Y, at 6 Mo not 4 Wk | Y at 4 Wk and 6 Mo | *P* |
|---|---|---|---|---|---|
| Health of the baby within past months? | | | | | |
| % Not "very healthy" (40.0%) | 36.5 | 39.2 | 45.8 | 42.1 | *** |
| OR unadjusted | 1.00 | 1.12 (0.99, 1.25) | 1.47 (1.25, 1.73) | 1.26 (1.16, 1.38) | *** |
| OR adjusted | 1.00 | 1.13 (0.99, 1.28) | 1.41 (1.18, 1.70) | 1.19 (1.07, 1.32) | *** |
| Has doctor been called to home for ill baby? | | | | | |
| % Home visit (29.9%) | 23.5 | 31.0 | 32.0 | 34.4 | **** |
| OR unadjusted | 1.00 | 1.46 (1.29, 1.66) | 1.53 (1.28, 1.82) | 1.70 (1.55, 1.88) | **** |
| OR adjusted | 1.00 | 1.26 (1.09, 1.46) | 1.33 (1.09, 1.62) | 1.34 (1.19, 1.50) | **** |
| Child been taken to the doctor? | | | | | |
| % doctor visit (74.4%) | 70.2 | 75.5 | 75.5 | 77.2 | **** |
| OR unadjusted | 1.00 | 1.31 (1.15, 1.49) | 1.31 (1.09, 1.57) | 1.43 (1.30, 1.58) | **** |
| OR adjusted | 1.00 | 1.22 (1.05, 1.41) | 1.31 (1.06, 1.61) | 1.28 (1.14, 1.44) | **** |
| Child been admitted to hospital? | | | | | |
| % Hospital stay (11.2%) | 9.0 | 11.5 | 14.8 | 12.3 | **** |
| OR unadjusted | 1.00 | 1.31 (1.09, 1.58) | 1.76 (1.40, 2.23) | 1.43 (1.24, 1.64) | **** |
| OR adjusted | 1.00 | 1.25 (1.00, 1.55) | 1.27 (0.95, 1.70) | 1.31 (1.10, 1.56) | * |

Percentages denote the prevalence of the outcome within the pacifier history group.
Adjusted OR allowed for all the variables in Table 2.
**** $P < .0001$; *** $P < .001$; ** $P < .01$; * $P < .05$; NS, $P \geq .05$.

**TABLE 4.** Respiratory Symptoms in the First 6 Months by Pacifier Use

| | Never | Y, at 4 Wk | Y, at 6 Mo not 4 Wk | Y, at 4 Wk and 6 Mo | *P* |
|---|---|---|---|---|---|
| Ever had cold/snuffles? | | | | | |
| % With cold (87.4%) | 87.4 | 87.3 | 86.6 | 87.6 | NS |
| OR unadjusted | 1.00 | 1.00 (0.84, 1.18) | 0.94 (0.74, 1.18) | 1.02 (0.89, 1.16) | NS |
| OR adjusted | 1.00 | 1.08 (0.89, 1.31) | 0.95 (0.73, 1.23) | 1.09 (0.93, 1.28) | NS |
| Ever had cough? | | | | | |
| % With cough (64.7%) | 62.2 | 66.1 | 65.5 | 66.0 | ** |
| OR unadjusted | 1.00 | 1.19 (1.06, 1.34) | 1.16 (0.98, 1.37) | 1.18 (1.08, 1.29) | ** |
| OR adjusted | 1.00 | 1.22 (1.07, 1.41) | 1.18 (0.98, 1.43) | 1.16 (1.04, 1.29) | ** |
| Ever coughed for at least 2 d? | | | | | |
| % Coughed ≥2 d (44.0%) | 42.7 | 44.3 | 42.9 | 45.1 | NS |
| OR unadjusted | 1.00 | 1.07 (0.95, 1.19) | 1.01 (0.86, 1.19) | 1.10 (1.01, 1.20) | NS |
| OR adjusted | 1.00 | 1.12 (0.99, 1.28) | 1.07 (0.89, 1.40) | 1.15 (1.03, 1.28) | NS |
| Ever been breathless? | | | | | |
| % Breathless (6.0%) | 4.6 | 5.9 | 7.4 | 7.0 | **** |
| OR unadjusted | 1.00 | 1.30 (1.01, 1.67) | 1.68 (1.22, 2.30) | 1.56 (1.29, 1.89) | **** |
| OR adjusted | 1.00 | 1.12 (0.83, 1.49) | 1.23 (0.84, 1.81) | 1.23 (0.97, 1.55) | NS |
| Ever had episodes of stopping breathing (6–8 mo)? | | | | | |
| % Apnea (2.2%) | 1.3 | 2.2 | 3.2 | 2.6 | *** |
| OR unadjusted | 1.00 | 1.66 (1.09, 2.52) | 2.41 (1.46, 3.96) | 1.99 (1.43, 2.77) | **** |
| OR adjusted | 1.00 | 1.63 (1.01, 2.64) | 1.13 (0.55, 2.31) | 1.60 (1.06, 2.41) | NS |
| When asleep, seems to hold breath for several seconds | | | | | |
| % Holds breath often/sometimes (19.1%) | 19.2 | 19.6 | 18.2 | 18.8 | NS |
| OR unadjusted | 1.00 | 1.05 (0.65, 1.70) | 0.60 (0.26, 1.41) | 1.07 (0.74, 1.54) | NS |
| OR adjusted | 1.00 | 1.08 (0.91, 1.28) | 0.29 (0.07, 1.28) | 1.03 (0.61, 1.73) | NS |
| Breathes through mouth rather than through nose | | | | | |
| % Breathes through mouth all/much of time (23.3%) | 20.4 | 21.6 | 22.7 | 26.5 | **** |
| OR unadjusted | 1.00 | 1.08 (0.91, 1.28) | 1.15 (0.91, 1.45) | 1.41 (1.25, 1.60) | **** |
| OR adjusted | 1.00 | 0.95 (0.78, 1.15) | 1.00 (0.77, 1.31) | 1.03 (0.88, 1.20) | NS |
| Snores for more than few minutes at time | | | | | |
| % Snores most nights/quite often (14.3%) | 11.2 | 14.1 | 13.0 | 17.0 | **** |
| OR unadjusted | 1.00 | 1.30 (1.08, 1.56) | 1.18 (0.91, 1.53) | 1.63 (1.41, 1.87) | **** |
| OR adjusted | 1.00 | 1.06 (0.85, 1.31) | 0.92 (0.68, 1.25) | 1.16 (0.97, 1.37) | NS |
| Has regular sleeping? | | | | | |
| % Regular sleep (85.2%) | 84.5 | 85.1 | 82.8 | 86.3 | * |
| OR unadjusted | 1.00 | 1.05 (0.89, 1.23) | 0.88 (0.71, 1.09) | 1.15 (1.02, 1.30) | * |
| OR adjusted | 1.00 | 0.98 (0.82, 1.18) | 0.86 (0.68, 1.10) | 1.01 (0.87, 1.17) | NS |
| Ever had wheezing attacks with whistling on the chest? | | | | | |
| % Wheezed (19.6%) | 16.1 | 19.7 | 20.2 | 22.3 | **** |
| OR unadjusted | 1.00 | 1.28 (1.11, 1.48) | 1.32 (1.08, 1.62) | 1.50 (1.34, 1.68) | **** |
| OR adjusted | 1.00 | 1.18 (1.00, 1.40) | 1.18 (0.94, 1.50) | 1.23 (1.08, 1.42) | * |

Percentages denote the prevalence of the outcome within the pacifier history group.
Adjusted OR allowed for all the variables in Table 2.
**** $P < .0001$; *** $P < .001$; ** $P < .01$; * $P < .05$; NS, $P \geq .05$.

*Gastrointestinal Signs and Symptoms*

It can be determined from Table 6 that significant differences exist between the proportions of children in each of the three pacifier-using groups who had posseted (ie, brought up small amounts of food) often and who had suffered from diarrhea/gastro-

**TABLE 5.** Ear Problems in the First 6 Mo by Pacifier Use

| | Never | Y, at 4 Wk | Y, at 6 Mo not 4 Wk | Y, at 4 Wk and 6 Mo | *P* |
|---|---|---|---|---|---|
| Ever had earache? | | | | | |
| % With earache (9.9%) | 8.3 | 10.7 | 9.7 | 11.0 | *** |
| OR unadjusted | 1.00 | 1.34 (1.04, 1.52) | 1.19 (0.90, 1.56) | 1.37 (1.18, 1.58) | *** |
| OR adjusted | 1.00 | 1.27 (1.03, 1.58) | 1.26 (0.94, 1.70) | 1.37 (1.14, 1.63) | ** |
| Ever had ear discharge? | | | | | |
| % Discharge (2.8%) | 2.4 | 3.0 | 2.6 | 3.1 | NS |
| OR unadjusted | 1.00 | 1.26 (0.89, 1.77) | 1.10 (0.66, 1.81) | 1.32 (1.01, 1.72) | NS |
| OR adjusted | 1.00 | 1.22 (0.83, 1.82) | 1.19 (0.68, 2.06) | 1.26 (0.91, 1.74) | NS |
| Child's hearing worse after a cold? | | | | | |
| % Hearing much/little worse (6.7%) | 6.4 | 6.5 | 6.2 | 7.0 | NS |
| OR unadjusted | 1.00 | 1.03 (0.77, 1.36) | 0.96 (0.64, 1.45) | 1.10 (0.89, 1.36) | NS |
| OR adjusted | 1.00 | 1.18 (0.86, 1.62) | 1.05 (0.67, 1.64) | 1.18 (0.91, 1.54) | NS |

Percentages denote the prevalence of the outcome within the pacifier history group.
Adjusted OR allowed for all the variables in Table 2.
**** $P < .0001$; *** $P < .001$; ** $P < .01$; * $P < .05$; NS, $P \geq .05$.

**TABLE 6.** Gastrointestinal Signs and Symptoms in the First 6 Mo by Pacifier Use

| | Never | Y, at 4 Wk | Y, at 6 Mo not 4 Wk | Y, at 4 Wk and 6 Mo | *P* |
|---|---|---|---|---|---|
| Possets often? | | | | | |
| % Posseted (25.3%) | 22.37 | 26.0 | 22.9 | 27.8 | **** |
| OR unadjusted | 1.00 | 1.20 (1.05, 1.37) | 1.01 (0.84, 1.22) | 1.31 (1.19, 1.45) | **** |
| OR adjusted | 1.00 | 1.35 (1.16, 1.56) | 1.15 (0.93, 1.42) | 1.53 (1.36, 1.73) | **** |
| Has ever been ill with diarrhea or gastroenteritis? | | | | | |
| % Diarrhea/gastroenteritis (28.1%) | 21.9 | 28.8 | 29.7 | 32.6 | **** |
| OR unadjusted | 1.00 | 1.44 (1.27, 1.64) | 1.51 (1.26, 1.80) | 1.72 (1.56, 1.90) | **** |
| OR adjusted | 1.00 | 1.23 (1.07, 1.43) | 1.44 (1.18, 1.75) | 1.25 (1.11, 1.41) | **** |
| Has choked on feeding? | | | | | |
| % Choked (21.3%) | 21.4 | 22.4 | 18.5 | 21.3 | NS |
| OR unadjusted | 1.00 | 1.06 (0.93, 1.21) | 0.83 (0.68, 1.02) | 0.99 (0.89, 1.10) | NS |
| OR adjusted | 1.00 | 1.10 (0.95, 1.28) | 0.75 (0.60, 0.95) | 1.01 (0.89, 1.14) | * |
| Ever had vomiting? | | | | | |
| % Vomited (31.2%) | 28.2 | 34.2 | 30.5 | 32.6 | **** |
| OR unadjusted | 1.00 | 1.32 (1.17, 1.49) | 1.12 (0.94, 1.33) | 1.23 (1.12, 1.35) | **** |
| OR adjusted | 1.00 | 1.27 (1.10, 1.45) | 0.99 (0.82, 1.21) | 1.09 (0.97, 1.97) | ** |
| Has blood in stools? | | | | | |
| % Blood (3.9%) | 3.3 | 3.7 | 3.9 | 4.6 | * |
| OR unadjusted | 1.00 | 1.13 (0.83, 1.53) | 1.19 (0.78, 1.81) | 1.42 (1.13, 1.78) | * |
| OR adjusted | 1.00 | 1.21 (0.85, 1.72) | 1.24 (0.77, 2.00) | 1.49 (1.12, 1.97) | * |

Percentages denote the prevalence of the outcome within the pacifier history group.
Adjusted OR allowed for all the variables in Table 2.
**** $P < .0001$; *** $P < .001$; ** $P < .01$; * $P < .05$; NS, $P \geq .05$.

enteritis. Frequent posseting was more likely to occur in infants reported as using a pacifier at 4 weeks of age, with ORs of 1.53 (95% CI: 1.36, 1.73) and 1.35 (95% CI: 1.10, 1.45).

Each group of infants with a history of having pacifiers was more likely to have suffered from diarrhea/gastroenteritis, particularly those who only had a pacifier at 6 months of age. This relationship was highly significant, with an adjusted OR of 1.44 (95% CI: 1.18, 1.75). Only one significant difference was apparent between the children experiencing choking on feeding and pacifier use: those not having a pacifier at 4 weeks but having one at 6 months were significantly less likely to experience this, the OR after adjustment for this group was 0.75 (95% CI: 0.60, 0.95).

*Crying and Colic*

At 6 months, the mother was asked whether her child had ever experienced colic symptoms. It can be determined from Table 7 that continuous pacifier users were more likely to be described as having had colic, with an adjusted OR of 1.75 (95% CI: 1.57, 1.95). Short-term users at 4 weeks also were significantly more likely to experience these symptoms, with the OR being 1.38 (95% CI: 1.21, 1.57) after the adjustments were made. The group of short-term users at 6 months of age also were more likely to have had colic, with the adjusted OR being 1.40 (95% CI: 1.16, 1.68).

The mother was asked whether she felt that her child's crying was a problem. Both unadjusted and adjusted analyses produced significant results for infants who had used a pacifier at either time point. A greater proportion in each of the three pacifier user groups were reported as having a crying problem in contrast to the infants who had never had a pacifier at 4 weeks or 6 months of age, the highest being those using at 6 months only. This group had an OR of 2.03 (95% CI: 1.29, 3.20).

*Miscellaneous Signs and Symptoms*

There were no significant differences between pacifier users and nonpacifier users for the proportions

**TABLE 7.** Crying and Colic in the First 6 Months by Pacifier Use

| | Never | Y, at 4 Wk | Y, at 6 Mo not 4 Wk | Y, at 4 Wk and 6 Mo | *P* |
|---|---|---|---|---|---|
| Ever had colic? | | | | | |
| % Colic (39.3%) | 33.2 | 40.2 | 40.1 | 43.8 | **** |
| OR unadjusted | 1.00 | 1.35 (1.20, 1.52) | 1.35 (1.14, 1.59) | 1.57 (1.43, 1.71) | **** |
| OR adjusted | 1.00 | 1.38 (1.21, 1.57) | 1.40 (1.16, 1.68) | 1.75 (1.57, 1.95) | **** |
| Ever had crying problem? | | | | | |
| % Crying problem (3.2%) | 2.3 | 3.5 | 5.0 | 3.4 | **** |
| OR unadjusted | 1.00 | 1.54 (1.11, 2.14) | 2.22 (1.49, 3.30) | 1.48 (1.14, 1.93) | **** |
| OR adjusted | 1.00 | 1.60 (1.11, 2.32) | 2.03 (1.29, 3.20) | 1.55 (1.13, 2.13) | ** |

Percentages denote the prevalence of the outcome within the pacifier history group.
Adjusted OR allowed for all the variables in Table 2.
**** $P < .0001$; *** $P < .001$; ** $P < .01$; * $P < .05$; NS, $P \geq .05$.

of children in each category who had experienced a convulsion or fit in the first 6 months of life. The ORs for this health outcome are noticeably high, but the incidence of convulsions/fits are very small and the relationships on adjustment were not statistically significant. Greater than one third of the mothers in each of the four groups responded positively to the question asking about high temperatures, with the highest proportion (40.0%) being in the continuous users group. In fact, the ORs were significant for this group only, with an adjusted OR of 1.23 (95% CI: 1.10, 1.37).

## DISCUSSION

It is apparent from the results of investigating the relationship between pacifier use and the sociodemographic variables that significant differences do exist. Pacifier users are significantly more likely to be boys; this also was found to be the case by Larsson[3] and by Gale and Martyn.[10] The mothers of pacifier users are significantly younger and more likely to live in publicly owned (council) accommodation and overcrowded housing. The mothers giving their infants a pacifier are more likely to smoke and to have greater financial difficulties compared with those who do not give a pacifier. From this it would appear that the most likely mothers to allow their child to use a pacifier are those who are socially disadvantaged in some way. This may explain somehow the differences in morbidity between pacifier users and nonusers, although we have taken many aspects of social deprivation into account. Most results, however, are still significant after taking these factors into consideration and, in some instances, ORs are increased on adjustment (eg, posseting, blood in stools, colic, high temperature). Thus, pacifier use may lead to an increased risk of a variety of symptoms in this particular population.

In a previous ALSPAC study by Hunt and associates,[11] unadjusted associations were found between sleeping in the prone position and an increased risk of similar symptoms to those we have found here. However, prone sleepers are significantly less likely to use a pacifier and, therefore, any adverse effects we have seen are not attributable to sleeping position.

One question that arises from studying these results is that of whether the use of the pacifier leads to an increased risk of ill health or whether it is fact that children with more health problems are more likely to be given a pacifier to soothe and comfort. This is illustrated clearly with crying problems and colic. From the results obtained in this study, there is strong evidence to suggest that pacifier users have a higher incidence of colic and crying problems compared with those children who were not given a pacifier. It is probable that mothers gave a pacifier to their child if they felt that their child's crying was a problem. Pacifiers are given this name because of the calming effect they have on the child, and they are often given for this purpose.

The associations found between pacifier use and the various illnesses and health problems that have been investigated in this study may be confounded by the mother's perception of her child's health and how serious she feels each symptom is. There is a possibility that mothers who overreport ill health are actually more likely to give the child a pacifier. But we have no evidence that this is the case.

It is surprising that few studies have looked at any health effects of the use of the pacifier. Theoretically, there is increased risk of gastrointestinal infection in putting an unwashed pacifier into a child's mouth, and this may well explain the strong association with diarrhea and possibly with the finding of blood in the stools and episodes of high temperature (Tables 6 and 8).

A study of 5-year-olds in Scandinavia has examined evidence for a relationship between the use of pacifiers and episodes of acute otitis media on the hypothesis that prolonged sucking of either the thumb or a pacifier would alter the dental structure and cause malfunction of the eustachian tube, thus increasing the risk of otitis media.[6] They found no association with thumb-sucking but a significant relationship between pacifier use and a history of four or more episodes of acute otitis media (OR, 1.43; 95% CI: 1.06, 1.93). The lack of association with thumb-sucking suggested by the findings of Niemela and colleagues that their original hypothesis was wrong, but they hypothesized that either a pacifier could cause mechanical blocking of the nasopharynx by raising the soft palate and impairing the functioning of the Eustachian tube or that it may increase the growth of pathogenic bacteria in the nasopharynx. Elsewhere we have shown that there was no independent association with either persistent or tran-

**TABLE 8.** Miscellaneous Signs and Symptoms in the First 6 Months by Pacifier Use

| | Never | Y, at 4 Wk | Y, at 6 Mo not 4 Wk | Y, at 4 Wk and 6 Mo | *P* |
|---|---|---|---|---|---|
| Ever had high temperature? | | | | | |
| % Pyrexia (39.2%) | 37.0 | 38.6 | 40.6 | 40.8 | ** |
| OR unadjusted | 1.00 | 1.07 (0.95, 1.20) | 1.16 (0.99, 1.36) | 1.17 (1.08, 1.28) | ** |
| OR adjusted | 1.00 | 1.13 (0.99, 1.29) | 1.16 (0.96, 1.39) | 1.23 (1.10, 1.37) | ** |
| Ever had convulsions/fits? | | | | | |
| % Fits (0.7%) | 0.5 | 0.9 | 1.4 | 0.69 | * |
| OR unadjusted | 1.00 | 1.92 (0.97, 3.77) | 2.94 (1.35, 6.39) | 1.37 (0.76, 2.49) | * |
| OR adjusted | 1.00 | 2.09 (0.99, 4.44) | 2.41 (0.95, 6.10) | 1.34 (0.66, 2.73) | NS |
| Ever had rash? | | | | | |
| % Rash (38.1%) | 37.1 | 37.4 | 38.1 | 39.1 | NS |
| OR unadjusted | 1.00 | 1.01 (0.90, 1.14) | 1.04 (0.88, 1.23) | 1.09 (1.00, 1.19) | NS |
| OR adjusted | 1.00 | 1.02 (0.90, 1.17) | 1.07 (0.89, 1.29) | 1.14 (1.02, 1.26) | NS |

Percentages denote the prevalence of the outcome within the pacifier history group.
Adjusted OR allowed for all the variables in Table 2.
**** $P < .0001$; *** $P < .001$; ** $P < .01$; * $P < .05$; NS, $P \geq .05$.

sient otitis media with effusion (C. R. Dewey, personal communication, 1998).

Thus, there is evidence from this observational study that use of a pacifier may put an infant at higher risk of a number of adverse symptoms in the first months of life, some of which may be causally related. This should be balanced against dental malocclusion that occurs as a consequence of thumb- and finger-sucking in a child not given a pacifier.[2]

The most appropriate advice to parents at this point may be to guard against infection being transmitted from a pacifier to the infant. In particular, the use of a pacifier should be reconsidered for children suffering from severe or recurrent problems such as earache.

There are several implications for future research resulting from this study. Long-term or continuous pacifier use needs to be investigated later into childhood before any adverse effects on health can be deduced. Also, the amount of time actually spent sucking could be taken into consideration. Unfortunately, the self-completion questionnaires used in ALSPAC did not make detailed inquiries into the day-to-day sucking habits of the sample. A difference may exist between habitual pacifier use: those having a pacifier almost constantly when they are not being fed compared with those who may only suck for a short period each day.

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**Pacifier Use and Morbidity in the First Six Months of Life**

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