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Predictors of Breastfeeding Duration: Evidence From a Cohort Study

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ABSTRACT

OBJECTIVE. To report the duration of breastfeeding among a population of Australian women and to identify factors that are associated with the duration of full breastfeeding to 6 months and any breastfeeding to 12 months.

METHODS. Participants were 587 women who were recruited from 2 maternity hospitals in Perth and completed a baseline questionnaire just before or shortly after discharge from the hospital. Women were followed up by telephone interview at 4, 10, 16, 22, 32, 40, and 52 weeks postpartum. Data collected included sociodemographic, biomedical, hospital-related, and psychosocial factors associated with the initiation and the duration of breastfeeding. Cox's proportional hazards model was used to identify factors that were associated with the risk for discontinuing full breastfeeding before 6 months and any breastfeeding before 12 months.

RESULTS. At 6 months of age, fewer than one half of infants were receiving any breast milk (45.9%), and only 12% were being fully breastfed. By 12 months, only 19.2% of infants were still receiving any breast milk. Breastfeeding duration was independently, positively associated with maternal infant feeding attitudes and negatively associated with breastfeeding difficulties in the first 4 weeks, maternal smoking, introduction of a pacifier, and early return to work.

CONCLUSIONS. Relatively few women achieved the international recommendations for duration of full and overall breastfeeding. Women should receive anticipatory guidance while still in the hospital on how to prevent or manage common breastfeeding difficulties and should be discouraged from introducing a pacifier before 10 weeks, if at all. Improved maternity leave provisions and more flexible working conditions may help women to remain at home with their infants longer and/or to combine successfully breastfeeding with employment outside the home.

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Key Words

breastfeeding, duration, maternal employment, pacifiers, breastfeeding problems

Abbreviations

PIFS—Perth Infant Feeding Study
SCN—special care nursery
WHO—World Health Organization
CI—confidence interval
IIFAS—Iowa Infant Feeding Attitude Scale
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INTERNATIONALLY, IT IS recommended that a woman exclusively breastfeed her infant for the first 6 months and that she continue to breastfeed into the second year of life or longer.¹⁻³ Although breastfeeding initiation rates are relatively high in Australia, with >80% of women leaving the hospital breastfeeding, fewer than half of infants receive any breast milk at 6 months.⁴ Continued surveillance of breastfeeding practices is necessary to determine to what extent national breastfeeding targets are being met and how practices are changing.⁵ It is also important to identify factors that influence a woman's ability and/or willingness to adhere to current infant feeding recommendations so that breastfeeding promotion interventions can be targeted at women who are least likely to initiate breastfeeding or to breastfeed for the recommended duration.

The literature suggests that successful breastfeeding depends on multiple factors related to the mother, infant, and the supportive environment. Breastfeeding duration has been positively associated with maternal age,⁶⁻⁹ level of maternal education,⁶⁻¹¹ and a variety of hospital practices, such as 24-hour rooming-in¹² and early infant-to-breast contact.¹²⁻¹⁴ The introduction of pacifiers,^{10,15-18} maternal smoking,^{8-11,13,19} maternal obesity,^{14,20} and an early return to work^{17,21,22} all have been shown to be negatively associated with breastfeeding duration.

We have already reported a significant increase over a 10-year period in the proportion of women in Perth, Australia, who breastfeed at discharge from the hospital.²³ The purpose of this article was to determine whether there had been a corresponding increase in the proportion of women who breastfeed at 6 months and to identify factors that are associated with duration of full breastfeeding to 6 months and any breastfeeding to 12 months.

METHODS

The second Perth Infant Feeding Study (PIFSII) was conducted between mid-September 2002 and mid-July 2003 to monitor breastfeeding rates and identify changes in breastfeeding practices and the determinants of breastfeeding. The study was conducted in the same hospitals as the first Perth Infant Feeding Study (PIFSI),^{24,25} which was conducted 10 years earlier, using the same method.

Attempts were made to contact all mothers within the first 3 days after the birth of their infant. However, not all eligible women were contacted because some may have been discharged before or were not available at the times when the researcher visited. Women were considered to be eligible for the study when they had delivered a live infant who was free of any serious health conditions that would require transfer to the NICU at Perth's major maternity hospital. Mothers whose infants were admitted to the special care nurseries (SCNs) of the

participating hospitals, however, were eligible for recruitment.

All women who were contacted were given a written and verbal explanation of the purpose of the study. Those who agreed to participate completed the self-administered baseline questionnaire while in the hospital or shortly after discharge from the hospital. Women who declined to participate were asked to provide some basic sociodemographic data to determine the representativeness of the sample. Women were followed up by telephone interview at 4, 10, 16, 22, 32, 40, and 52 weeks postpartum. The study instruments used in the PIFSII were essentially the same as those used in PIFSI, with only minor improvements and additions being made.

In total, 1068 women were eligible to participate in the PIFSII. Of these, 870 were contacted and 587 completed baseline questionnaires, representing 68% of women who were contacted and 55% of those who were eligible to participate. The characteristics of women who participated in the PIFSII are presented in Table 1. There were no significant differences in the age or level of education of participants compared with nonparticipants.²³

Breastfeeding Definitions

Where appropriate, the breastfeeding terms that were used in this study were those recommended by the World Health Organization (WHO)²⁶ and adopted for monitoring purposes in Australia.⁵ An infant was considered to be exclusively breastfed when he or she had received only breast milk with no other liquids (including water) or solids. An infant was considered to be fully or predominantly breastfed when he or she received breast milk as the main source of nourishment, that is,

TABLE 1 Characteristics of Participants in the PIFSII

	<i>n</i>	%
Maternal age, y (<i>n</i> = 586)		
<20	32	5.5
20-24	122	20.8
25-29	170	29.0
30-34	178	30.4
≥35	84	14.3
Maternal education, y (<i>n</i> = 577)		
<12	249	43.2
≥12	328	56.8
Mother's country of birth (<i>n</i> = 585)		
Australia/New Zealand	428	73.2
United Kingdom/Ireland	53	9.0
Other	104	17.8
Parity (<i>n</i> = 587)		
Primiparous	216	36.8
Multiparous	371	63.2
Method of delivery (<i>n</i> = 582)		
Vaginal	411	70.6
Cesarean	171	29.4

with or without water, water-based drinks, fruit juice, or oral rehydration solution, but did not receive any other liquids (including breast milk substitutes) or solids. Any breastfeeding was defined as an infant's being fully breastfed or receiving both breast milk and a formula, with or without solids.

Statistical Analysis

Data were entered and analyzed using the SPSS for Windows, Version 11.5 (SPSS Inc, Chicago, IL). The χ^2 test was used to compare the sociodemographic characteristics of participants and nonparticipants. Survival analysis was used to examine the duration of any breastfeeding and full breastfeeding because it provides a good understanding of breastfeeding behavior over time. This type of analysis is used because of the presence of censored data. The term "censored data" refers to data from participants who continued to breastfeed beyond the end of the study period or beyond the time at which the participant dropped out of the study. The proportion of women who were breastfeeding at each time point for each level of a predictor variable was identified, and the 95% confidence interval (CI) was calculated. The proportions and 95% CIs then were converted to percentages. The difference between 1 level of a variable and the reference level was considered to be significant when the 95% CIs did not overlap.

Determinants of breastfeeding duration were investigated in a regression analysis using Cox's proportional hazards model. This model allows joint estimation of the effects of predictor variables on the "hazard," the risk for cessation of breastfeeding, rather than the duration itself, and can be used to analyze data that contain censored observations.²⁷ It uses all available data and is a more powerful statistical technique than single-point prevalence. Because of the small number of infants who were exclusively breastfed, using the WHO definition, which precludes the giving of water, we chose to investigate the factors that were associated with the duration of full breastfeeding. All of the variables explored in the bivariate analysis, with the exception of intended duration, were entered into the multivariate models to determine risk for cessation of full breastfeeding before 6 months and any breastfeeding before 12 months. Peat et al²⁸ argued that intended duration of breastfeeding is not a predictor of breastfeeding duration but in fact lies directly on the causal decision-making pathway and as such should not be included in any multivariate model that investigates the duration of breastfeeding. Each full model was reduced using the backward elimination procedure ($P < .05$ for removal). When any of the variables that remained in the final model were excluded, the change in deviance compared with the corresponding χ^2 test statistic on the relevant degrees of freedom was significant at the $P < .05$ level.

Variables that were investigated in each model in-

cluded a variety of sociodemographic, biomedical, hospital-related, and psychosocial factors that have been reported in the literature to have an effect on the duration of breastfeeding. A mother's attitude toward infant feeding was measured by the Iowa Infant Feeding Attitude Scale (IIFAS).²⁹ The IIFAS is a 17-item scale that measures attitudes toward both breastfeeding and formula feeding with regard to the health and nutritional benefits and the cost and convenience of each method. It was shown previously to be a valid and reliable measure of infant feeding attitudes among women in the United States²⁹ and Scotland.³⁰ Each item is measured on a 5-point scale, and total scores could range from 17 (reflecting positive formula-feeding attitudes) to a high of 85 (indicating attitudes that favor breastfeeding). For the purposes of the bivariate analysis, mothers were split into 2 groups: those with an IIFAS score at or above the median (≥ 65) and those with a score less than the median (< 65). In the multivariate analyses, the IIFAS score was entered into each model as a continuous variable.

Ethical Considerations

The PIFSII was approved by the Human Ethics Committee of the Curtin University of Technology and the Research Ethics Committees of the 2 participating hospitals. Signed informed consent was obtained from participants. Confidentiality was ensured, and mothers were advised that their participation was voluntary and that they could withdraw at any time without prejudice.

RESULTS

In total, 93.8% of women left the hospital breastfeeding, with 75.6% of infants being exclusively breastfed. With the exception of breastfeeding at the time of hospital discharge and at 1 week, the percentage of women who were breastfeeding at each time point was not significantly different from that of women who had participated in the PIFSII 10 years earlier (Table 2). At 6 months of age, fewer than one half (45.8%) of infants were receiving any breast milk (95% CI: 41.8–49.8), and only 12.0% (95% CI: 9.4–14.6) were being fully breastfed. Fewer than 1% of infants were exclusively breastfed at 6 months of age. The median duration of full and exclusive breastfeeding was 5 and 3 weeks, respectively.

The bivariate analysis (Table 3) revealed significant differences in breastfeeding duration related to maternal age and a number of hospital practices and biomedical and psychosocial factors. Infants of mothers who were younger than 30 years were less likely to be receiving any breast milk or fully breastfed at different time points. Similarly, infants who had been introduced to a pacifier at or before 4 weeks of age or whose mother had smoked during pregnancy or experienced difficulties with breastfeeding at or before 4 weeks postpartum were less likely

TABLE 2 Women Who Were Breastfeeding in the PIFSII Compared With the PIFSI and National Health Survey Results

Any Breastfeeding ^a	PIFSII 2002–2003 (n = 587)	PIFSI 1992–1993 (n = 556)	NHS 1995 ^b Perth	NHS 2001 ^c Australia
At discharge	93.8 (91.9–95.7)	83.8 (80.7–86.9)	87.0 (83.7–90.3)	83.0
1 wk	89.6 (87.1–92.1)	80.7 (77.4–84.0)	NA	NA
1 mo	78.2 (74.9–81.5)	74.8 (71.1–78.4)	NA	NA
3 mo	62.1 (58.2–66.0)	60.9 (56.9–65.0)	69.0 (64.5–73.5)	
6 mo ^d	45.8 (41.8–49.8)	50.0 (45.8–54.1)	50.6 (46.1–55.1)	48.0
12 mo	19.2 (16.0–22.4)	NA	NA	23.0

Data are % (95% CI). NHS indicates National Health Survey; NA, not available.

^a Includes fully and partially breastfed infants.

^b NHS 1995.⁴⁷

^c NHS 2001.⁴

^d Taken as 24 weeks in PIFSI, 26 weeks in PIFSII, and 25 weeks in NHS 1995.

to be fully breast fed or receiving any breast milk at the different time points.

Women who perceived their partner or own mother to prefer breastfeeding had consistently higher breastfeeding rates. For example, 59% of women who perceived their partner to prefer breastfeeding were maintaining breastfeeding at 6 months, and 53% were fully breastfeeding their infants at 3 months compared with 30% and 26%, respectively, of women who perceived their partner either to prefer formula feeding or to be ambivalent about how their infant was fed. Finally, women who did not have a strongly favorable attitude toward breastfeeding or intended to discontinue breastfeeding before 6 months were less likely to be either fully breastfeeding or giving their infant any breast milk at most time points.

The factors that were independently associated with duration of any and/or full breastfeeding are presented in Table 4. Maternal age was negatively associated with the risk for women's discontinuing breastfeeding before 12 months but was not associated with the risk for discontinuing full breastfeeding before 6 months. Women who returned to work before 6 months were less likely to be fully breastfeeding at 6 months or to be still breastfeeding at 12 months, as were women who returned to work between 6 and 12 months. Women who had experienced difficulties with breastfeeding in the first 4 weeks had a higher risk for discontinuing full breastfeeding before 6 months and any breastfeeding before 12 months. The introduction of a pacifier before 10 weeks of age was significantly associated with a shorter duration of any or full breastfeeding, as was smoking. Risk for cessation of full breastfeeding before 6 months and any breastfeeding at 12 months was negatively associated with a woman's IIFAS score; that is women with higher IIFAS scores that favored breastfeeding were less likely to have discontinued breastfeeding than those with lower scores. Women who had planned their pregnancy or who perceived their partner to prefer breastfeeding were less likely to have discontinued full breastfeeding before their infant reached 6

months of age. Similarly, those who perceived their own mother to prefer breastfeeding were less likely to have discontinued breastfeeding before their infant's first birthday.

DISCUSSION

We previously reported that the initiation of breastfeeding in Perth, Australia, is approaching universality,²³ with initiation rates similar to those reported for Nordic countries.^{7,9,13} The results presented here indicate, however, that the increase in breastfeeding initiation during the 10-year period from 1992–1993 to 2002–2003 was not accompanied by an increase in breastfeeding duration. Internationally, it is promoted that women should exclusively breastfeed their infants for up to 6 months of age and that breastfeeding should continue into the second year of a child's life and for longer if possible or desired.^{1–3} In our study, relatively few women achieved these targets and, although just under half of infants were still receiving some breast milk at 6 months, 88% of infants had received infant formula and/or solids before 6 months of age and only 19% were still receiving breast milk at 12 months of age. Fewer than 1% of infants were exclusively breastfed at 6 months, inasmuch as they had not received anything other than breast milk, including water.

These recommendations for duration of exclusive breastfeeding are relatively new and at the time that our study was conducted, Australian women were being encouraged to breastfeed exclusively for 4 to 6 months.³¹ Nevertheless, 72% of mothers failed to meet the infant feeding recommendation of the time and had given their infant formula and/or solids by 4 months of age.

Traditionally, Australia has reported a higher initiation and duration of breastfeeding compared with the United States.³² This seems to remain the case with the duration of overall breastfeeding because, with the exception of the 12-month time point, the percentage of women from this Australian population who were breastfeeding at 1 week and at 1, 3, and 6 months was higher (89.8% vs 68.4%, 78.3% vs 63.2%, 62.2% vs

TABLE 3 Women Who Were Breastfeeding to Any Extent, by Maternal, Infant, Biomedical, Hospital, and Psychosocial Characteristics

	n	Fully Breastfed				Any Breastfeeding				
		At 7 d	At 1 mo	At 3 mo	At 6 mo	At 7 d	At 1 mo	At 3 mo	At 6 mo	At 12 mo
All mothers		76.0 ± 3.4	58.2 ± 4.0	40.6 ± 4.0	12.0 ± 2.6	89.6 ± 2.5	78.2 ± 3.3	62.1 ± 3.9	45.8 ± 4.0	19.2 ± 3.2
Sociodemographic										
Mother's age, y										
<20	32	68.2 ± 16.1	36.4 ± 16.7 ^a	22.7 ± 14.5 ^a	22.7 ± 14.5	82.6 ± 13.1	61.0 ± 17.0	50.3 ± 17.3	36.8 ± 16.7	26.3 ± 15.2
20–29	292	76.0 ± 4.9	57.4 ± 5.7	33.9 ± 5.4 ^a	8.2 ± 3.1 ^a	86.9 ± 3.8 ^a	75.0 ± 5.0	57.3 ± 5.7 ^a	37.8 ± 5.6 ^a	13.3 ± 3.9 ^a
≥30 (ref)	262	77.0 ± 5.1	61.2 ± 5.9	49.4 ± 6.0	16.0 ± 4.4	93.8 ± 2.9	83.9 ± 4.4	68.8 ± 5.6	55.2 ± 6.0	24.8 ± 5.2
Mother's education (years of schooling)										
<12	249	76.4 ± 5.3	55.4 ± 6.2	35.1 ± 5.9	7.6 ± 3.3	86.6 ± 4.2	72.0 ± 5.6	53.9 ± 6.2	40.1 ± 6.1	15.7 ± 4.5
≥12 (ref)	328	75.4 ± 4.7	59.5 ± 5.3	43.4 ± 5.4	14.4 ± 3.8	91.9 ± 3.0	82.5 ± 4.1	67.5 ± 5.1	49.4 ± 5.4	21.4 ± 4.4
Marital status										
Other	47	77.7 ± 11.9	57.0 ± 14.2	32.5 ± 13.4	5.4 ± 6.5	92.8 ± 7.4	72.2 ± 1.3	54.1 ± 14.2	42.7 ± 14.1	16.0 ± 10.5
Married/de facto (ref)	540	75.9 ± 3.6	58.2 ± 4.2	41.1 ± 4.1	12.7 ± 2.8	89.4 ± 2.6	78.6 ± 3.5	62.7 ± 4.1	46.0 ± 4.2	19.5 ± 3.3
Mother's country of birth										
Australia/New Zealand (ref)	428	78.0 ± 3.9	57.3 ± 4.7	39.3 ± 4.6	10.3 ± 2.9	89.9 ± 2.8	76.9 ± 4.0	60.5 ± 4.6	43.3 ± 4.7	16.9 ± 3.6
United Kingdom/Ireland	53	68.2 ± 12.5	57.8 ± 13.3	40.0 ± 13.2	10.5 ± 8.2	84.3 ± 9.8	78.2 ± 11.1	59.8 ± 13.2	45.3 ± 13.4	14.2 ± 9.4
Other	104	73.2 ± 8.5	59.4 ± 9.4	48 ± 9.6	20.9 ± 7.8	93.1 ± 4.9	85.2 ± 6.8	71.0 ± 8.7	57.1 ± 9.5	33.3 ± 9.1 ^a
Age of infant when mother returned to work										
<6 mo	141	80.4 ± 6.6	57.1 ± 8.2	32.2 ± 7.7 ^a	9.4 ± 4.8	92.9 ± 4.2	81.6 ± 6.4	58.3 ± 8.1	41.0 ± 8.1	11.4 ± 5.2 ^a
6–12 mo	77	72.5 ± 10.1	54.1 ± 11.1	37.6 ± 10.8	3.2 ± 3.9 ^a	90.9 ± 6.4	76.6 ± 9.5	63.6 ± 10.8	42.9 ± 11.0	12.2 ± 7.3 ^a
Not working at 12 mo (ref)	283	76.8 ± 4.9	62 ± 5.6	46.6 ± 5.8	16.7 ± 4.3	89.4 ± 3.6	79.5 ± 4.7	66.8 ± 5.5	51.5 ± 5.8	25.8 ± 5.1
Biomedical										
Parity										
Primiparous (ref)	216	70.5 ± 6.1	49.4 ± 6.7	33.0 ± 6.3	10.6 ± 4.1	89.9 ± 4.0	75.0 ± 5.8	57.0 ± 6.6	42.0 ± 6.6	16.0 ± 4.9
Multiparous	371	79.2 ± 4.1	63.1 ± 4.9	44.9 ± 5.1 ^a	12.8 ± 3.4	89.4 ± 3.1	80.1 ± 4.1	65.0 ± 4.8	48.0 ± 5.1	21.0 ± 4.1
Method of delivery										
Vaginal (ref)	411	79.0 ± 3.9	60.2 ± 4.7	42.3 ± 4.8	12.5 ± 3.2	90.2 ± 2.9	79.5 ± 3.9	62.4 ± 4.7	45.6 ± 4.8	20.4 ± 3.9
Cesarean section	171	39.5 ± 6.9	54.3 ± 7.5	37.4 ± 7.2	11.4 ± 4.9	89.2 ± 4.6	76.4 ± 6.4	62.6 ± 7.2	47.3 ± 7.5	16.8 ± 5.6
Mother's prepregnancy BMI (kg/m ²)										
<25(ref)	362	82.1 ± 3.9	60.1 ± 5.0	44.1 ± 5.1	12.7 ± 3.4	91.8 ± 2.8	80.1 ± 4.1	65.2 ± 4.9	49.0 ± 5.2	20.7 ± 4.2
25–29.9	106	70.5 ± 8.7	59.1 ± 9.4	38.8 ± 9.3	13.5 ± 6.5	89.3 ± 5.9	82.4 ± 7.2	65.5 ± 9.0	48.3 ± 9.5	18.7 ± 7.4
30+	86	63.1 ± 10.2 ^a	52.2 ± 10.5	30.3 ± 9.7	13.0 ± 7.1	85.9 ± 7.4	72.7 ± 9.4	49.4 ± 10.6	35.7 ± 10.1 ^a	15.6 ± 7.7
Mother smoked before pregnancy										
No (ref)	357	80.8 ± 4.1	62.7 ± 5.0	47.9 ± 5.2	13.8 ± 3.6	95.6 ± 2.6	82.6 ± 4.9	70.2 ± 5.9	52.0 ± 6.5	22.0 ± 5.3
Yes	228	71.9 ± 5.8	50.8 ± 6.5 ^a	28.3 ± 5.8 ^a	9.7 ± 3.8	91.4 ± 2.9	71.4 ± 4.7 ^a	49.0 ± 5.2 ^a	35.7 ± 5.0 ^a	14.9 ± 3.7
Infant gender										
Male (ref)	316	73.2 ± 4.9	54.2 ± 5.4	35.8 ± 5.3	11.2 ± 3.5	88.3 ± 3.5	74.9 ± 4.8	57.1 ± 5.5	42.3 ± 5.3	17.7 ± 4.2
Female	271	79.4 ± 4.8	62.8 ± 5.8	46.2 ± 5.9	12.6 ± 4.0	91.5 ± 3.3 ^a	82.1 ± 4.62	68.0 ± 5.5	50.0 ± 6.0	21.1 ± 4.9
Infant admitted to SCN										
No (ref)	512	77.6 ± 3.6	59.8 ± 4.2	37.4 ± 4.3	11.8 ± 2.8	90.9 ± 2.5	78.5 ± 3.6	62.9 ± 4.2	46.6 ± 4.3	19.6 ± 3.4
Yes	63	64.9 ± 11.8	46.5 ± 12.3	34.6 ± 11.7	14.7 ± 8.7	86.8 ± 8.4	85.1 ± 8.8	56.8 ± 12.2	41.2 ± 12.2	15.7 ± 9.0
Breastfeeding problems ≤4 wk										
Yes	201	75.7 ± 5.9 ^a	40.5 ± 6.7 ^a	27.8 ± 6.2 ^a	9.6 ± 4.1	91.0 ± 4.0 ^a	70.6 ± 6.3 ^a	50.3 ± 6.9 ^a	35.8 ± 6.6 ^a	13.1 ± 4.7 ^a
No (ref)	277	87.0 ± 4.0	77.8 ± 4.9	56.4 ± 5.8	15.7 ± 4.3	97.8 ± 1.7	95.6 ± 2.4	81.2 ± 4.6	61.6 ± 5.7	26.9 ± 5.2
Age pacifier introduced										
≤4 wk	347	72.2 ± 4.7	48.8 ± 5.3 ^a	28.7 ± 4.8 ^a	7.1 ± 2.7 ^a	87.3 ± 3.5	73.5 ± 4.6 ^a	53.6 ± 5.2 ^a	36.4 ± 5.1 ^a	12.8 ± 3.5 ^a
4 ≤ 10 wk	47	70.2 ± 13.1	63.7 ± 13.7	45.2 ± 14.2	11.0 ± 8.9	89.4 ± 8.8	76.6 ± 12.1	59.1 ± 14.1	44.4 ± 14.2	14.8 ± 10.2
10 wk	27	92.4 ± 10.0	80.9 ± 14.8	57.3 ± 18.6	20.2 ± 15.1	100.0 ± 0.0	92.6 ± 9.9	85.2 ± 13.4	66.3 ± 17.8	20.9 ± 15.3
Not using a pacifier at 12 mo (ref)	140	82.4 ± 6.3	66.1 ± 7.3	55.7 ± 7.7	23.3 ± 7.0	92.9 ± 4.2	87.1 ± 5.6	79.1 ± 6.7	64.6 ± 7.9	36.1 ± 8.0
Hospital practices										
Infant's first feed										
Formula/other	91	42.0 ± 10.1 ^a	30.0 ± 9.4 ^a	18.9 ± 0.8 ^a	0.0 ^a	69.3 ± 9.5 ^a	52.6 ± 10.3 ^a	36.6 ± 9.9 ^a	29.8 ± 9.18	16.0 ± 7.5
Breast milk/colostrum (ref)	494	86.1 ± 3.0	63.2 ± 4.2	44.6 ± 4.4	13.1 ± 3.0	97.7 ± 1.3	83.0 ± 3.3	66.7 ± 4.2	49.0 ± 4.4	20.1 ± 3.5
24 hour rooming-in in hospital										
No	279	71.7 ± 5.3	52.4 ± 5.9	38.1 ± 5.7	11.2 ± 3.7	92.7 ± 3.0	75.5 ± 5.0	59.0 ± 5.8	43.4 ± 5.8	18.5 ± 4.6
Yes (ref)	306	78.5 ± 6.5	47.5 ± 7.9 ^a	24.9 ± 6.8 ^a	6.8 ± 3.9	92.2 ± 3.0	80.9 ± 4.4	65.0 ± 5.3	48.0 ± 5.6	20.0 ± 4.5
Infant demand fed										
No	155	67.5 ± 7.4	48.0 ± 7.9 ^a	36.4 ± 7.6	6.2 ± 3.8	84.2 ± 5.7	68.5 ± 7.3 ^a	52.0 ± 7.9 ^a	38.2 ± 7.7	13.8 ± 5.4
Yes (ref)	428	78.0 ± 3.9	61.4 ± 4.6	42.0 ± 4.7	14.2 ± 3.3	91.7 ± 2.6	81.6 ± 3.7	65.6 ± 4.5	48.6 ± 4.7	21.2 ± 3.9
Early infant-to-breast contact										
<30 min after birth (ref)	241	76.9 ± 4.6	57.9 ± 5.4	39.4 ± 5.4	14.9 ± 3.9	97.0 ± 2.2	87.0 ± 4.3	67.8 ± 5.9	50.0 ± 6.3	17.8 ± 4.8
≥30 min after birth	316	84.8 ± 4.5	66.1 ± 6.0	47.4 ± 6.3	9.8 ± 3.8	97.1 ± 1.8	79.1 ± 4.5	63.8 ± 5.3	47.0 ± 5.5	22.2 ± 4.6

TABLE 3 Continued

	n	Fully Breastfed				Any Breastfeeding				
		At 7 d	At 1 mo	At 3 mo	At 6 mo	At 7 d	At 1 mo	At 3 mo	At 6 mo	At 12 mo
Psychosocial										
Intended pregnancy										
Yes (ref)	280	78.0 ± 4.8	56.5 ± 5.8	41.3 ± 5.8	9.8 ± 3.5	88.4 ± 3.8	79.0 ± 4.8	63.8 ± 5.6	49.0 ± 5.9	18.1 ± 4.5
No	286	76.9 ± 4.9	60.1 ± 5.7	40.4 ± 5.7	15.0 ± 4.1	91.6 ± 3.2	78.9 ± 4.7	61.2 ± 5.6	43.9 ± 5.8	20.1 ± 4.6
Mother attended antenatal classes for this or a previous pregnancy										
No	204	74.0 ± 6.0	54.3 ± 6.8	35.5 ± 6.6	9.8 ± 4.1	86.7 ± 4.7	75.6 ± 6.0	53.9 ± 6.9 ^a	38.9 ± 6.7	19.8 ± 5.5
Yes (ref)	380	77.1 ± 4.2	60.0 ± 4.9	43.4 ± 5.0	13.0 ± 3.4	91.4 ± 4.6	78.7 ± 4.1	66.2 ± 4.8	49.4 ± 5.0	19.4 ± 4.0
Mother's IIFAS score										
Low (<65)	288	64.9 ± 5.5 ^a	39.0 ± 5.6 ^a	23.4 ± 4.9 ^a	6.1 ± 2.8	80.8 ± 4.6 ^a	63.1 ± 5.6 ^a	43.4 ± 5.7 ^a	27.7 ± 5.2 ^a	11.7 ± 3.7 ^a
High (≥65; ref)	299	86.4 ± 3.9	75.9 ± 4.8	56.3 ± 5.6	17.1 ± 4.3	97.9 ± 1.6	92.4 ± 3.0	79.7 ± 4.6	62.7 ± 5.4	26.3 ± 5.0
Father prefers breastfeeding										
No or ambivalent	273	68.5 ± 5.5 ^a	47.1 ± 5.9 ^a	25.9 ± 5.2 ^a	8.6 ± 3.3	83.2 ± 4.4 ^a	68.5 ± 5.5 ^a	48.6 ± 5.90 ^a	30.4 ± 5.4 ^a	11.8 ± 3.8 ^a
Yes (ref)	314	82.5 ± 4.2	67.7 ± 5.2	53.1 ± 5.5	15.1 ± 4.0	95.1 ± 2.4	86.5 ± 3.7	73.6 ± 4.8	58.86 ± 5.4	25.5 ± 4.8
Maternal grandmother prefers breastfeeding										
No or ambivalent	386	71.5 ± 4.5 ^a	52.2 ± 5.0 ^a	34.4 ± 4.8 ^a	9.6 ± 2.9	87.4 ± 3.3	73.5 ± 4.4 ^a	55.4 ± 4.0 ^a	38.3 ± 4.8 ^a	15.6 ± 3.6 ^a
Yes (ref)	197	85.5 ± 4.9	70.1 ± 6.4	53.2 ± 7.0	16.7 ± 5.3	94.8 ± 3.4	87.98 ± 4.6	75.1 ± 6.0	60.5 ± 6.8	26.2 ± 6.2
Intended breastfeeding duration										
<6 mo/undecided	242	72.7 ± 5.6 ^a	45.0 ± 6.3 ^a	24.4 ± 5.4 ^a	2.8 ± 2.1 ^a	92.3 ± 3.4	69.3 ± 5.8 ^a	45.3 ± 6.3 ^a	29.5 ± 5.8 ^a	8.6 ± 3.5 ^a
≥6 mo (ref)	312	81.1 ± 3.7	75.0 ± 4.8	57.7 ± 5.5	20.5 ± 4.5	97.3 ± 1.8	93.6 ± 2.7	81.9 ± 4.3	63.5 ± 5.3	29.5 ± 5.1

Data are % ± half 95% CI.

^aSignificantly different from reference level (ref) with $P < .05$.

51.5%, and 45.9% vs 35.1%, respectively) than that of a national sample of women from the United States whose children were born between 1999 and 2001.³³ Surprising, however, with the exception of the percentage of women who were fully breastfeeding at 1 week, which was higher among women in our study (76.0% vs 63.4%), the percentage of Australian women who were fully breastfeeding at 1, 3, and 6 months was virtually the same as that of the American women. It should be noted that Li et al³³ described their sample as exclusively breastfeeding but, as their definition of exclusivity allowed for infants to receive water, it is equivalent to the WHO definition²⁶ for full breastfeeding used in this study. Therefore, although significantly more Australian women than American women continue to initiate breastfeeding, rates of full breastfeeding are similar from 1 month postpartum.

Maternal age⁶⁻⁸ and level of maternal education^{6-8,10,11} have been shown repeatedly to be positively associated with both breastfeeding initiation and duration. We previously failed, in this cohort of women, to find an association between any sociodemographic factor and the initiation of breastfeeding and suggested that social inequalities in breastfeeding initiation are less apparent as breastfeeding initiation approaches universality.³⁴ Similarly, in this investigation of duration, with the exception of maternal age, we found no association between mother's level of education, ethnic background, and marital status and the likelihood of discontinuing full breastfeeding by 6 months and breastfeeding overall by 12 months.

Lawson and Tulloch¹² in an earlier study of Australian women showed that breastfeeding duration up to 3 months was related to the timing of the first breastfeeding and the extent of mother-infant contact in the 72 hours after birth. We failed, however, to show any independent association between duration of breastfeeding and hospital ward practices, such as 24-hour rooming-in, demand feeding, and early infant-to-breast contact. This is not to say, however, that hospitals should not continue to encourage these practices. Especially as it has been shown that the Baby-Friendly Hospital Initiative,³⁵ which promotes these practices as part of the 10 Steps to Successful Breastfeeding, can increase both the duration and the exclusivity of breastfeeding in the first year of life.³⁶

Prelacteal feeds and the early supplementation of breastfeeding with infant formula have been associated previously with shorter duration of breastfeeding.^{7,37} It is unclear whether the reported association between formula supplementation during the first few days of life and breastfeeding duration is causal, because the use of supplements may be a marker rather than a cause of breastfeeding difficulties.⁷ Peat et al²⁸ considered the introduction of formula to be a surrogate outcome and argued against including the introduction of formula feeding in multivariate statistical models on the basis that it inevitably distorts the model. It was for this reason that we did not include the age at which regular formula was introduced as a variable in our models. We did, however, investigate the impact of prelacteal feeds on breastfeeding duration.

TABLE 4 Factors That Were Independently Associated With the Risk for Discontinuing Any Breastfeeding Before 12 Months and Full Breastfeeding Before 6 Months (*n* = 382)

Variable ^a	Fully Breastfeeding to 6 mo		Any Breastfeeding to 12 mo	
	HR	95% CI	HR	95% CI
Maternal age, y				
<20	NS		0.57	0.23–1.41
20–29			1.55	1.21–1.98
≥30			1.00	
Age of infant when mother returned to work				
<6 mo	1.42	1.08–1.88	1.69	1.28–2.34
6–12 mo	1.63	1.18–2.25	1.50	1.07–2.09
Not working at 12 mo	1.00		1.00	
Breastfeeding problems at or before 4 wk				
Yes	1.75	1.35–2.23	1.64	1.29–2.10
No	1.00		1.00	
Age of infant when pacifier first introduced				
<4 wk	1.92	1.39–2.64	1.92	1.40–2.64
4–10 wk	1.85	1.06–3.22	1.97	1.13–3.46
>10 wk	1.47	0.79–2.73	1.61	0.86–3.00
Not using a pacifier at 12 mo	1.00		1.00	
Mother smoked during pregnancy				
Yes	1.32	1.02–1.71	1.35	1.05–1.73
No	1.00		1.00	
Mothers infant feeding attitude	0.97	0.96–0.99	0.96	0.94–0.98
Father's feeding preference ^b				
Prefers formula or ambivalent	1.00		NS	
Prefers breastfeeding	0.71	0.55–0.91		
Maternal grandmother's feeding preference ^b				
Prefers formula or ambivalent	NS		1.00	
Prefers breastfeeding			0.71	0.55–0.2
Planned pregnancy				
Yes	0.76	0.60–0.98	NS	
No (unintended or mistimed)	1.00			
–2 log likelihood (deviance)	2815.38, df = 10		2880.62, df = 11	

Variables in full models included maternal age, years of education, marital status, country of birth, parity, age of infant when mother returned to work, whether mother smoked during pregnancy, delivery method, whether the pregnancy was planned, whether mother roomed-in in the hospital, demand fed or initiated breastfeeding within 30 minutes of birth, gender of the infant, whether infant was admitted to SCN, infant's first feed, age of infant when pacifier first introduced, whether the mother attended antenatal classes, whether mother had experienced breastfeeding difficulties by 4 weeks postpartum, mother's infant feeding attitude, father's feeding preference, and maternal grandmother's feeding preference. HR indicates hazard ratio; NS, not significant; df, degrees of freedom.

^a All variables in the final model were variables for which when excluded the change in deviance compared with the corresponding χ^2 test statistic on the relevant df was significant.

^b As perceived by the mother.

A recent study of Swedish women¹³ examined the effect of supplementation in the hospital on the duration of breastfeeding on the basis of supplementation reason. They reported that supplementation for medical reasons had no significant influence on breastfeeding duration; however, supplementation without medical reasons was negatively associated with a shorter duration of exclusive and any breastfeeding.¹³ Their findings help to explain why we failed to show an independent association between infant's first feed (colostrum versus prelacteal) and duration of full breastfeeding to 6 months or overall breastfeeding to 12 months. There was a strong association between an infant's first feeding and both admission to the SCN and delivery method. Almost one half (47.6%) of the infants who were admitted to the SCN had received formula or a glucose as their first feeding,

compared with only 11.9% of infants who were not admitted to the SCN ($\chi^2 P < .001$). Similarly, 21.6% of infants who were born to mothers who had delivered by cesarean section received a prelacteal feeding compared with 12.9% of infants who were born to women who had delivered vaginally ($\chi^2 P = .008$). Although we did not ascertain the reason that prelacteal feeds were given, our findings suggest that most prelacteal feeds were given for medical reasons.

A negative association between maternal smoking and breastfeeding duration has been reported consistently in a range of countries.^{8–11,13,19} In our study, women who smoked during their pregnancy had a shorter duration of both full and overall breastfeeding. It has been proposed that nicotine has a negative effect on breast milk supply by suppressing prolactin levels,³⁸ and

it has been suggested that breastfeeding could be increased if women reduced or quit smoking cigarettes.¹⁹ Although several studies have found a negative dose-response relationship between the number of cigarettes smoked each day and breastfeeding duration,^{11,19} other studies have failed to find an association between smoking and duration.^{17,39}

Donath and Amir⁴⁰ argued that if smoking had a negative physiologic effect on breastfeeding, then we would expect the effects of smoking to be seen universally. In a review of the epidemiologic evidence,⁴¹ they reported that women who smoked were less likely to intend to breastfeed and to initiate breastfeeding. They contended that psychosocial factors are largely responsible for the lower rates of breastfeeding found in women who smoke compared with those who do not smoke. When data from the ALSPAC study,⁴⁰ a large longitudinal cohort study, were analyzed, it was found that significantly fewer women who smoked intended to breastfeed for at least 4 months compared with nonsmokers (33.7% vs 47.4%; $\chi^2 P < .001$). Similarly, in our study, fewer smokers intended to breastfeed for 6 months or longer compared with nonsmokers (47.2% vs 62.1; $\chi^2 P = .001$). In the ALSPAC study, the independent effect of breastfeeding intention on duration was stronger than the effect of cigarette smoking.⁴⁰ Donath and Amir⁴⁰ argued that “women who are strongly motivated to breastfeed are more likely to succeed than women with low breastfeeding expectations, regardless of smoking status” (p 1517).

In support of this argument is our finding that the risk for discontinuing full breastfeeding before 6 months and any breastfeeding before 12 months was negatively associated with a mother’s attitude toward infant feeding, as measured by the IIFAS.²⁹ That is, women with higher IIFAS scores, favoring breastfeeding, had a longer duration of breastfeeding than women with lower scores, favoring formula feeding. We³⁴ and others^{29,30} previously showed maternal infant feeding attitude to be a stronger independent predictor of breastfeeding initiation than sociodemographic factors.

Difficulty with breastfeeding in the early postpartum period was a significant risk factor for the early cessation of breastfeeding. Women who had experienced problems within the first 4 weeks were significantly more likely to discontinue full breastfeeding before 6 months and to have a shorter duration of breastfeeding overall. Breastfeeding problems in the early postpartum period are relatively common, and just more than one third (36.1%) of women in our study reported having 1 or more problems with breastfeeding in the first 4 weeks. DiGirolamo et al⁴² in a study of women in the United States reported that a similar percentage of women (37.5%) had problems during the first week. They also found that breastfeeding problems during the first week were a significant risk factor for stopping breastfeeding

by 10 weeks. However, having problems with breastfeeding during the first week was not a significant predictor of stopping breastfeeding at 10 to <20 weeks or at 20 to <30 weeks. They suggested that women who experienced problems during the first week but continued to breastfeed developed greater self-efficacy for breastfeeding, thereby decreasing the influence of those early experiences on breastfeeding duration.

We¹⁸ and others^{11,15,16} previously reported a negative association between pacifier use and the duration of breastfeeding, even among a group of women who were highly motivated to breastfeed.¹⁵ We found in our study that the introduction of a pacifier in the first 10 weeks increased the risk for the cessation of full breastfeeding by 6 months and overall breastfeeding by 12 months. Breastfeeding duration, however, was not significantly affected when a pacifier was introduced after 10 weeks. It has been suggested that the decrease in breastfeeding duration associated with pacifier use may be the consequence of less frequent episodes of breastfeeding^{15,16} and shorter suckling duration.¹⁵ Clements et al¹¹ suggested that the effect of pacifier use on breastfeeding warrants additional study and argued that pacifier use may be causally related to breastfeeding duration or a marker for breastfeeding difficulties. Howard et al,¹⁶ however, contended that women who introduce pacifiers experience problems that are consistent with infrequent breastfeeding, suggesting that breastfeeding problems may follow the introduction of a pacifier.

The use of pacifiers was relatively widespread among this cohort of women, but what remain unclear are the reasons for introducing a pacifier in the first place. Is the use of a pacifier related to cultural norms (ie, everyone uses them), or is their use a marker for breastfeeding difficulties? Additional studies are needed to determine whether breastfeeding problems that are associated with the use of pacifiers precede or follow their introduction. If problems precede the introduction of a pacifier, then more effort needs to be made to provide women with anticipatory guidance on how to prevent or identify and manage common breastfeeding problems as a means of reducing the need for the use of pacifiers. If, however, breastfeeding difficulties follow the introduction of pacifiers, then women need to be discouraged from introducing pacifiers as a means of reducing the risk for breastfeeding problems and increasing breastfeeding duration.

Among this cohort of Australian women, an intention to return to employment within 6 months postpartum was not associated with breastfeeding initiation.³⁴ However, women who returned to work before their infant was 12 months of age were less likely to be fully breastfeeding at 6 months or to be giving their infant any breast milk at 12 months. This negative association between early return to work and breastfeeding duration

has been reported in numerous studies of women in industrialized societies.^{17,21,22}

Visness and Kennedy²¹ reported a positive association between the duration of maternity leave and the duration of breastfeeding. Certainly, Nordic countries with high breastfeeding rates^{7,9,13} also benefit from generous statutory maternity leave programs. For example, Norwegian women are entitled to a total of 116 weeks of job-protected maternity and child care leave, which includes 42 weeks of maternity leave remunerated at 100% of normal earnings.⁴³ Norwegian breastfeeding rates are correspondingly higher than those of Australia, with 85% of infants being breastfed at 4 months and 80% at 6 months.⁹ In contrast, Australian maternity leave provisions provide for 52 weeks of job-protected but unpaid leave,⁴³ although some employees may have access to varying lengths of paid leave through union contracts and individual employer policies. However, almost half of women in the Australian workforce are employed on either a part-time (22%) or casual (29%) basis and are not entitled to any maternity leave.⁴⁴ Although there is not a simple relationship between a country's breastfeeding rates and labor policy, Galtry⁴⁵ contended that a country's breastfeeding rates are influenced by and reflected in its maternity leave program. More generous maternity leave provisions in the form of statutory paid leave for both permanent and casual employees may enable women to remain at home with their infants for longer periods. In the absence of this, more flexible working conditions, including increased opportunities for part-time work, improved conditions at work for breastfeeding, and breastfeeding breaks at work, will help to support breastfeeding among women who work outside the home.⁴⁶

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Predictors of Breastfeeding Duration: Evidence From a Cohort Study

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