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Association between Breastfeeding and Severity of Acute Viral Respiratory Tract Infection

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Abstract

In a cross-sectional analysis of 629 mother-infants dyads, breastfeeding (ever vs. never) was associated with a decreased relative odds of a lower versus upper respiratory tract infection (AOR: 0.64; 95% CI: 0.42, 0.99). There was not a significant association between breastfeeding and bronchiolitis severity score or length of hospital stay.

Keywords

breastfeeding; acute respiratory infection severity; upper respiratory tract infection; lower respiratory tract infection

INTRODUCTION

Acute viral respiratory infections (ARIs) are a leading cause of infant morbidity.⁽¹⁾ Although viral upper respiratory tract infections (URIs) are common in infancy, currently, there are no effective vaccines to prevent the most common viral etiologies of ARIs, such as respiratory syncytial virus (RSV).⁽²⁾ Viral lower respiratory tract infections (LRTIs) are a leading cause

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of hospitalizations during infancy in the US^(2, 3) and are associated with subsequent wheeze and asthma.⁽³⁾

Breastfeeding is a protective factor for ARI.^(4, 5) Exclusive breastfeeding has been associated with decreased risk of ARI,⁽⁴⁻⁷⁾ however findings have been less consistent regarding partial breastfeeding.^(4, 6, 7) Our objective was to assess the association between history of breastfeeding (ever vs. never) and ARI severity in a cohort of 629 mother-infant dyads enrolled in the Tennessee Children's Research Initiative (TCRI).

METHODS

We investigated the association between history of breastfeeding and infant ARI severity, as measured by involvement of the lower respiratory tract and bronchiolitis severity score, using a cross-sectional analysis of data from the TCRI cohort.⁽⁸⁾ Briefly, TCRI is a prospective study of mother-infant dyads designed to assess the association between infant ARI and childhood asthma.⁽⁸⁾ Participants were recruited from September through May 2004-2008 during an acute visit (ambulatory or inpatient) for a URI or LRTI. Term infants without chronic medical conditions were eligible, with oversampling for hospitalized infants.⁽⁸⁾ At enrollment, trained research personnel administered a structured questionnaire to collect data on infant feeding, socio-demographics, medical history, environmental exposures, and family history. Informed consent was obtained from the women. The Vanderbilt University Institutional Review Board approved the study.

Infants were classified as having a URI or LRTI based on physician discharge diagnosis and chart review, with LRTI considered as more severe.⁽⁸⁾ Symptoms indicative of a URI included fever, cough, congestion, hoarse cry, otitis media, and/or rhinorrhea without lower respiratory symptoms. Infants with a LRTI had symptoms including grunting, nasal flaring, and/or chest wall retractions, diffuse wheezing, rales, or rhonchi. LRTI severity was assessed using the ordinal bronchiolitis severity score (BSS) and length of stay (LOS) for hospitalized infants. The BSS ranges from 0-12 (12 most severe) and scores (0-3) flaring/retraction, respiratory rate, wheezing, and oxygen saturation.⁽⁸⁾ Length of hospital stay was measured in days.⁽⁸⁾ Viral testing for RSV and other viruses was conducted on infant nasopharyngeal specimens obtained at enrollment using RT-PCR.⁽⁸⁾

We obtained infant breastfeeding history using the questions, "was your child ever breastfed?" and "If yes, for how long? (specify in weeks)" Responses were dichotomized as "ever" and "never" breastfed. "Ever breastfed" was categorized by a history of any breastfeeding and the minimum duration recorded was one week. We derived current breastfeeding by report of breastfeeding with length reported as current. We a priori selected covariates based on association with breastfeeding and ARI severity,^(9, 10) including: maternal factors (ethnicity/race, age, asthma, enrollment year) and infant factors (estimated gestational age, birth weight, age at enrollment, insurance, daycare attendance, secondhand smoke exposure, and siblings).

Univariate analyses compared breastfeeding and ARI severity using Pearson χ^2 tests for categorical variables and Wilcoxon rank sum tests for continuous variables. We used

multivariable regression models to investigate the association of breastfeeding with ARI severity. When our regression sample size was small for the number of adjustment covariates in subset analyses, we used propensity score adjustment method.⁽¹¹⁾ We estimated the relative odds of LRTI versus URI in infants with a history of breastfeeding compared to those who were never breastfed using multivariable logistic regression. In a sub-analysis, we assessed the association between current breastfeeding and relative odds of LRTI versus URI. In the LRTI subset, we assessed the association between breastfeeding and BSS (ordinal dependent variable) using the proportional odds model. Finally, we used multivariable linear regression to evaluate the association of breastfeeding and BSS and LOS in hospitalized infants using log transformed LOS. Multivariable regression models were controlled for maternal factors (age, asthma, ethnicity/race, enrollment year) and infant gender, estimated gestational age (EGA), birth weight, age, daycare attendance, insurance, secondhand smoke exposure (SHS), and sibling number. To potentially relate to RSV, we further assessed the association between breastfeeding and BSS among LRTI infants with RSV positivity. All analyses were performed using R version 2.15.2 software.

RESULTS

Overall 629 infants were included; median infant EGA was 39 weeks and age at enrollment was 12 weeks (Table 1). Fifty-seven percent had a history of breastfeeding. The median duration for breastfed infants was 6 weeks (interquartile range 3-10). In univariate comparisons, women who breastfed were older (median 26 versus 23 years, $p<0.001$) and less likely to be African-American (16% versus 31%). Breastfed infants were more likely to have private insurance (32% versus 17%), higher median birth weight (3,345 versus 3,232 grams $p=0.002$), and lower SHS (47% vs. 66%, $p<0.001$) compared to never breastfed infants (Table 1). Seventy-two percent of infants in the study had a LRTI ($n=455$). Compared to infants with a URI, infants with LRTI were younger (median age 11 vs. 23 weeks, $p<0.001$), had older mothers (median 26 vs. 23 years, $p<0.001$), higher median gestational age (39 [38, 40] vs. 39 [39, 40], $p<0.001$) and sibling number (1[1,2] vs. 1[0,2], $p<0.001$) distributions, were less likely to have an African-American mother (19% vs. 33%) and more likely to have private insurance (31% vs. 11%).

In univariate analysis, the proportion of LRTI diagnoses was not statistically different in those with a history of breastfeeding compared to those never breastfed, (70% vs. 76%, $p=0.087$) respectively. In multivariable analyses, infants who were breastfed had a 36% decreased relative odds of having a LRTI than a URI (adjusted OR 0.64; 95% CI: 0.42, 0.99) compared to infants who were never breastfed. There were 140 infants who were currently breastfed. The relative adjusted odds of LRTI versus URI by current breastfeeding was 0.69 (95% CI: 0.41-1.15). In the subset of infants with a LRTI, approximately 55% had a history of breastfeeding. The BSS was not significantly different by history of breastfeeding (median BSS ever 6 [4,8.5] versus never 6.5 [4,9.0], $p=0.14$); in multivariable analysis, there was not a significant association between breastfeeding and BSS (adjusted OR 0.97, 95% CI: 0.69-1.39). Eighty-six percent of infants diagnosed with a LRTI were hospitalized. In univariate analyses, infants with a history of breastfeeding did not differ in their LOS compared to those who were never breastfed but trended toward a lower BSS distribution (Table 1). In adjusted analyses, there was not a statistically significant

association between breastfeeding history and BSS (adjusted OR: 0.79; 95% CI: 0.54, 1.16) or LOS (Beta coefficient: -0.12 ; 95% CI: $-0.27, 0.03$). In analysis of the RSV LRTI subset, we did not detect a statistically significant association between breastfeeding and BSS or LOS (data not shown).

DISCUSSION

Breastfeeding is the ideal form of infant nutrition and has protective effects on infant respiratory health,⁽⁴⁻⁷⁾ although findings regarding partial breastfeeding have been less consistent.^(4, 6, 7) In our cross-sectional study of mother-infant dyads, we found that infants with a history of breastfeeding compared to those who were never breastfed had a 36% decreased relative odds of having a lower versus upper respiratory tract infection (adjusted OR 0.64; 95% CI: 0.42, 0.99).

Studies have shown that exclusive breastfeeding is protective against LRTI⁽⁷⁾ and LRTI hospitalization,^(4, 6) but results regarding partial breastfeeding yielded weaker associations.⁽⁶⁾ We investigated the association of a history of breastfeeding that included a minimal duration of one week vs. infants who were not breastfed and found a protective association between breastfeeding and LRTI versus URI. The association between current breastfeeding and LRTI vs. URI was similar although not statistically significant, possibly due to smaller number of current breastfeeders and the heterogeneous comparison group. In our subset of children hospitalized with LRTI, we did not detect a statistically significant relationship between breastfeeding and LOS or BSS. Our findings may be impacted by cohort recruitment and composition which included a high prevalence of severe disease; therefore a study with a greater spectrum of disease severity might detect differences by breastfeeding.

There are limitations to consider. We did not capture breastfeeding exclusivity and due to the cross-sectional nature of the study we were not able to study the longitudinal association between breastfeeding duration and ARI severity. Previous studies have found a potential differential protective effect of breastfeeding on ARI by infant gender,⁽¹²⁾ however due to limited power, we did not include interactions. There was an overrepresentation of infants with LRTI and a large proportion with severe disease, which might limit generalizability. Our study population may be disproportionately of lower socioeconomic status (SES), however, women of lower SES are at risk for lower breastfeeding duration and less exclusivity,⁽⁷⁾ so this population is important to study. Although we controlled for potential confounders, there may be unmeasured factors that affect the relationships studied.

We conclude that breastfeeding with a minimal duration of one week was associated with a decreased relative odds of having a LRTI versus a URI. Exclusive breastfeeding is the recommended feeding method within the first 6 months; but partial breastfeeding may provide some protection from LRTI.

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Table 1
Characteristics of mother-infant dyads enrolled in the Tennessee Children's Research Initiative by breastfeeding history, 2004-2008

Characteristic	Never Breastfed (N =273) n (%)	Ever Breastfed (N= 356) n (%)
Maternal age *	23[20,28]	26[22,31]
Maternal race		
White	166 (61)	209 (59)
Black	84 (31)	58 (16)
Hispanic	20 (7)	66 (19)
Other	2 (1)	23 (6)
Maternal asthma		
Yes	53 (19)	69 (19)
Smoke exposure		
Yes	178 (66)	167 (47)
Insurance type		
Private	46 (17)	115 (32)
Medicaid	215 (79)	212 (60)
None	12 (4)	29 (8)
Gestational age *	39 [38,40]	39 [38,40]
Birth weight (g) *	3232[2948,3544]	3345[3062,3685]
Infant sex		
Female	124 (45)	153 (43)
Male	149 (55)	203 (57)
Infant age (weeks)	11 [6,26]	13 [6,28]
Daycare attendance		
Yes	69 (25)	84 (24)
Siblings in home *	1 [1,2]	1 [0.75, 2]
ARI type		
LRTI	207 (76)	248 (70)
URI	66 (24)	108 (30)
Bronchiolitis Severity Score *	5 [2,8]	4 [1,7.5]
Length of Stay (for hospitalized, n=423) *	3 [2,5]	2 [2,4]
Infants hospitalized with LRTI (n=392)		
Bronchiolitis Severity Score *	7 [5,9]	7 [4.5,8.5]
Length of Stay *	3 [2,5]	3 [2,4]

* values reported contain the median and interquartile ranges for continuous variables

p<0.05