

Breastfeeding Protects against Current Asthma up to 6 Years of Age

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Objective To investigate the effects of breastfeeding on wheezing and current asthma in children 2 to 6 years of age.

Study design Infants (n = 1105) were enrolled in a prospective birth cohort in New Zealand. Detailed information about infant feeding was collected using questionnaires administered at birth and at 3, 6, and 15 months. From this, durations of exclusive and any breastfeeding were calculated. Information about wheezing and current asthma was collected at 2, 3, 4, 5, and 6 years. Logistic regression was used to model associations between breastfeeding and outcomes with and without adjustment for confounders.

Results After adjustment for confounders, each month of exclusive breastfeeding was associated with significant reductions in current asthma from 2 to 6 years (all, $P < .03$). Current asthma at 2, 3, and 4 years was also reduced by each month of any breastfeeding (all, $P < .005$). In atopic children, exclusive breastfeeding for ≥ 3 months reduced current asthma at ages 4, 5, and 6 by 62%, 55%, and 59%, respectively.

Conclusion Breastfeeding, particularly exclusive breastfeeding, protects against current asthma up to 6 years. Although exclusive breastfeeding reduced risk of current asthma in all children to age 6, the degree of protection beyond 3 years was more pronounced in atopic children. (*J Pediatr* 2012; ■: ■-■).

The evidence supporting the relationship between breastfeeding and the development of asthma is conflicting and remains controversial. A number of prospective studies have reported that breastfeeding protects against wheeze and asthma in infancy and early childhood.¹⁻⁴ However, the effect of breastfeeding on asthma in older children (≥ 6 years) is less clear. Some studies have found that breastfeeding protects against asthma,^{5,6} whereas others have found that it has no effect⁷ or is even a risk factor for asthma in later childhood and adulthood.^{4,8} Findings from a large randomized controlled trial⁹ also failed to clarify the effect of breastfeeding on the development of asthma in older children as it was not designed to test this.¹⁰

In addition, there is debate about the relationship between breastfeeding and asthma risk in children with atopy or a family history of allergic disease. A meta-analysis of prospective studies by Gdalevich et al¹¹ found that breastfeeding reduced the risk of asthma in young children and that the protective effect was larger in children with a family history of atopy. However, an update by Ip et al,¹² which was stratified by a family history of asthma and included 3 additional studies, showed that the association between breastfeeding and asthma in children with a family history is far from clear. As this meta-analysis included studies with outcomes measured from 2 to 13 years of age, it is possible that this uncertainty reflects that the relationship between breastfeeding and asthma changes with age. For instance, when the only eligible study reporting outcomes in children older than 9 years of age⁴ was included, breastfeeding was no longer associated with a reduction in the asthma risk of children with a family history. In addition, Sears et al⁸ found that breastfeeding increased the risk of asthma after controlling for family history. However, this study could not be included in Ip et al's¹² meta-analysis as it did not meet the inclusion criteria as a result of the way that data about breastfeeding was collected and presented. Although more recent studies, showing that breastfeeding reduced the risk of asthma regardless of family history, are not included in this meta-analysis,^{3,6} another possible explanation for these apparently conflicting findings is the quality of breastfeeding data, in particular whether data were collected retrospectively or prospectively, the use of arbitrary intervals to describe breastfeeding duration as a categorical measure, and whether exclusive breastfeeding was also explored.

We have previously reported a strong protective effect of breastfeeding on adverse respiratory outcomes, including current asthma, in New Zealand children aged 15 months using comprehensive breastfeeding data.³ The aim of this analysis was to investigate whether breastfeeding continued to protect against current asthma and wheezing in children up to 6 years of age. In addition, we explored these relationships in children with and without atopy and a family history of allergic disease. This study is unusual because we collected and analyzed durations

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Funded by grants from the Health Research Council of New Zealand, the Child Health Research Foundation, the Canterbury Medical Research Foundation, the Asthma Research Foundation of New Zealand (Christchurch), and the David and Cassie Anderson Bequest (Wellington). The authors declare no conflicts of interest.

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BMI Body mass index

of exclusive and any breastfeeding as continuous measures, which gives a greater sensitivity for detecting changes in the effects of these exposures.

Methods

The New Zealand Asthma and Allergy Cohort Study was established in Christchurch and Wellington in 1997 as a large prospective birth cohort to investigate risk factors for the development of asthma. Ethics approval for the study was obtained from the Wellington and Canterbury Regional Ethics Committees. Full details of the cohort, including assembly, demographics, and methodology, have been published elsewhere.¹³

Recruitment took place in Christchurch and Wellington between 1997 and 2001. Expectant mothers were recruited by midwives before birth, and consent was confirmed by the study team soon after. No explicit attempt was made to recruit families with a history of atopy, allergic disease, or asthma, and the resulting cohort sample is largely representative of the wider New Zealand population.¹³

Breastfeeding

Detailed information about infant feeding was collected using questionnaires administered at birth and at 3, 6, and 15 months. Breastfeeding was assessed in 2 ways: the duration of “exclusive” breastfeeding (age when infant formula, food, or other drinks, except water, were introduced) and the duration of “any” breastfeeding (age when breastfeeding was stopped). From these, the duration of “additional” breastfeeding (duration of any breastfeeding minus the duration of exclusive breastfeeding) was derived. These were modeled as continuous variables.

The 6-month questionnaire was not completed for 24 of the 1011 children, for whom there was complete breastfeeding data, thus restricting the exclusive breastfeeding data to 987 children. In addition, 170 (16.8%) children were still being breast fed at their 15-month assessment. The duration of any breastfeeding for these children was therefore determined from this date.

Outcomes

The primary outcome in this analysis was “current asthma.” “Current wheezing” was a secondary outcome measure. Current asthma at 2, 3, 4, 5, and 6 years of age was defined as “ever had a doctor’s diagnosis of asthma” AND [“wheeze in the last 12 months” OR “used an inhaler in the last 12 months”]. Current wheezing was defined as “any wheezing in the last 12 months”.

Confounding Variables

Potential confounding variables included sex, gestational age <37 weeks, study site, smoking in pregnancy, household smoking at 15 months, respiratory tract infections (parental report of colds, coughs, chest, and ear infections) in the first 3 months of life, and parental history of allergic disease (asthma OR eczema OR hayfever in at least one parent).

These were all modeled as binary covariates. Ethnicity (Maori, Pacific, Pakeha/European, and other) was modeled as a prioritized categorical variable, whereas birth weight and other anthropometric birth measures, parity, crowding (number of rooms per person), body mass index (BMI) at 15 months, and the New Zealand Deprivation Index 2001 (1-10, with 1 representing the least deprived) as a marker of socioeconomic status¹⁴ were modeled as continuous variables.

The variables entered into the final models were ethnicity, socioeconomic status, parity, BMI at 15 months, smoking in pregnancy, sex, and respiratory infections in the first 3 months of life. Although birth weight and household smoking were relevant, they were not included in the final models because of their close correlation with BMI at 15 months and smoking in pregnancy, respectively.

Research has suggested that the protective effect of breastfeeding is influenced by a family history of allergic disease.^{2,4,11} Parental history of allergic disease required both parents to be living with the child at the time of the 3-month questionnaire; hence, these data were not available for 111 children. As the inclusion of parental history of allergic disease markedly reduced the available sample size, models were constructed with and without this as a confounding variable.

Modifying Variables

Given the uncertainty about the relationship between breastfeeding and asthma risk in children with atopy, atopy was explored as a potential modifying variable. Skin prick tests were performed using the following allergens (Dome/ Hollister-Stier, Spokane, Washington): *Dermaphagoides pteronyssinus*, perennial rye grass, olive tree (*Olea europaea*), cat pelt, dog hair (dander), horse hair, cockroach mix (american, german), egg white, peanut mix (runner, virginia, spanish), cow’s milk (whole), *Aspergillus fumigatus* and *Alternaria tenuis*. A positive (Histamine 10%), and negative control were also included. Consent for this test was obtained for 889 (87.9%) children at 15 months. Children were categorized as atopic if there was an allergen to histamine wheal ratio of >0.5 after subtraction of the negative control wheal size. This derived measure was used to control for the variable response to histamine in infancy and interoperator and interbatch allergen variability.^{15,16}

Statistical Analysis

Binary logistic regression analyses were used to test the associations between breastfeeding and respiratory outcomes. Unadjusted ORs and 95% CIs were calculated for durations of exclusive and any breastfeeding. Multivariate models incorporating the confounding variables outlined earlier were used to generate adjusted ORs and 95% CIs. In addition, both exclusive and additional breastfeeding were modeled simultaneously to determine the independent effects of these exposures on respiratory outcomes. To explore whether the effect of breastfeeding

on current asthma was modified by atopy, the interaction between breastfeeding duration and atopy was entered as a term into the multivariate logistic regression models. All analyses were performed using SPSS (Version 13, 2004; SPSS Inc, Chicago, Illinois). We did not impute missing data.

The rationale for the cohort size has been reported elsewhere.¹³

Results

A total of 1105 children were enrolled before birth. Questionnaires were completed for 1064 children at 3 months (96.3%), 1011 at 15 months (91.5%), 1011 at 2 years (91.5%), 1007 at 3 years (91.1%), 986 at 4 years (89.2%), 990 at 5 years (89.6%), and 920 (83.3%) at 6 years, with complete data available to 6 years for 892 (80.7%) children. Key characteristics and the prevalence of outcomes of those for whom there were complete breastfeeding data are listed in **Table I**.

Breastfeeding and Current Asthma

Of the 202 children with current asthma at 6 years of age, 78% had current asthma at 5 years, 69% at 4 years, 60% at 3 years, 47% at 2 years, and 28% at 15 months.

The median duration of exclusive breastfeeding was 1.4 (IQR, 0-4) months and of any breastfeeding was 9.0 (IQR, 4-13) months. The duration of exclusive breastfeeding was correlated with the duration of additional breastfeeding beyond the exclusive period ($P < .001$). However, exclusive breastfeeding was found to be more strongly associated with the outcomes than any breastfeeding at every time point (**Table II**).

After adjustment for confounders, excluding parental history of allergic disease, each month of exclusive breastfeeding was associated with a significant reduction in current asthma at 2, 3, 4, 5, and 6 years of age (all, $P < .03$; **Table II**). Each month of exclusive breastfeeding reduced the risk of current asthma by 17% (OR, 0.83; 95% CI, 0.76-0.92) at 2 years; by 12% (0.88, 0.80-0.96) at 3 years; by 11% (0.89, 0.82-0.97) at 4 years, by 12% (0.88, 0.80-0.95) at 5 years, and by 9% (0.91, 0.83-0.99) at 6 years. **Figure 1** (available at www.jpeds.com) shows the unadjusted percentage of children with current asthma from 2 to 6 years of age by duration of exclusive breastfeeding. Current asthma was reduced by 6% (0.94, 0.90-0.97) at 2 years, 6% (0.94, 0.91-0.97) at 3 years, and 4% (0.96, 0.93-0.99) at 4 years for each month of any breastfeeding (all $P < .005$; **Table II**). The relationship between any breastfeeding and current asthma after adjustment for confounders was not significant at 5 and 6 years of age. Although a parental history of allergic disease was associated with current asthma at 2, 3, 4, 5, and 6 years of age, adjusting for this did not markedly alter our findings. However, the association with current asthma at 4 and 6 years of age just failed to reach significance in the exclusive breastfeeding models adjusted for parental history of allergic disease.

Table I. Prevalence of selected exposure characteristics and outcomes in children from the New Zealand Asthma and Allergy Birth Cohort for whom there was complete breastfeeding data

Characteristics	No. (%)
Male (n = 1011)	515 (50.9)
Māori (n = 1011)	148 (14.6)
Gestational age <37 wk (n = 1011)	37 (3.7)
Mean (SD) gestational age (n = 1011)	39.6 (1.47)
Mean (SD) New Zealand Index of Deprivation (n = 1011)	4.7 (2.87)
Mean (SD) BMI at 15 mo (n = 994)	17.5 (1.72)
Smoking in pregnancy (n = 1011)	206 (20.4)
Respiratory infections ≤ 3 mo (n = 1011)	623 (61.6)
Smoking in household at 15 mo (n = 1011)	335 (33.1)
Atopy at 15 mo (n = 889)	249 (28.0)
Parental history of allergic disease (n = 900)	751 (83.4)
Maternal history of asthma (n = 1009)	277 (27.5)
Exclusive breastfeeding	
Age when infant formula, food, or other drinks introduced (n = 987)	
≤ 1 wk	337 (34.1)
>1 wk-1 mo	125 (12.7)
>1-2 mo	101 (10.2)
>2-3 mo	84 (8.5)
>3-4 mo	156 (15.8)
>4-5 mo	131 (13.3)
>5-6 mo	52 (5.3)
>6 mo	1 (0.1)
Any breastfeeding	
Age when breastfeeding stopped (n = 1011)	
≤ 1 wk	60 (5.9)
>1 wk-1 mo	65 (6.4)
>1-2 mo	54 (5.3)
>2-3 mo	56 (5.5)
>3-4 mo	33 (3.3)
>4-5 mo	41 (4.1)
>5-6 mo	72 (7.1)
>6-12 mo	335 (33.1)
>12 mo	295 (29.2)
Outcomes	
Current asthma	
2 y (n = 999)	163 (16.3)
3 y (n = 997)	200 (20.1)
4 y (n = 976)	210 (21.5)
5 y (n = 980)	217 (22.1)
6 y (n = 913)	202 (22.1)
Current wheezing	
2 y (n = 1009)	308 (30.5)
3 y (n = 998)	225 (22.5)
4 y (n = 986)	263 (26.7)
5 y (n = 984)	263 (26.7)
6 y (n = 920)	225 (24.5)

Data given as number (%) unless otherwise stated.

The relationship between exclusive breastfeeding and current asthma was modified by atopy at 4, 5, and 6 years of age (P values for the interaction terms for 4-, 5-, and 6-year data, .02, .04, and .058, respectively). In all instances, the protective effects of breastfeeding were more pronounced in atopic children. **Figure 2** shows the unadjusted percentage of children with current asthma from 2 to 6 years of age by duration of exclusive breastfeeding with and without atopy. Exclusive breastfeeding for ≥ 3 months reduced current asthma in atopic children by 63% (0.37, 0.19-0.72) at 4 years of

Table II. ORs (95% CIs) for the *individual* effects of each month of exclusive and any breastfeeding on current asthma from 2 to 6 years of age

Current asthma	Exclusive breastfeeding						Any breastfeeding					
	Unadjusted	P value	Adjusted*	P value	Adjusted†	P value	Unadjusted	P value	Adjusted*	P value	Adjusted†	P value
2 y	0.81 (0.75-0.90)	<.001	0.83 (0.76-0.92)	<.001	0.85 (0.76-0.94)	.002	0.93 (0.90-0.96)	<.001	0.94 (0.90-0.97)	<.001	0.94 (0.90-0.97)	.001
3 y	0.86 (0.79-0.93)	<.001	0.88 (0.80-0.96)	.004	0.88 (0.80-0.97)	.008	0.93 (0.90-0.96)	<.001	0.94 (0.91-0.97)	<.001	0.94 (0.91-0.97)	.001
4 y	0.87 (0.80-0.95)	.001	0.89 (0.82-0.97)	.008	0.92 (0.84-1.00)	.056	0.95 (0.92-0.98)	<.001	0.96 (0.93-0.99)	.005	0.96 (0.92-0.99)	.01
5 y	0.85 (0.79-0.93)	<.001	0.88 (0.80-0.95)	.002	0.88 (0.80-0.96)	.005	0.96 (0.94-0.99)	.01	0.98 (0.95-1.01)	.11	0.98 (0.94-1.00)	.07
6 y	0.88 (0.81-0.96)	.003	0.91 (0.83-0.99)	.03	0.92 (0.84-1.01)	.08	0.99 (0.96-1.02)	.49	1.00 (0.97-1.04)	.93	0.99 (0.96-1.03)	.75

*Adjusted for ethnicity, socioeconomic status, parity, BMI at 15 mo, smoking in pregnancy, sex, and respiratory infections in the first 3 mo of life.

†Adjusted for ethnicity, socioeconomic status, parity, BMI at 15 mo, smoking in pregnancy, sex, respiratory infections in the first 3 mo of life, and parental history of allergic disease.

age, 56% (0.44, 0.23-0.84) at 5 years, and 59% (0.41, 0.21-0.78) at 6 years.

The results of analyses, which included both exclusive and additional breastfeeding variables in the models, as well as other confounders, are given in **Table III**. Associations for breastfeeding (exclusive and additional) and current asthma were independently significant up to 3 years of age, after which time only exclusive breastfeeding was significantly associated with a reduction in risk of current asthma. Once again, our findings did not change markedly after adjustment for parental history of allergic disease.

There was no evidence that prolonged breastfeeding (exclusive or any) increased the risk of current asthma in any subgroup of children, including atopic children with a maternal history of asthma.

Breastfeeding and Current Wheezing

After adjustment for confounders, excluding parental history of allergic disease, every month of exclusive or any breastfeeding was associated with a significant reduction in current wheezing at 2 and 3 years of age (all, $P < .003$; **Table IV**;

available at www.jpeds.com). Each month of exclusive breastfeeding reduced the risk of current wheezing by 12% (0.88, 0.82-0.95) at 2 years and 10% (0.90, 0.83-0.96) at 3 years. Risk of current wheezing was reduced by 4% (0.96, 0.93-0.99) for every month of any breastfeeding at both 2 and 3 years of age. Breastfeeding was not associated with current wheezing beyond 3 years. When exclusive and additional breastfeeding were modeled simultaneously to determine the independent effects of these exposures on current wheezing, exclusive breastfeeding remained significant in the adjusted models at 2 and 3 years of age (data not shown). Additional breastfeeding in these models failed to reach significance at any time-point.

Discussion

Our results show that breastfeeding, particularly exclusive breastfeeding, continued to protect against current asthma from 2 to 6 years of age. Although the degree of protection for each month of exclusive breastfeeding across the whole cohort decreased from 21% at 15 months³ to around 9% at 6 years, it is important to stress the magnitude of these findings. For instance, if every infant in this cohort had been exclusively breast fed for 6 months, as is currently recommended by the World Health Organization, current asthma would have been reduced by 50% at 2 years, 42% at 3 years, 30% at 4 years, 42% at 5 years, and 32% at 6 years (data not shown).

The decline in protection as our cohort aged was not surprising given that other important risk factors for asthma are likely to come into play as a child ages. However, further exploration of our data revealed that the protection associated with exclusive breastfeeding was more pronounced in atopic children beyond 3 years of age. Despite finding no association between breastfeeding and atopy,³ children with atopy were much more likely than nonatopic children to have current asthma at 4, 5, and 6 years (data not shown), but if they had been exclusively breast fed for at least 3 months, their risk was reduced to approximately that of nonatopic children. Although this subgroup ultimately appear to benefit from exclusive breastfeeding the most, something not previously reported, our data support a global public health message about breastfeeding and asthma. This is because all children in the cohort benefited from breastfeeding, albeit to varying degrees depending on their age. Second, parents

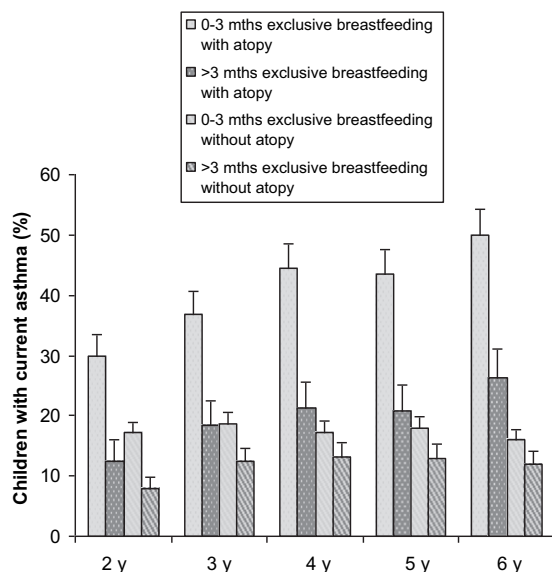


Figure 2. Unadjusted percentage of children with current asthma up to 6 years of age by duration of exclusive breastfeeding with and without atopy.

Table III. Adjusted ORs (95% CIs) for the *independent* effects of each month of exclusive and additional breast-feeding on current asthma from 2 to 6 years of age

Current asthma	Exclusive breastfeeding				Additional breastfeeding			
	Adjusted*	P value	Adjusted†	P value	Adjusted*	P value	Adjusted†	P value
2 y	0.84 (0.76-0.93)	.001	0.86 (0.77-0.95)	.005	0.95 (0.91-0.99)	.01	0.95 (0.91-1.00)	.03
3 y	0.89 (0.81-0.97)	.01	0.89 (0.81-0.98)	.02	0.95 (0.91-0.99)	.007	0.96 (0.92-1.00)	.04
4 y	0.90 (0.82-0.98)	.01	0.92 (0.84-1.01)	.09	0.97 (0.94-1.01)	.12	0.97 (0.93-1.01)	.11
5 y	0.88 (0.80-0.95)	.002	0.88 (0.80-0.96)	.006	0.99 (0.96-1.03)	.67	0.99 (0.95-1.03)	.48
6 y	0.91 (0.83-0.99)	.02	0.92 (0.84-1.01)	.08	1.02 (0.98-1.06)	.28	1.01 (0.97-1.05)	.54

*Adjusted for ethnicity, socioeconomic status, parity, BMI at 15 mo, smoking in pregnancy, sex, and respiratory infections in the first 3 mo of life.

†Adjusted for ethnicity, socioeconomic status, parity, BMI at 15 mo, smoking in pregnancy, sex, respiratory infections in the first 3 mo of life, and parental history of allergic disease.

will not know the atopic status of a child when decisions about breastfeeding, particularly exclusive breastfeeding, are being made.

Our findings extend those of several other prospective birth cohorts, which have investigated the relationship between breastfeeding and respiratory outcomes up to^{1,2,4} and beyond^{5,6} 6 years of age, and do not appear to be the result of reverse causation due to early wheezing.³ We were unable to explore whether early signs of eczema had led to an increase in the duration of breastfeeding, but there was no relationship between breastfeeding and eczema at 15 months.³ Most studies that failed to show a beneficial effect of breastfeeding studied children at an older age; for instance, Burgess et al⁷ reported outcomes in children at age 14 years. Sears et al,⁸ who showed a harmful effect of breastfeeding, also reported outcomes in older children. The effect of breastfeeding on the development of asthma in this same cohort also differed by sex and maternal and paternal atopy.¹⁷ Wright et al,⁴ however, identified that prolonged exclusive breastfeeding increased the risk of asthma and recurrent wheeze from 6 years of age, but only in a subgroup of children with atopy and a maternal history of asthma. This effect continued up to age 13. Our findings directly contradict those of Mandhane et al¹⁷ and Wright et al,⁴ as there was no indication that asthma risk was increased by breastfeeding (exclusive or any) in any subgroup of children at 6 years.

There are several plausible explanations for these differences. Our data show a waning of the effect of breastfeeding on current asthma beyond 4 years, so the studies that show no benefit in later years may also be reflecting this trend. This, however, does not explain the increased risk found by some investigators. Possibilities for this might include the quality of breastfeeding data collected and whether exclusivity was explored. For instance, no child in the Sears study⁸ was likely to have been exclusively breast fed because it was the practice for all children to receive infant formula in hospital in the 1970s when the cohort was established. In addition, the description of exclusive breastfeeding used by Wright et al⁴ was not clear. Another possibility is that between 6 years and later, some children develop a wheezy phenotype, which is caused by or worsened by breastfeeding in early life. However, this is not supported by longitudinal studies of asthma phenotypes. Finally, it may not be

appropriate to compare the impact of breastfeeding in populations from different geographical locations where there are differences in the food supply, exposure to environmental toxins, and maternal diet that may affect the quality or constituents of breast milk. It is also difficult to make direct comparisons between studies with very different rates of breastfeeding, asthma, and allergy.

Strengths of this study were that data collection was prospective, and there was a good retention rate with sufficient statistical power. Our breastfeeding information was comprehensive and the definition of exclusive breastfeeding was rigorous. There was also a wide range of breastfeeding duration, which was collected very precisely, allowing analysis of the breastfeeding data as continuous variables and giving us a unique opportunity to explore the relationship with asthma over time. Most other studies, even those which have shown that breastfeeding reduces asthma risk, have only reported results for breastfeeding with durations categorized as a consequence of the way data were collected or because there was inadequate variation in the duration data.

Although it is possible that the strong protective effect of breastfeeding is only seen in populations where there is a high prevalence of asthma and allergy, breastfeeding has been shown to be protective in studies where the prevalence of a positive family history was relatively low.^{2,5} In one study, the protective effect of breastfeeding was found to be even more pronounced in children without a family history.² In addition, the prevalence of a positive family history of allergic disease in our cohort was similar to that reported by Sears et al,⁸ another New Zealand-based cohort, where, conversely, breastfeeding was reported to be associated with an increased risk of asthma in older children and adults. Unfortunately, temporal and methodological differences, including the choice of outcome measures, the type and quality of breastfeeding data, and the child's age when exposure and outcome data were collected, mean it is difficult to make direct comparisons between these 2 studies.

As previously reported, our data do not appear to support the hypothesis that breastfeeding only protects the infant against virus-induced wheezing episodes in early life.³ Other explanations for our findings include the exclusion of infant formula, food, or other drinks containing potentially allergenic components and the provision of anti-inflammatory

and nutritional or other components of human breast milk. In addition, breastfeeding duration may be a surrogate for other important factors, such as skin-to-skin contact, parenting style, the degree of mother-child bonding, or the time at which mothers returned to work. However, as breastfeeding is the intended mode of nourishment for a human infant, the most likely explanation is the combined impact of all of these. As a result of this and other known benefits of breastfeeding for mother and child, any advice against breastfeeding must be supported by very strong evidence.

In summary, breastfeeding, particularly exclusive breastfeeding, protects against current asthma up to 6 years of age. Although exclusive breastfeeding reduced the risk of current asthma in all children to age 6, the degree of protection beyond 3 years was more pronounced in atopic children. ■

The authors are very grateful to the families in Wellington and Christchurch who have generously given their time. We also acknowledge the outstanding efforts of the midwives in Wellington, Porirua, and Canterbury for assistance with recruitment.

Submitted for publication Apr 28, 2011; last revision received Jul 25, 2011; accepted Nov 23, 2011.

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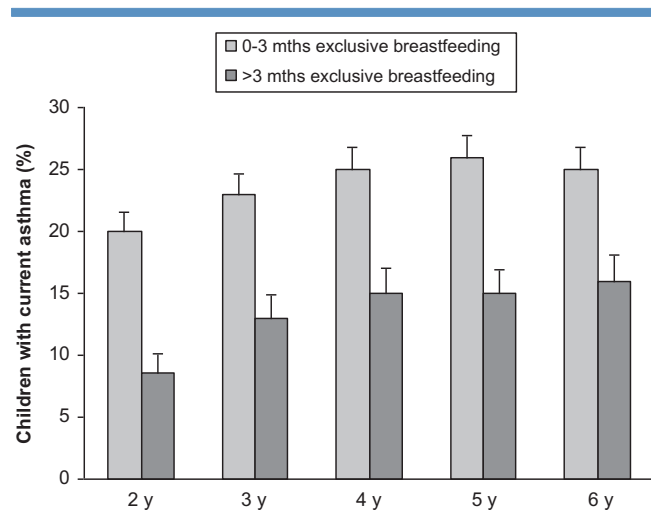


Figure 1. Unadjusted percentage of children with current asthma up to 6 years of age by duration of exclusive breastfeeding.

Table IV. ORs (95% CIs) for the *individual* effects of each month of exclusive and any breastfeeding on current wheezing from 2 to 6 years of age

Current wheezing	Exclusive breastfeeding						Any breastfeeding					
	Unadjusted	P value	Adjusted*	P value	Adjusted†	P value	Unadjusted	P value	Adjusted*	P value	Adjusted†	P value
2 y	0.86 (0.80-0.92)	<.001	0.88 (0.82-0.95)	.001	0.90 (0.83-0.97)	.008	0.95 (0.92-0.97)	.004	0.96 (0.93-0.99)	.003	0.95 (0.92-0.98)	.001
3 y	0.88 (0.82-0.95)	.001	0.90 (0.83-0.96)	.003	0.90 (0.84-0.98)	.01	0.95 (0.93-0.98)	<.001	0.96 (0.93-0.99)	.003	0.96 (0.93-0.99)	.003
4 y	0.93 (0.87-1.00)	.046	0.95 (0.88-1.02)	.14	0.97 (0.89-1.04)	.36	0.97 (0.95-1.00)	.046	0.98 (0.95-1.01)	.18	0.98 (0.95-1.01)	.14
5 y	0.92 (0.85-0.99)	.03	0.93 (0.86-1.01)	.08	0.94 (0.87-1.03)	.17	0.99 (0.96-1.02)	.62	1.00 (0.97-1.03)	.96	1.00 (0.97-1.03)	.98
6 y	0.94 (0.87-1.01)	.11	0.97 (0.89-1.05)	.38	0.98 (0.90-1.07)	.67	1.00 (0.97-1.03)	.86	1.10 (0.98-1.04)	.50	1.01 (0.98-1.04)	.59

*Adjusted for ethnicity, socioeconomic status, parity, BMI at 15 mo, smoking in pregnancy, sex, and respiratory infections in the first 3 mo of life.

†Adjusted for ethnicity, socioeconomic status, parity, BMI at 15 mo, smoking in pregnancy, sex, respiratory infections in the first 3 mo of life, and parental history of allergic disease.

Appendix

The New Zealand Asthma and Allergy Cohort Study Group comprises the following staff or past staff of the University of Otago (in alphabetical order): Mrs Rebecca Betts, Mrs Kristi Calder, Ms Julie Cook, Professor Julian Crane, Ms Caro Dench, Ms Mary Duignan, Dr Michael Epton, Dr David Fishwick, Dr Penny Fitzharris, Associate Prof Chris Frampton, Ms Tracey Hewitt, Dr Tristram Ingham, Ms Virginia Irvine, Ms Robyn Kelly, Ms Phillipa Lampshire, Ms Juliette Lane, Dr Philip Leadbitter, Ms Gillian Lewis, Ms Fiona McCartin, Ms Claire Macdonald, Ms Sue McLeod, Mr David Morrison, Ms Alex Nicholson, Dr Philip Pattemore, Mrs Karen Roff, Ms Kelly Sallaway, Ms Gillian Sawyer, Mr Rob Siebers, Dr Karen Silvers, Professor Ian Town, Dr Kristin Wickens, Ms Helen Wilson, Mrs Marti Winn, and Ms Kathy Withell.