

# SCHS Studies

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## The Association of Breastfeeding and Childhood Asthma: Results from the 2005 North Carolina Child Health Assessment and Monitoring Program

by

Harry Herrick, MSPH, MSW

### ABSTRACT

**Objectives:** This study examines the association of breastfeeding duration and the incidence of diagnosed childhood asthma in North Carolina.

**Methods:** The North Carolina Child Health Assessment and Monitoring Program (CHAMP) is a follow-up survey on the health and health practices of children (0 to 17 years) from households that participated in the North Carolina Behavioral Risk Factor Surveillance System (BRFSS) survey of adults ages 18 and older. The adult most knowledgeable about the health of the selected child is asked to complete the CHAMP survey.

For this study, 2,044 children ages 2 to 12 were included in the analysis. Breastfeeding was assigned to five categories ranging from “no days” to 365+ days. Logistic regression was used to measure the association of breastfeeding duration and the likelihood of childhood asthma, while controlling for the child’s birth weight, age, race, and gender.

**Results:** Among the breastfeeding groups, the prevalence of childhood asthma ranged from a high of 20.6 percent for the never-breastfed group to a low of 8.8 percent for those breastfed for one year or more. A negative linear relationship ( $p < 0.01$ ) was found between breastfeeding duration and childhood asthma. When controlling for the other risk factors, the odds of asthma (adjusted OR=2.39) was significantly higher among the never-breastfed group than among those who were breastfed for one year or more.

**Conclusion:** The results of this study suggest that new mothers should be encouraged to breastfeed for as long as possible, and that never breastfeeding, or breastfeeding for less than 3 months (1-90 days), may be an independent risk factor for childhood asthma.



## Introduction

Research conclusions on the protective effect of breastfeeding on the incidence of childhood asthma are still controversial. An early, longitudinal study of children born in 1972-1973 who were and were not breastfed found that more children who were breastfed, compared to those who were not, reported current asthma at each assessment between ages 9 and 26 years.<sup>1</sup> A large study (N=6,783) of child participants in NHANES III (National Health and Nutrition Examination Survey, 1988-94), found that breastfeeding, and the duration of breastfeeding, did not appear to “prevent childhood asthma, delay its onset, or reduce its severity.”<sup>2</sup> Similarly, a large cohort study (N=7,223) conducted in Australia found that breastfeeding (> = 4 months) neither helped nor hindered the onset of asthma among 14-year-olds.<sup>3</sup>

Despite these findings of negative or non-effects of breastfeeding on childhood asthma, the majority of published studies show a protective effect. Meta-analysis and literature reviews have shown the benefits of exclusive breastfeeding.<sup>4,5</sup> The introduction of milk other than breast milk before four months of age has been shown to increase the risk of asthma in children.<sup>6</sup> And in the majority of these studies, the protective effect of breastfeeding has been linked to its duration. Researchers report a dose-response relationship, i.e., the longer the infant is breastfed the lower the risk of asthma.<sup>7</sup>

In this study, we test the assumption of a dose-response relationship between breastfeeding duration and child asthma (ever-diagnosed) among children ages 2 to 12. Breastfeeding duration is broken into five time periods, ranging from no breastfeeding days to breastfeeding for one year or more. We anticipate that, as breastfeeding duration increases, the prevalence of child asthma will decrease.

To measure the effect of breastfeeding duration, we controlled for low birth weight, which has been shown to increase a child’s risk of asthma.<sup>8</sup> We also controlled for the excess risk of asthma known to be present with male gender and African American race.<sup>9</sup> In addition, we controlled for the child’s age, since older children are at higher risk for asthma and mothers who breastfed

for any duration tended to have younger children than the mothers who reported never breastfeeding.

## Methods

### *North Carolina CHAMP and BRFSS Surveys*

The North Carolina Child Health Assessment and Monitoring Program (CHAMP) is a household, telephone follow-back survey on child and adolescent health (ages 0 to 17). The sample for CHAMP is derived from the North Carolina Behavioral Risk Factor Surveillance System (BRFSS) survey of resident adults, which is a random-digit-dial telephone survey of non-institutionalized adults (18+ years) living in households with land-line telephones. Towards the end of the BRFSS interview, adult respondents living in households with children are asked to participate in the CHAMP study. One child (even if more than one exists) is randomly selected to be the target child for CHAMP. The CHAMP interview is then conducted with the adult most knowledgeable about the health and health practices of the selected child. Usually, the time lapse between the BRFSS and CHAMP interview is about 2-3 weeks.

### *The Sample*

The breastfeeding questions are asked of the child’s biological mother or father (assessed early in the CHAMP interview) and only about children ages 12 and younger. The asthma questions are asked about children at least two years of age. Therefore, the child age range for this study was 2- to 12-year-olds. The total number of completed CHAMP interviews in 2005 was 3,964; of those, 2,044 mother/father respondents with children ages 2 to 12 completed the breastfeeding and asthma questions, making them study members.

### *Study Variables*

The child’s birth weight in pounds and ounces was obtained from CHAMP. For this study, only pounds were used to construct the low birth weight class. Recall of birth weight in ounces was deemed to be too unreliable, particularly for older children or for father respondents. Low birth weight was defined as reported birth weights of less than five pounds; all other birth weights were assigned to the normal birth weight group, and all missing birth weights were excluded.

Breastfeeding was assigned to five levels: (1) no breast feeding days, (2) 0 to 90 days, (3) 91-181 days, (4) 181-364 days, and (5) 365+ days – one year or more.

Maternal smoking and maternal history of asthma are well-established risk factors for child asthma.<sup>10-11</sup> These items are collected on the BRFSS survey, rather than the CHAMP survey. We would have liked to include these variables in all our analyses, but limitations in the way these data were collected on the BRFSS precluded this. The BRFSS survey does not identify the biological mother, so we had to use information from respondents who were the oldest females in the household as a proxy for the maternal information. After excluding male BRFSS respondents, female respondents who were not the oldest female in the household, and female respondents who were over the age of 65, there were 1,343 females from the BRFSS survey from whom we could collect information on maternal smoking and maternal history of asthma. This information is included in Figure 2. Because we had this maternal information for only about 65 percent of the 2,044 children in the study, we did not include maternal smoking and asthma as variables in the multivariate analysis.

### Analysis

Descriptive statistics (rates and 95% confidence intervals) were calculated for the prevalence of child asthma by breastfeeding duration (Figure 1). The prevalence of asthma was also calculated for the risk factors of maternal smoking, maternal asthma, and low birth weight (Figure 2).

Logistic regression was used to calculate the conditional odds ratios for child asthma among the breastfeeding groups, after adjusting for the influence of other risk factors. The odds of asthma for the first four levels of breastfeeding (from “no days” to “181-364 days”) were compared to the odds of asthma among mothers who breastfed for one year or more (the reference group). Low birth weight was constructed as a dichotomous variable: risk present (=1), risk not present (=0). Demographic risks included African American race, male gender, and older children (ages 6 to 12).

The SAS-callable SUDAAN software was used to calculate the descriptive statistics and the adjusted odds ratios and their corresponding 95% confidence intervals

for the logistic regression analysis. All analyses of child-level variables in the study were conducted with the appropriate final weight from the CHAMP survey, and the BRFSS variables were analyzed with the appropriate weight from the BRFSS survey.

## Results

Table 1 shows the characteristics of the child asthma sample population. Not surprisingly, the mother was chosen 85 percent of the time as the parent respondent most knowledgeable about the child’s health. Male and female children were almost equally represented in the sample. African American children comprised about 17

**Table 1.**  
**Characteristics of Child Asthma (ages 2-12)**  
**Study Population: 2005 North Carolina CHAMP**

	Unweighted Number	Weighted Percent
<b>Total</b>	2,044	100%
<b>Parent respondent</b>		
Mother	1,803	85.3
Father	241	14.7
<b>Ever breastfed</b>		
Yes	1,325	65.6
No	719	34.4
<b>Child race</b>		
White	1,432	69.6
African American	367	16.5
Other minority	237	13.3
Don't know	3	0.4
Refused	5	0.2
<b>Child gender</b>		
Male	1,047	50.0
Female	994	49.6
Refused	3	0.4
<b>Child age group</b>		
2-5 yrs. (preschool)	755	41.4
6-12 yrs. (school age)	1,289	58.6
<b>Birth weight (pounds)</b>		
<5 lbs. (LBW study group)	83	3.8
5 lbs. or greater	1,915	93.2
Don't know	45	3.0
Refused	1	–
<b>Child ever asthma</b>		
Yes	354	16.8
No	1,690	83.2

**Note:** The weighted percents cannot be calculated from the numbers in this table.

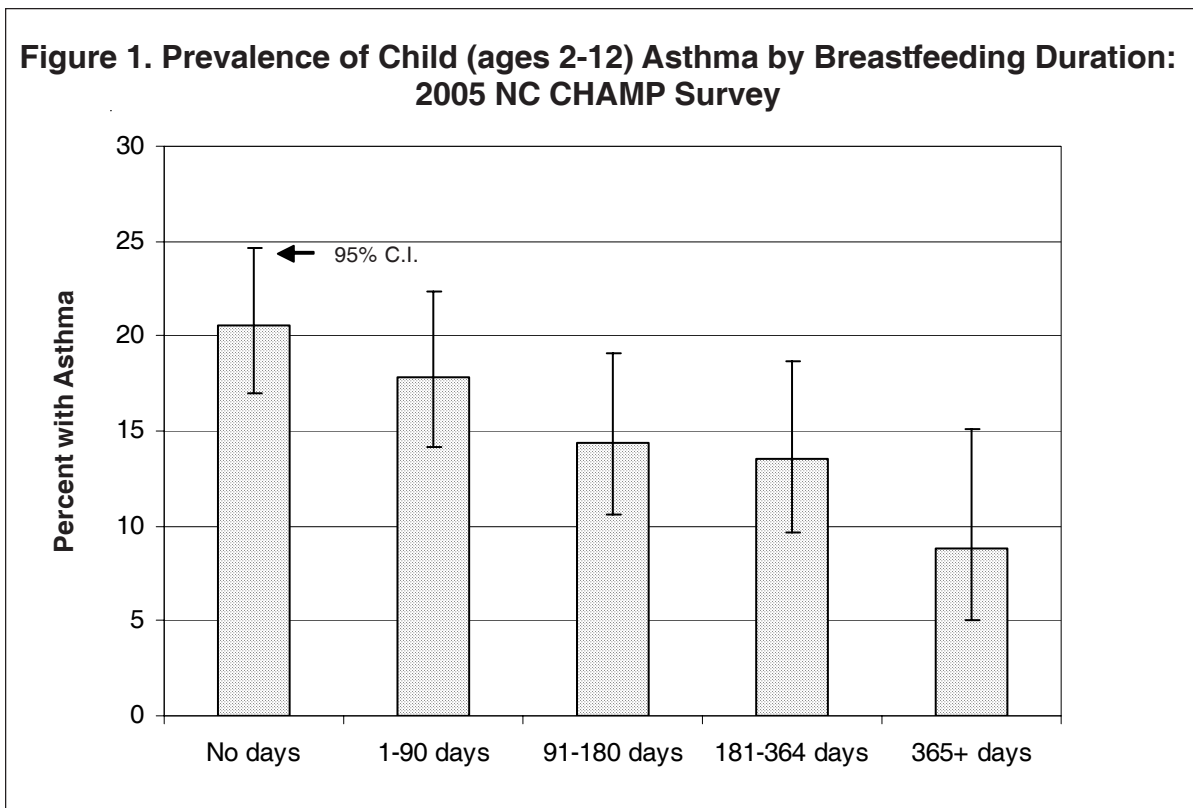
percent of the study sample. Older children, ages 6 to 12, comprised about 60 percent of the study sample. Low birth weight children comprised about 4 percent of the sample, while missing birth weights (refusals and don't knows) comprised an additional 3 percent.

About two-thirds of parent respondents reported that their child had ever been breastfed. Figure 1 shows the prevalence of child asthma by breastfeeding duration. The results demonstrate that as levels of breastfeeding increase from “no days” to “365+ days,” the prevalence of asthma decreases.

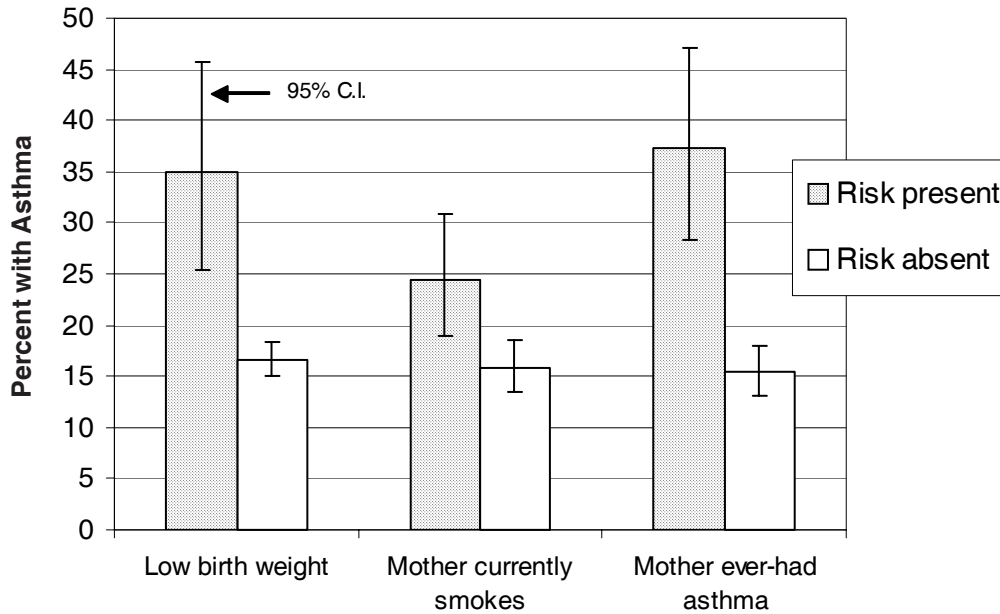
Figure 2 shows the prevalence of child asthma by low birth weight, maternal smoking (at the time of the BRFSS interview), and maternal asthma. Several results are noteworthy. The prevalence of child asthma is about 35 percent among CHAMP children born with low birth weight, and about 37 percent among CHAMP

children born to mothers with a history of asthma. The prevalence of child asthma is about 24 percent for CHAMP children living in households where the mother currently smokes. For the corresponding *risk-absent* groups, the prevalence of child asthma is about 15 percent.

The adjusted odds of child asthma among the group who reported their child was never breastfed was about 2.4 times the odds among those who reported breastfeeding for 365 or more days – the reference group (Table 2). For mothers who breastfed the least amount (i.e., 1 to 90 days), the odds of asthma among their children was about twice as large as that of the reference group, and this difference was statistically significant ( $p=0.04$ ). Among the remaining groups (i.e., 91-180 days or 181-364 days), the odds of asthma were also higher, though not significantly higher, than the reference group.



**Figure 2. Prevalence of Child (ages 2-12) Asthma by Child and Maternal\* Risk Factors (present/absent): 2005 CHAMP and BRFSS Surveys**



\* For maternal risk factors the available sample size is 1,343.

**Table 2. Predictors of Childhood Asthma\*: Multiple Logistic Regression Results Using Data from the 2005 North Carolina CHAMP Survey (N=1,988\*\*)**

Predictors	Adj. Odds Ratio	(95% C.I.)	p values
<b>Breast feeding duration</b>			
No days	2.39	(1.22 - 4.68)	0.01
1 to 90 days	1.97	(1.01 - 3.86)	0.04
91 to 180 days	1.65	(0.81 - 3.33)	0.16
181 to 364 days	1.61	(0.78 - 3.31)	0.19
365+ days	1.00	1.00	
<b>Low birth weight</b>			
Less than 5 lbs.	2.10	(1.18 - 3.72)	0.01
5 or more lbs.	1.00	1.00	
<b>Child gender</b>			
Male	1.32	(0.98 - 1.78)	0.06
Female	1.00	1.00	
<b>Child age</b>			
2 - 5 year olds	0.76	(0.55 - 1.05)	0.09
6 - 12 year olds	1.00	1.00	
<b>Child race</b>			
African American	1.25	(0.86 - 1.82)	0.23
Other race	1.00	1.00	

\*Ever-diagnosed.

\*\*56 observations were deleted from the analysis due to missing values.

When examining the adjusted odds found among the risk groups, one factor remained a strong independent predictor of child asthma: low birth weight (adj. OR=2.1). Male children were about 32 percent (adj. OR=1.3) more likely to ever have asthma than female children, though this association was not quite significant. African American children and older children also had higher odds of asthma than their reference groups, but these adjusted odds ratios were not statistically significant.

## Discussion

The results of this study lend support to the growing body of research that shows that breastfeeding is protective against child asthma. We found evidence of a dose-response relationship between length of time of breastfeeding and subsequent reduction in the prevalence of a child ever having asthma. A negative linear relationship ( $p < 0.01$ ) was found between the five levels of breastfeeding and the prevalence of child asthma. Furthermore, when controlling for other risk factors such as child's gender and race, infants who were breastfed for 90 days or less had an independently high risk of asthma, compared to those who had been breastfed for a year or more.

Several studies have reported that a significant reduction in the risk of childhood asthma has been associated with at least 3-4 months of exclusive breastfeeding.<sup>12-13</sup> One such study included a prospective birth cohort study of 4,089 children followed through age 4. The authors found that exclusive breastfeeding for 4 months or more reduced the risk of asthma at age 4.<sup>14</sup> To compare these findings with our CHAMP data, we conducted a test of the difference in asthma prevalence between the no breastfeeding group and those who breastfed 91-180 days (3-6 months). We found a statistically significant difference ( $p = 0.03$ ), with a lower asthma prevalence in the 91-180 days group (see Figure 1). Importantly, these findings from CHAMP support what other studies have found about the importance of a minimum breastfeeding period of four months.

We also found that current smoking among CHAMP mothers was associated with a higher prevalence of

child asthma (Figure 2). In support of these findings, a recently published study of asthma in Danish children (N=3,052) found that both asthma and current wheeze in late-preschool children was associated with current maternal tobacco use (adj. OR=1.69), as well as other risks including male gender.<sup>15</sup>

Aside from no breastfeeding (adj. OR=2.4), the strongest independent risk factor for child asthma was low birth weight (adj. OR=2.1;  $p < 0.05$ ). We defined low birth weight as less than 5 pounds, which is a lower threshold than the standard definition of less than 5 pounds 9 ounces. Nevertheless, a recent study (2006) published in the American Journal of Public Health reported that low birth weight (using the standard definition) children were twice as likely (adj. OR=2.4;  $p < 0.001$ ) as normal weight children to have an asthma diagnosis, after controlling for an extensive set of demographic, medical, and behavioral factors.<sup>16</sup> Findings from this study are similar to the risk-estimate we observed for CHAMP low birth weight births.

There are several limitations of this study. Maternal smoking or maternal history of asthma may have contributed to the risk of child asthma in this study; by not considering these risks in the regression model, the odds ratios we obtained (Table 2) may overstate the effect that breastfeeding has on child asthma. Also, we could not measure exclusive breastfeeding from the CHAMP survey. Some of the breastfeeding mothers in this study would have included milk formula in their infants' diet during the breastfeeding period. As cited previously, research has found that the introduction of milk formula other than breast milk can increase the risk of child asthma. This would result in our study underestimating the association of exclusive breastfeeding with a reduction in asthma prevalence. Finally, this study examined only children who had ever been diagnosed with asthma. Recovery from symptoms of asthma is known to occur in older children who were once diagnosed with asthma at a young age.

In conclusion, the results from this study (first-year of NC CHAMP) should be viewed with caution, but there is evidence that breastfeeding, and in particular longer duration of breastfeeding, is protective against childhood asthma. New mothers should be encouraged



to breastfeed for as long as possible, since never-breastfeeding or breastfeeding for less than 3 months (1-90 days) may be an independent risk factor for childhood asthma.

### *Plans to Improve Data Collection*

To improve our assessment of childhood asthma in North Carolina, changes are being planned for the upcoming 2007 BRFSS and CHAMP surveys. For the new BRFSS survey, questions are being added that will define the adult respondent's relationship (e.g., biological mother or father) to the selected CHAMP child. For the 2007 CHAMP survey, we plan to extend the assessment of breastfeeding for children of all ages (0-17 years). For respondents who report breastfeeding, we plan to ask a question on whether milk formula was also introduced during the breastfeeding period. If the child's biological father is interviewed in CHAMP, we plan to ask the father if the child's biological mother currently uses tobacco or has had a history of asthma. Finally, child asthma will be assessed beginning at one year of age, rather than the current two years of age. These proposed changes will allow us to refine and improve our studies of childhood asthma in North Carolina.

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