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# Does Breastfeeding Protect Against Substantiated Child Abuse and Neglect? A 15-Year Cohort Study

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## What's Known on This Subject

Child maltreatment is associated with multiple adverse developmental outcomes in children, and the biological mother the most frequently reported perpetrator. Breastfeeding may enhance mother-infant bonding through release of the neuropeptide oxytocin, helping to elevate mood and reduce maternal anxiety and physiological stress.

## What This Study Adds

This study reveals high rates of maternally perpetrated child maltreatment and demonstrates that breastfeeding may help to protect against maternal neglect. These findings are consistent with animal research on the effects of oxytocin on long-term maternal behavior.

## ABSTRACT

**OBJECTIVES.** We explored whether breastfeeding was protective against maternally perpetrated child maltreatment.

**METHODS.** A total of 7223 Australian mother-infant pairs were monitored prospectively over 15 years. In 6621 (91.7%) cases, the duration of breastfeeding was analyzed with respect to child maltreatment (including neglect, physical abuse, and emotional abuse), on the basis of substantiated child protection agency reports. Multinomial logistic regression was used to compare no maltreatment with nonmaternal and maternally perpetrated maltreatment and to adjust for confounding in 5890 cases with complete data (81.5%). Potential confounders included sociodemographic factors, pregnancy wantedness, substance abuse during pregnancy, postpartum employment, attitudes regarding infant caregiving, and symptoms of anxiety or depression.

**RESULTS.** Of 512 children with substantiated maltreatment reports, >60% experienced  $\geq 1$  episode of maternally perpetrated abuse or neglect (4.3% of the cohort). The odds ratio for maternal maltreatment increased as breastfeeding duration decreased, with the odds of maternal maltreatment for nonbreastfed children being 4.8 times the odds for children breastfed for  $\geq 4$  months. After adjustment for confounding, the odds for nonbreastfed infants remained 2.6 times higher, with no association seen between breastfeeding and nonmaternal maltreatment. Maternal neglect was the only maltreatment subtype associated independently with breastfeeding duration.

**CONCLUSION.** Among other factors, breastfeeding may help to protect against maternally perpetrated child maltreatment, particularly child neglect. *Pediatrics* 2009;123:483–493

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### Key Words

attachment, breastfeeding, child maltreatment, child neglect, mother-child relations, oxytocin

### Abbreviations

OR—odds ratio  
CI—confidence interval

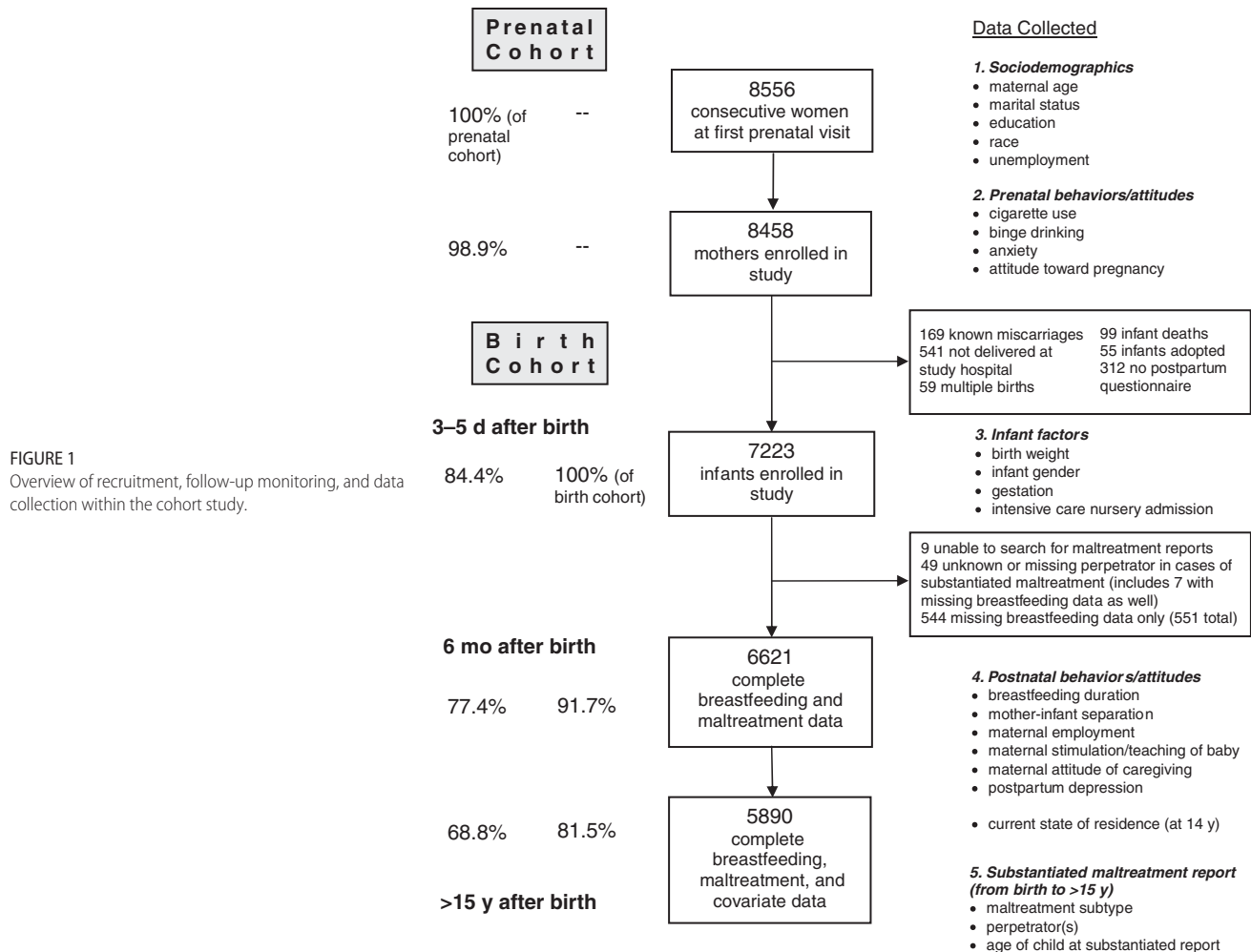
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**M**ALTREATMENT PERPETRATED BY a child's own biological mother represents a fundamental breakdown in the mother-child relationship. Nationwide data in the United States indicate that, in almost 60% of substantiated cases, the mother is an identified perpetrator.<sup>1</sup> With child maltreatment being strongly associated with a range of adverse child outcomes, including impaired emotional and cognitive development<sup>2-4</sup> and increased risk for perpetrating maltreatment in adulthood,<sup>5,6</sup> this is cause for significant concern. Understanding which factors may prevent or minimize risk is therefore of critical importance, both in formulating effective intervention strategies for mothers and in preventing possible long-term and intergenerational sequelae for children.

The causes of child maltreatment have been studied extensively in past decades, with multiple risk and protective factors, from individual parent- and child-related factors to broader community and societal factors, being found to interact at various levels.<sup>7,8</sup> Cultural risk factors include a limited social support network, young maternal age, unplanned pregnancy, low education, unemployment, and poverty. Parent-related risk factors include anxiety and depression, whereas prematurity and admission to the NICU are child-related factors associated with maltreatment in some studies. Finally, some patterns of early parent-child interaction, such as few expressions of positive affection, less child-focused communication, or more controlling, interfering, or hostile interactions, are predictive of subsequent maltreatment.<sup>7-9</sup>



**FIGURE 1**  
Overview of recruitment, follow-up monitoring, and data collection within the cohort study.

Human and animal research suggests that early physical contact between a mother and her offspring is important in stimulating and maintaining maternal behavior,<sup>10</sup> which may help protect against maternally perpetrated maltreatment. Breastfeeding may enhance maternal responsiveness by stimulating oxytocin release, which is associated with reduced anxiety and elevated mood, a blunted physiological stress response, and more-attuned patterns of maternal behavior, presumably through its central nervous system activity.<sup>11–13</sup> A recent report showed that increases in peripheral oxytocin levels during pregnancy were associated with increased maternal-fetal attachment.<sup>14</sup> Another study reported not only that breastfeeding mothers perceived less overall stress but also that breastfeeding, compared with bottle feeding, resulted in a significant reduction in negative mood.<sup>15</sup> A mother's response to both child-related and non-child-related stressors may be an important determinant of child maltreatment.<sup>16</sup> More long-term associations were seen in a birth cohort of ~1000 mothers and their now-adolescent children; breastfeeding duration was related significantly to the adolescents' positive perceptions of maternal care received in childhood.<sup>17</sup> Finally, simple neonatal procedures that supported breastfeeding and mother-infant contact were

associated with decreased rates of infant abandonment in developing countries,<sup>18,19</sup> which suggests a link between breastfeeding and reduced child neglect. We hypothesized that the absence of breastfeeding during the infant's first 6 months of life would independently predict maternally perpetrated child maltreatment.

## METHODS

### Study Design, Setting, and Participants

This birth cohort was derived from a longitudinal prenatal cohort of obstetric patients enrolled at a tertiary care maternity hospital in Brisbane Australia, between 1981 and 1984.<sup>20</sup> Consecutive public patients attending their first prenatal clinic visit were invited to enroll. During those years, a majority of all hospital births (~60%) were to public patients.<sup>20</sup> Data were collected with self-administered questionnaires at 3 time points, namely, before birth, 3 to 5 days after delivery, and 6 months after delivery, with informed consent. The birth cohort consisted of children born in live singleton births and discharged from the maternity hospital (excluding adopted children), with completed prenatal and postnatal questionnaires (Fig 1). The mothers and children were monitored over the next 15 to 20 years, and gov-

ernment agency reports of child maltreatment were accessed in September 2000. Because this study's hypotheses were not formulated until that time, original data collectors were blinded to this study's aims, as well as to each family's maltreatment status.

### Exposure Variable: Breastfeeding Duration

The key exposure variable was breastfeeding duration, as reported in the 6-month questionnaire. Duration of breastfeeding (full or partial) was recorded in 6 categories, that is, not at all,  $\leq 2$  weeks, 3 to 6 weeks, 7 weeks to 3 months, 4 to 6 months, and still breastfeeding. Because 50% of those reporting still breastfeeding responded to their questionnaire at 5 to 6 months, the later 2 categories were combined into  $\geq 4$  months. The remaining 4 categories were combined into not breastfed and breastfed  $< 4$  months, to contrast the absence of breastfeeding with other categories and to maximize numbers in each group.

### Potential Confounding Variables

On the basis of known maltreatment risk factors<sup>3,7,8</sup> and breastfeeding predictors,<sup>21,22</sup> as well as data available from study questionnaires, 18 potential confounding variables, divided into 4 groups, were examined (Fig 1). Binge drinking was defined as having  $\geq 5$  glasses of alcohol on at least one half of the drinking occasions during pregnancy. Maternal anxiety and depression were determined by using standard cutoff values for the short form of the Delusions-Symptoms-States Inventory,<sup>23</sup> a validated self-report measure. Attitude toward pregnancy was determined from responses to 4 statements about whether the mother planned or wanted to be pregnant at that time or meant to avoid pregnancy ( $\alpha = 0.89$ ). Pregnancy ambivalence was gauged when the mother answered predominantly "unsure" to these questionnaire items. At  $\sim 6$  months after delivery, mothers were also asked, "How many hours per week does someone else look after the infant for you?"; 4 possible response categories ranged from never to  $> 20$  hours per week. Maternal stimulation/teaching of the infant was based on 4 statements about how often the mother plays with, teaches, or talks to her infant ( $\alpha = .71$ ). Similarly, maternal caregiving attitude was based on the mother's ratings of 6 statements, examining feelings of satisfaction or frustration in caregiving ("very satisfying" and "my infant is so good" versus "makes me too tired," "fed up," or "angry") ( $\alpha = .77$ ).

### Outcome Variable: Substantiated Child Maltreatment

In September 2000, cases of child abuse and neglect investigated by a government child protection agency were accessed and confidentially linked to the longitudinal database. Statewide mandatory reporting laws for medical practitioners were in force during the entire study period. Data confidentiality was preserved by using an identification number to link the 2 databases anonymously, as described previously.<sup>3,24</sup> Researchers analyzing the maltreatment data had no access to identifying information. Ethical approval for the anonymous

database matching was obtained from the ethical review committees of both the Mater Misericordiae Children's Hospital and the University of Queensland.

Cases of suspected child maltreatment were identified from state-based child protection records, along with the date of each episode of substantiated harm or risk, the subtypes of maltreatment reported (neglect, physical abuse, emotional abuse, and/or sexual abuse), and any identified perpetrators. Substantiated maltreatment was determined by child protection case workers, who investigated each report of suspected abuse or neglect, when there was "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected" (ie, substantiated harm or risk).<sup>25</sup> Childhood neglect was defined as any serious omission of care jeopardizing or impairing the child's psychological, intellectual, or physical development. Physical abuse was defined as any nonaccidental physical injury inflicted by a person having care of the child. Emotional abuse included attitudes or behaviors leading to impairment of the child's social, emotional, intellectual, or physical development. Finally, sexual abuse included exposing a child to, or involving a child in, sexual activities inappropriate for the child's age or level of development.<sup>25</sup> Cases were defined as individual children exposed to abuse or neglect, whereas episodes referred to individual occasions of maltreatment. Many cases had multiple episodes recorded over time. Perpetrators listed as mother or both parents were classified as maternal perpetrators, whereas stepmother and father's partner were included in the nonmaternal maltreatment group (Table 1). Substantiated reports, rather than all suspected maltreatment reports, were examined because perpetrator information was available only for substantiated episodes.

To examine the association between breastfeeding and subsequent maternally perpetrated maltreatment, each maltreatment episode was categorized according to perpetrator (maternal, nonmaternal, or unknown/missing) (Table 1), and each mother-child pair was classified into 1 of 3 groups, that is, (1) no substantiated maltreatment of any type, (2) substantiated maltreatment, with all perpetrators being nonmaternal, or (3) substantiated maltreatment, with  $\geq 1$  episode of maternal offense (Table 2). Specific subtypes of maltreatment, such as neglect, were defined similarly, that is, (1) no substantiated neglect (but possibly other types of substantiated maternal or nonmaternal maltreatment), (2) substantiated neglect, with all perpetrators of neglect being nonmaternal, or (3)  $\geq 1$  episode of substantiated, maternally perpetrated neglect. Similar variables were created for emotional abuse and physical abuse.

With regard to sexual abuse, the mother was listed as a perpetrator in 32 of 199 substantiated episodes (Table 2). In all of those cases, however, either a male perpetrator (eg, father or partner) also was listed ( $n = 24$ ), the report was for substantiated sexual abuse risk rather than harm ( $n = 4$ ), or other maltreatment subtypes (eg, maternal neglect and sexual abuse) were listed concurrently ( $n = 4$ ). Because it was unclear whether the mother was the actual perpetrator of sexual abuse in those cases, sexual abuse was not examined as a separate

**TABLE 1 Perpetrators of Substantiated Maltreatment Episodes (N = 512 Children)**

Primary Maltreatment Perpetrator	Substantiated Maltreatment Episodes, n (%)				
	Neglect	Emotional Abuse	Physical Abuse	Sexual Abuse	Any Maltreatment
<b>Maternal</b>					
Biological mother	297 (56.1)	227 (50.0)	190 (40.9)	24 (12.1)	738 (44.8)
Biological mother and father	120 (22.7)	85 (18.7)	87 (18.8)	8 (4.0)	300 (18.2)
Any maternal perpetrator	417 (78.8)	312 (68.7)	277 (59.7)	32 (16.1)	1038 (63.0)
<b>Nonmaternal</b>					
Biological father	48 (9.1)	81 (17.8)	104 (22.4)	54 (27.1)	287 (17.4)
Stepmother/father's partner	0 (0)	1 (0.2)	5 (1.1)	0 (0)	6 (0.4)
Stepfather/mother's partner	6 (1.1)	25 (5.5)	38 (8.2)	31 (15.6)	100 (6.1)
Other relative	7 (1.3)	6 (1.3)	7 (1.5)	25 (12.6)	45 (2.7)
Nonrelative	5 (0.9)	5 (1.1)	6 (1.3)	26 (13.1)	42 (2.6)
Any nonmaternal perpetrator	66 (12.4)	118 (25.9)	160 (34.5)	136 (68.4)	490 (29.2)
Unknown/missing data	46 (8.7)	24 (5.3)	27 (5.8)	31 (15.6)	128 (7.8)
<b>Total</b>	<b>529 (100)</b>	<b>454 (100)</b>	<b>464 (100)</b>	<b>199 (100)</b>	<b>1646 (100)</b>

The sum of percentage values may not equal 100% because of rounding.

maltreatment subtype. With the mother specifically identified as a perpetrator in those substantiated reports, however, the cases were still included in the variable "any substantiated maternal maltreatment."

### Statistical Analyses

The influence of multiple confounding variables was first tested within the 4 separate variable groups listed in Table 2. All variables in a group were entered simultaneously into a multinomial regression model. Variables from each group that remained significant at  $P < .2$  were included in the final model. This approach was then repeated with each maltreatment subtype (neglect, emotional abuse, or physical abuse) as the dependent variable. As a result of this process, the only variables excluded from the overall model were pregnancy gestation and intensive care nursery admission.

Multinomial logistic regression analysis was used to compare associations between breastfeeding duration, confounding variables, and the different maltreatment categories (no maltreatment, nonmaternal maltreatment, and maternal maltreatment). Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated for each level of breastfeeding duration and for each potential confounding variable. Adjusted ORs were obtained by including previously described potential confounders in a backward regression model, with variables with a statistical significance of  $P > .2$  being withdrawn in a stepwise manner. In additional posthoc analyses, the independent associations between predictor variables and specific types of maltreatment (neglect, emotional abuse, and physical abuse) were examined similarly. Maltreatment subtypes were added to the final regression models (eg, substantiated neglect was adjusted for concurrent emotional and physical abuse episodes).

Additional sensitivity analyses were performed: (1) comparing results for children with a mean age at substantiated maltreatment of  $<5$  or  $>5$  years; (2) comparing children with single versus multiple episodes of maltreatment; (3) excluding siblings of previously enrolled children from the data set (520 children, 7.2% of the

birth cohort); and (4) including only families known to be living in the state of Queensland at 14 years of age. Finally, to assess whether exclusion of participants from the final analysis because of missing data produced bias in the results, we applied inverse probability weighting to the data for the included subjects to restore the representation of subjects excluded or lost to follow-up monitoring.<sup>26</sup>

Two-tailed  $P$  values of  $<.05$  were considered statistically significant. Statistical analyses were performed by using SPSS 15 for Windows (SPSS Inc, Chicago, IL) and Stata (Stata Corp, College Station, TX).

## RESULTS

### Study Population

Of the 8556 consecutive public patients who were attending their first prenatal clinic visit, 98.9% were enrolled in the study and completed the first prenatal questionnaire (mean gestational age:  $20 \pm 6$  weeks). The birth cohort consisted of 7223 children, 52% of whom were male and 96% delivered at term (see Fig 1 for those not included). The mean age of the cohort mothers at study entry was  $25 \pm 5$  years, with 75% being married, 12% in cohabiting relationships, and 10% single. Eighty-seven percent of mothers were of white background, 6% were Australian Aboriginal or Pacific Torres Strait Islander, and 4% were Asian.

The study group was defined as the children with complete breastfeeding and maltreatment data (6621 children; 91.7% of the birth cohort). Maltreatment records were not accessed for 8 families because of missing contact details needed for matching, and 1 family was omitted inadvertently. Cases in which maternal maltreatment could not be ruled out, such as when the perpetrator was unknown or missing, were excluded from all analyses ( $n = 49$ ). An additional 544 children were excluded because of missing breastfeeding data. Complete breastfeeding, maltreatment, and confounding variable data were available for 5890 children (81.5% of the birth cohort) (Fig 1).

**TABLE 2** Prevalence of Potential Confounders for Substantiated Maltreatment (N = 6621)

	N	Any Substantiated Maltreatment		
		None, %	Nonmaternal, %	Maternal, %
<b>Prenatal maternal sociodemographic factors</b>				
Maternal age				
13–19 y	1010	88.9	2.9	8.2
20–34 y	5308	94.8	1.7	3.5
>34 y	303	96.7	2.6	0.7
Marital status				
Married	5056	95.8	1.6	2.5
Unmarried cohabitating	714	89.5	2.4	8.1
Divorced/separated/widowed	157	86.6	3.8	9.6
Single	636	86.2	3.5	10.4
Missing data	58	93.1	3.4	3.4
Education				
Incomplete high school	1157	89.1	3.2	7.7
Complete high school	4227	94.4	1.9	3.7
Post[en] high school	1196	97.3	0.8	1.8
Missing data	41	92.7	4.9	2.4
Race				
Non-Aboriginal	6056	94.3	1.9	3.8
Aboriginal or Pacific Torres Strait Islander	367	88.8	2.5	8.7
Missing data	198	95.5	1.5	3.0
Unemployment (either partner)				
Not unemployed	5409	95.4	1.6	2.9
Unemployed	1116	87.5	3.4	9.1
Missing data	96	87.5	3.1	9.4
<b>Prenatal maternal behaviors/attitudes</b>				
Cigarette use during early pregnancy				
None	4123	95.6	1.5	2.9
Light smoker	1904	91.9	2.6	5.6
Heavy smoker	527	88.8	3.2	8.0
Missing data	67	95.5	0	4.5
Binge drinking during pregnancy				
Never or occasionally	6344	94.3	1.9	3.8
More than one half of times	201	85.1	3.0	11.9
Missing data	76	90.8	1.3	7.9
Anxiety symptoms during pregnancy				
Not anxious	5627	94.7	1.8	3.5
Anxious	813	88.9	2.8	8.2
Missing data	181	95.6	1.7	2.8
Attitude toward pregnancy				
Unsure	1649	92.0	2.2	5.8
Wanted	3564	94.9	1.9	3.3
Unplanned/unwanted	1249	94.2	1.8	3.9
Missing data	159	93.1	2.5	4.4
<b>Infant factors</b>				
Birth weight, kg	6620	3.40 ± 0.51 <sup>a</sup>	3.28 ± 0.53 <sup>a</sup>	3.29 ± 0.57 <sup>a</sup>
Gender				
Female	3172	93.5	2.2	4.3
Male	3449	94.4	1.7	3.9
Gestation				
Term	6356	94.2	1.9	3.9
Preterm (<37 wk of gestation)	265	89.4	3.0	7.5
Intensive care nursery admission				
No admission	6154	94.2	1.9	3.9
Admission	464	90.9	2.4	6.7
Missing data	3	100.0	0	0
<b>Postpartum maternal behaviors/attitudes (6 mo)</b>				
Mother-infant separation				
>20 h/wk	232	89.2	3.0	7.8
5–20 h/wk	610	92.1	2.5	5.4
<4 h/wk	2495	94.0	1.8	4.2
Never	3263	94.8	1.9	3.3
Missing data	21	81.0	0	19.0

**TABLE 2 Continued**

	N	Any Substantiated Maltreatment		
		None, %	Nonmaternal, %	Maternal, %
<b>Maternal employment</b>				
Homemaker	4892	95.0	1.8	3.1
Part-time employed or self-employed	591	95.8	1.0	3.2
Full-time employed	212	92.0	3.3	4.7
Other (pension, student, or unemployed)	877	87.7	3.0	9.4
Missing data	49	91.8	0	8.2
<b>Maternal stimulation/teaching of baby</b>				
Not always	965	93.8	2.1	4.1
Always	5639	94.0	1.9	4.1
Missing data	17	100.0	0	0
<b>Positive about caring for baby</b>				
Not always	395	92.7	1.8	5.6
Mostly	3643	93.7	2.2	4.1
Always	2567	94.6	1.6	3.7
Missing data	16	100.0	0	0
<b>Depression</b>				
Not depressed	6288	94.3	1.8	3.9
Depressed	308	88.6	4.2	7.1
Missing data	25	92.0	0	8.0

<sup>a</sup> Value is mean ± SD.

**Maltreatment Reports**

In the birth cohort of 7223 children, 780 children (10.8%) were reported to child protective services because of suspected child abuse or neglect between 1981 and 2000, and 512 children (7.1%) had ≥1 substantiated maltreatment episode. Substantiated neglect was reported in 271 cases (3.8%), emotional abuse in 268 cases (3.7%), physical abuse in 286 cases (4.0%), and sexual abuse in 146 cases (2.0%).

For >60% of children with substantiated maltreatment, there was ≥1 episode of maternally perpetrated abuse or neglect (313 children; 4.3% of the birth cohort), often involving multiple types of maltreatment concurrently. Maternally-perpetrated substantiated neglect was identified in 218 cases (3%). Almost one half of the children with substantiated maltreatment had multiple substantiated episodes (241 children, with a range of 2–14 episodes per child; median: 3 episodes per child). Overall, there were 1646 episodes of substantiated maltreatment, of which almost two thirds involved the biological mother as a primary perpetrator (*n* = 1038); >40% of those episodes were of child neglect (*n* = 417) (Table 1). The biological mother was the most

frequently identified perpetrator of substantiated neglect (79% of neglect episodes), emotional abuse (69%), and physical abuse (60%), whereas the biological father was the most frequent perpetrator of sexual abuse.

**Breastfeeding and Maternal Maltreatment**

The relationships between confounding variables and substantiated maltreatment are shown in Table 2. The only variables that were not statistically associated with any maltreatment were infant gender and maternal attitudes regarding infant stimulation/teaching and caregiving. All variables except infant gender were also statistically associated with breastfeeding duration, although the strengths of those associations were modest (Spearman correlation coefficients for continuous, dichotomous, and ordinal variables, *r<sub>s</sub>* ≤ 0.2). Similarly, there were only modest correlations between potential confounding variables.

The prevalence of breastfeeding, with respect to substantiated maternal and nonmaternal maltreatment, is shown in Table 3. Forty percent of cohort children were breastfed for ≥4 months and 39% for <4 months, whereas only 21% were not breastfed at all. An inverse

**TABLE 3 Prevalence of Substantiated Maltreatment According to Breastfeeding Duration (N = 6621)**

Breastfeeding Duration	Neglect			Emotional Abuse			Physical Abuse			Any Maltreatment		
	None	Nonmaternal	Maternal	None	Nonmaternal	Maternal	None	Nonmaternal	Maternal	None	Nonmaternal	Maternal
Proportion, %												
≥4 mo ( <i>N</i> = 2616; 40%)	98.8	0.3	0.9	98.2	0.7	1.0	98.4	0.7	0.9	97.0	1.4	1.6
<4 mo ( <i>N</i> = 2584; 39%)	96.4	0.3	3.3	96.3	1.0	2.7	96.0	1.4	2.6	92.8	2.4	4.8
Not at all ( <i>N</i> = 1421; 21%)	93.6	0.7	5.7	94.5	1.2	4.3	94.7	1.8	3.6	90.6	2.3	7.2
Total ( <i>N</i> = 6621), <i>n</i>	6406	25	190	6402	61	158	6399	81	141	6223	129	269

**TABLE 4** Substantiated Maltreatment According to Breastfeeding Duration (N = 5890)

Breastfeeding Duration	Unadjusted OR (95% CI)			Adjusted OR (95% CI) <sup>a</sup>			Adjusted OR (95% CI) (Including Maltreatment Subtypes) <sup>b</sup>		
	None	Nonmaternal	Maternal	None	Nonmaternal	Maternal	None	Nonmaternal	Maternal
Any maltreatment									
≥4 mo	1.0	1.0	1.0	1.0	1.0	1.0			
<4 mo	1.0	1.8 (1.2–2.8) <sup>c</sup>	3.0 (2.1–4.4) <sup>c</sup>	1.0	1.4 (0.9–2.2)	2.2 (1.5–3.2) <sup>c</sup>			
None	1.0	1.7 (1.0–2.8) <sup>c</sup>	4.5 (3.0–6.6) <sup>c</sup>	1.0	1.1 (0.6–1.9)	2.6 (1.7–3.9) <sup>c</sup>			
Neglect									
≥4 mo	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
<4 mo	1.0	0.9 (0.3–2.6)	3.4 (2.1–5.6) <sup>c</sup>	1.0	0.8 (0.3–2.4)	2.5 (1.5–4.0) <sup>c</sup>	1.0	0.7 (0.3–2.1)	2.3 (1.3–4.2) <sup>c</sup>
None	1.0	2.3 (0.9–6.0)	6.5 (4.0–10.5) <sup>c</sup>	1.0	1.9 (0.7–5.3)	3.8 (2.3–6.2) <sup>c</sup>	1.0	1.6 (0.6–4.6)	3.8 (2.1–7.0) <sup>c</sup>
Emotional abuse									
≥4 mo	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
<4 mo	1.0	1.3 (0.7–2.5)	2.7 (1.6–4.3) <sup>c</sup>	1.0	1.1 (0.5–2.0)	1.8 (1.1–2.9) <sup>c</sup>	1.0	0.8 (0.4–1.7)	1.1 (0.5–2.0)
None	1.0	1.5 (0.7–3.2)	4.3 (2.6–7.0) <sup>c</sup>	1.0	1.0 (0.5–2.2)	2.4 (1.4–4.0) <sup>c</sup>	1.0	0.8 (0.3–1.7)	1.1 (0.5–2.5)
Physical abuse									
≥4 mo	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
<4 mo	1.0	2.1 (1.2–3.8) <sup>c</sup>	2.7 (1.7–4.4) <sup>c</sup>	1.0	1.6 (0.9–2.9)	2.0 (1.2–3.3) <sup>c</sup>	1.0	1.5 (0.8–2.8)	1.7 (0.9–3.1)
None	1.0	2.3 (1.2–4.4) <sup>c</sup>	3.7 (2.2–6.2) <sup>c</sup>	1.0	1.4 (0.7–2.7)	2.3 (1.3–3.9) <sup>c</sup>	1.0	1.1 (0.5–2.2)	1.2 (0.6–2.4)

<sup>a</sup> Values were adjusted for maternal prenatal demographic factors (age, marital status, education, race, and employment), prenatal behaviors/attitudes (cigarette consumption and binge drinking during pregnancy, anxiety, and pregnancy ambivalence), infant factors (birth weight [as a continuous variable] and gender), and 6-month postpartum maternal behaviors and attitudes (mother-infant separation, employment, maternal stimulation/teaching of baby, maternal attitude of caregiving, and postpartum depression).

<sup>b</sup> Maltreatment subtypes were adjusted for covariates listed above, as well as other types of maltreatment (neglect, emotional abuse, and/or physical abuse).

<sup>c</sup> Statistically significant results.

relationship between breastfeeding duration and maternally perpetrated maltreatment was seen. The prevalence of maternal maltreatment increased as the duration of breastfeeding decreased, for all maltreatment subtypes examined separately or in combination. Children with no substantiated maltreatment were more often breastfed for ≥4 months.

In an unadjusted analysis of data for the group of 6621 children, the odds of nonbreastfed infants being maltreated by their mothers were 4.8 times (95% CI: 3.3–6.9 times) the odds for infants who were breastfed for ≥4 months. However, the highest unadjusted OR was seen for maternal neglect (OR: 6.6 [95% CI: 4.1–10.4]).

Although breastfeeding duration also was associated with nonmaternal maltreatment (particularly physical abuse), only results for maternally perpetrated maltreatment remained significant after adjustment for confounding (Table 4). For example, for nonbreastfed children, the adjusted OR for maternally perpetrated maltreatment was 2.6 (95% CI: 1.7–3.9), compared with a value of 1.1 (95% CI: 0.6–1.9) for nonmaternal maltreatment (model  $\chi^2 = 252.8$ ,  $df = 24$ ;  $P < .001$ ). Other variables that were independently associated with maternal maltreatment included unmarried status, low maternal education, prenatal unemployment, smoking or binge drinking during pregnancy, prenatal anxiety symptoms, and mother-infant separation 6 months after delivery (Table 5).

When the risks for specific subtypes of maltreatment were examined, each was inversely associated with breastfeeding duration in unadjusted and adjusted analyses (Table 4). However, only results for maternal neglect remained significant after adjustment for maltreatment subtypes, with a nearly fourfold increase in the

odds for nonbreastfed children, compared with the odds for children who were breastfed for ≥4 months (adjusted OR: 3.8 [95% CI: 2.1–7.0]; model  $\chi^2 = 745.9$ ,  $df = 24$ ;  $P < .001$ ). The OR for maternal neglect increased as the duration of breastfeeding decreased (adjusted ORs of 1.0, 2.3, and 3.8 with breastfeeding for ≥4 months, for

**TABLE 5** Other Independent Predictors of Substantiated, Maternally Perpetrated Maltreatment (N = 5890)

Other Maltreatment Predictors	Unadjusted OR (95% CI)	Adjusted OR (95% CI) <sup>a</sup>
Any substantiated maternal maltreatment		
Unmarried	1.7 (1.5–1.9)	1.4 (1.2–1.5)
Low education	2.1 (1.7–2.6)	1.6 (1.3–2.0)
Prenatal unemployment (either partner)	3.1 (2.3–4.1)	1.6 (1.2–2.3)
Cigarette use during pregnancy	1.9 (1.6–2.2)	1.3 (1.0–1.5)
Binge drinking during pregnancy	3.6 (2.2–5.8)	1.8 (1.1–3.1)
Anxiety symptoms during pregnancy	2.5 (1.8–3.4)	1.7 (1.2–2.4)
Mother-infant separation 6 mo after delivery	1.3 (1.1–1.6)	1.2 (1.0–1.4)
Substantiated maternal neglect		
Young maternal age	2.7 (2.0–3.8)	1.7 (1.1–2.7)
Low education	2.4 (1.9–3.2)	2.0 (1.4–2.8)
Aboriginal race	2.9 (1.8–4.5)	2.6 (1.4–4.8)
Prenatal unemployment (either partner)	3.3 (2.4–4.5)	1.6 (1.0–2.5)
Binge drinking during pregnancy	3.8 (2.2–6.6)	2.4 (1.2–5.0)
Anxiety symptoms during pregnancy	2.7 (1.9–3.9)	2.0 (1.2–3.2)
Emotional abuse	14.3 (11.5–17.9)	7.7 (5.7–10.5)
Physical abuse	10.2 (8.3–12.6)	2.5 (1.8–3.5)

<sup>a</sup> Values were also adjusted for breastfeeding duration.



<4 months, and not at all, respectively). Non-maternally perpetrated neglect was not associated with breastfeeding duration. Other variables independently associated with maternal neglect included young maternal age, low education level, aboriginal race, binge drinking and anxiety during pregnancy, and other maltreatment subtypes (Table 5).

A number of confounding variables each contributed to a modest decrease in the OR between unadjusted and adjusted analyses, including marital status, maternal education, young maternal age, unemployment, cigarette smoking, and binge drinking during pregnancy, and maternal employment status 6 months after delivery. These same variables showed a confounding influence for maternal neglect, as did maternal race, infant birth weight, anxiety, depression, and mother-infant separation at 6 months.

### Sensitivity and Attrition Analyses

To determine whether temporal proximity to breastfeeding modified these findings, the multinomial regression was repeated for children maltreated at a mean age of  $\leq 5$  years. As expected, this analysis revealed an even higher OR for maltreatment for nonbreastfed children  $\leq 5$  years of age (unadjusted OR: 8.1 [95% CI: 3.9–16.7];  $> 5$  years of age: OR: 3.8 [95% CI: 2.5–5.8]) (compare with Table 4). Results for maternal neglect revealed similar differences ( $\leq 5$  years of age, unadjusted OR: 7.8 [95% CI: 3.7–16.2];  $> 5$  years of age, OR: 5.7 [95% CI: 3.2–10.1]). Similarly, the OR for maternal maltreatment was even greater for multiple versus single substantiated reports ( $> 1$  report, unadjusted OR: 5.1 [95% CI: 3.3–8.1]; single report, OR: 4.2 [95% CI: 2.3–7.6]). Exclusion of siblings from the data set also strengthened the association between breastfeeding duration and maternal maltreatment, specifically child neglect ( $n = 5440$ ; adjusted OR, with adjustment also for maltreatment subtypes: 4.6 [95% CI: 2.4–9.0]).

At a 14-year study follow-up assessment, 238 families (3.6% of the study group) reported living outside the state of Queensland, which might have influenced the number of reported maltreatment cases from the state-based registry. Therefore, analyses were repeated for the families confirmed to be living within the state at that time ( $n = 5723$ ;  $n = 5088$  in adjusted analyses). This yielded modest decreases in ORs for most comparisons but no loss of statistical significance. For example, the OR for maternal neglect for nonbreastfed children was 3.3 (95% CI: 1.7–6.4) after adjustment for confounders (including maltreatment subtypes).

These sensitivity analyses revealed that the association between breastfeeding duration and maternal maltreatment remained statistically significant and was strengthened when data for younger children or children with multiple substantiated reports were examined. Furthermore, the association remained statistically significant after exclusion of siblings or families that moved out of state during the study period.

Finally, our results would be biased if the observed associations between breastfeeding and maltreatment were nonexistent or in the opposite direction for mothers who

were excluded because of missing data. However, the attrition analysis<sup>26</sup> found no difference between weighted and unweighted results, which suggests that attrition was unlikely to have biased our findings substantively.

## DISCUSSION

### Overall Findings

This study is the first to examine the relationship between breastfeeding duration and subsequent child maltreatment, using a large Australian birth cohort monitored prospectively over 15 years. We clearly demonstrated that lack of breastfeeding increased substantially the odds of maternal (but not nonmaternal) maltreatment, specifically child neglect. After adjustment for multiple confounders, there was a nearly fourfold increase in the odds of maternal neglect for nonbreastfed children, compared with children who were breastfed for  $\geq 4$  months. These findings suggest that breastfeeding may play a protective role in helping to prevent maternal neglect. With high incidence rates of maternally perpetrated maltreatment reported in the United States,<sup>1</sup> this study is also the first to confirm these data in an Australian sample of children. In both countries,  $> 60\%$  of substantiated maltreatment cases involved maternal perpetration.

### Possible Mechanisms

In lactating animals, suckling results in peripheral and central production of the neuromodulatory hormone oxytocin.<sup>27</sup> Oxytocin is released into the peripheral circulation from the posterior pituitary gland and also is produced by neurons of the hypothalamic paraventricular nucleus, which project to numerous brain regions involved in maternal behavior. It has a broad range of central effects that were characterized in both animal and human studies as the “calm and connection” response of the parasympathetic nervous system, balancing the sympathetically driven “fight or flight” response.<sup>27,28</sup> In addition to its well-known effects on the initiation of labor and lactation, oxytocin helps to prepare the central nervous system for the long-term endeavor of child rearing. During pregnancy and the peripartum period, oxytocin receptors are induced in many brain regions involved in maternal behavior,<sup>29</sup> and there is some evidence that suckling and infant-related stimulation may help to maintain these receptors.<sup>29,30</sup> Oxytocin plays an essential role in the onset of maternal behavior in both rat and sheep models<sup>31,32</sup> and results in selective bonding between ewes and their newborn lambs.<sup>32</sup> It seems to enhance 2 forms of memory and learning, namely, spatial memory in the hippocampus<sup>33</sup> and social memory in the amygdala,<sup>34,35</sup> both of which may result in enduring differences in maternal care.<sup>33</sup> In randomized, placebo-controlled, human trials, oxytocin (administered intranasally to facilitate central absorption) resulted in increased trust<sup>36</sup> and increased accuracy in assessing facial affect<sup>37</sup> but decreased anxiety<sup>38</sup> and reduced fear-related brain responses during functional MRI assessments.<sup>39</sup> In rat functional MRI studies, both oxytocin and suckling activated similar brain regions involved in maternal behavior.<sup>40</sup> Suckling also activates

dopamine-associated, reward-processing regions (even more so than intraventricular cocaine treatment in lactating rat dams),<sup>41</sup> which may result in a long-term conditioned preference. This may help to explain the apparent long-lasting association between breastfeeding and maternal care.<sup>17</sup> Similar results have been seen in the brain responses of human mothers to their own infant's facial expressions.<sup>42</sup> Therefore, as suggested by animal and human studies, a plausible physiological mechanism exists through which breastfeeding may result in an altered pattern of mother-child bonding, potentially reducing the risk of child neglect.

An alternative explanation for this association may be that a preexisting but unmeasured maternal characteristic is associated with both exposure and outcome variables. For example, women who decide to breastfeed may be more sensitive to their child's physical or emotional needs and thus less likely to be reported for child neglect. Britton et al<sup>22</sup> showed that maternal sensitivity to infant cues predicted breastfeeding duration during the first year of life, but not vice versa. Furthermore, impaired maternal sensitivity has been associated with parental abuse and neglect,<sup>9</sup> which suggests that it may at least partially confound the association between breastfeeding and maltreatment. Although maternal sensitivity was not directly measured in this study, the association between breastfeeding and neglect was adjusted for self-report measures of maternal caring and responsiveness, pregnancy ambivalence, and postpartum depression, none of which remained significant in the final regression model. With data from several animal studies suggesting that oxytocin receptor binding may be epigenetically programmed from early childhood,<sup>43-45</sup> a mother's own childhood attachment experience may well influence both maternal sensitivity and the likelihood of breastfeeding success (and thus the risk for neglectful parenting).

### Limitations

It should be noted that the interpretation of these results is limited by the definitions of both exposure and outcome variables. First, the breastfeeding variable did not distinguish full from partial breastfeeding (ie, supplementing breastfeeding with infant formula or solid foods). However, because exclusive breastfeeding has been associated with greater maternal sensitivity, compared with partial breastfeeding,<sup>22</sup> this distinction might have strengthened the observed associations. In addition, if direct mother-infant contact is an important factor linking breastfeeding with reduced risk of neglect, then breastfeeding needs to be defined in terms of how frequently the infant is fed from the mother's breast, as opposed to receiving expressed breast milk from an alternate caregiver. Although this information was not directly available, only a small proportion of mothers were separated from their infants for >4 hours per week (13%) (Table 2), which suggests that this factor did not affect study findings substantially. With >50% of married mothers with infants <1 year of age participating in the workforce today,<sup>46</sup> future studies certainly should make this distinction.

The fact that all exposure and confounding variables were self-report measures is another source of potential bias. Although the outcome variables were obtained from independent maltreatment reports, the definitions of maltreatment were limited to those used by the government child protection agency. Other investigators showed that important discrepancies exist between state-reported maltreatment data, self-report measures, and observed maternal behavior.<sup>47</sup> Although reports of suspected maltreatment were substantiated in formal investigations, socioeconomic, ethnic, or other factors might have biased the selection of cases. Neglect reports, for example, might have been skewed toward physical neglect, which is associated with socioeconomic disadvantage, compared with emotional neglect, which may occur more frequently in families with higher socioeconomic status but not come to the attention of child protection authorities.<sup>48</sup> Finally, grouping unsubstantiated maltreatment with no maltreatment also might have biased the results, although most likely weakening true associations.

Although cohort studies are inherently limited in their ability to allow causal inferences, a randomized, controlled trial of breastfeeding and neglect would be neither feasible nor ethical, especially given our current state of knowledge regarding the positive benefits of breastfeeding.<sup>49,50</sup> However, randomized, controlled trials of breastfeeding promotion strategies, such as the Baby-Friendly Hospital Initiative,<sup>49</sup> prenatal breastfeeding education, and postnatal support,<sup>51</sup> have demonstrated substantial increases in breastfeeding duration and exclusivity during the first 6 to 12 months of life. Examination of maltreatment reports or patterns of mother-infant interactions would be a logical extension of these studies, although any evidence of causality would still be indirect and could not distinguish between the effects of breastfeeding and the intervention itself. Additional cohort studies in different settings, with more stringently defined variables and adjustment for maternal sensitivity, may be warranted in the future.

### Implications

Each year in the United States, ~900 000 children become victims of child maltreatment (12 cases per 1000 children), with almost 60% reported as a result of child neglect.<sup>1</sup> Comparable rates of maltreatment (14 cases per 1000 children)<sup>52</sup> have been reported in Queensland, Australia, where this study originated. Maternally perpetrated maltreatment was noted in ~60% of substantiated cases, both in this study and in US data,<sup>1</sup> with the child's biological mother (who is most often the primary caregiver) being involved in almost 8 of 10 substantiated neglect episodes.

Crittenden<sup>48</sup> argued that the most basic etiologic factor underlying child neglect may be an impaired ability to form interpersonal relationships, which may help to explain observed associations between child neglect and teenage pregnancy, unemployment, substance abuse, and anxiety symptoms. Breastfeeding, in addition to its other beneficial effects on maternal and child health,<sup>50</sup> may be an important means of "training" a new mother in how to form a secure interpersonal relationship with her new infant, as has been the case with adoptive mothers who

establish breastfeeding.<sup>53</sup> Breastfeeding on demand, as recommended in the Baby-Friendly Hospital Initiative,<sup>49</sup> may particularly help mothers establish closer relationships with their infants, through responsive bidirectional touch, eye-to-eye gaze, and the physiological responses related to oxytocin and prolactin release.

Breastfeeding rates seen in this study (Table 3), consistent with another Australian study from the same time period,<sup>54</sup> were much higher than rates reported in the United States at that time.<sup>55</sup> In 1988, only 53% of new mothers in the United States initiated breastfeeding, compared with 80% in Australia, and only 25% were breastfeeding their infants >9 weeks after delivery. Although any link between breastfeeding and maltreatment might be attenuated in countries with lower breastfeeding rates, current breastfeeding initiation rates in the United States (74% of new mothers<sup>56</sup>) are more comparable to the rates for this Australian sample. However, only 42% of mothers in the United States are still breastfeeding by 6 months and only 11% are breastfeeding exclusively,<sup>56</sup> as recommended by the American Academy of Pediatrics.<sup>57</sup> With breastfeeding rates being lowest among those at highest risk for maltreatment (eg, unmarried women with low levels of education<sup>56</sup>) (Table 5), this study provides additional evidence to support the active promotion of breastfeeding. Despite endorsement by the World Health Organization, United Nations Children's Fund, and the American Academy of Pediatrics, <2% of US birthing hospitals are currently accredited as "baby friendly," with rates being 10 times higher in Australia.<sup>58</sup>

## CONCLUSIONS

Although it is abundantly clear that breastfeeding duration is only one of many factors associated with maternal abuse and neglect, this study provides new evidence for a possible protective effect. Although there is no single solution to the problem of child abuse and neglect, promoting breastfeeding may be a relatively simple and cost-effective additional means of strengthening the relationship between a mother and her child. This overarching goal would be best accomplished by promoting parent education and long-term marital stability and by providing economic and social support for new mothers who choose to stay at home with their infants. Together, these factors not only may increase the duration of breastfeeding but also may ultimately help protect against maternally perpetrated child abuse and neglect.

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## Does Breastfeeding Protect Against Substantiated Child Abuse and Neglect? A 15-Year Cohort Study

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