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Association of Severe Acute Respiratory Syndrome Coronavirus 2 Infection With Early Breastfeeding

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Abstract

Objective: The association of maternal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) status before delivery with breastfeeding is unknown. This study compares breastfeeding initiation, exclusivity, and duration between SARS-CoV-2-positive (+) and SARS-CoV-2-negative (-) mothers during the first 2 months of their newborns' lives.

Methods: A single center, retrospective cohort study of pediatric contacts during the first 2 months in a diverse mother-infant population (n = 285) compared breastfeeding outcomes by maternal SARS-CoV-2 status during a pandemic surge. Infants of SARS-CoV-2 positive mothers were also tested before discharge. Comparison of maternal demographics (age, race, ethnicity), maternal/infant characteristics (parity, insurance, delivery mode, infant sex, hospital length of stay), and pediatric contacts by maternal SARS-CoV-2 status included Fisher's exact and Wilcoxon tests and Poisson regression for count outcomes. Logistic regression compared breastfeeding outcomes between the 2 groups, adjusting for potential confounders and effect modifiers.

Results: Maternal demographics and maternal/infant characteristics were similar. While 19% of mothers tested positive for SARS-CoV-2 (n = 54), their infants were all negative. SARS-CoV-2 positive mothers had fewer in-person, but more virtual pediatric contacts. After controlling for the above variables, SARS-CoV-2 positive mothers had lower odds of breastfeeding initiation within 1 to 7 days of life (78% vs 88%; adjusted odds ratio [aOR] = 0.40, 95% confidence interval [CI]: 0.17, 0.96) and of *any* breastfeeding during month 2 (54% vs 76%; aOR = 0.37, 95% CI: 0.16, 0.86) compared with SARS-CoV-2 negative mothers.

Conclusions: Maternal SARS-CoV-2 positivity at delivery was independently associated with less initiation and shorter duration of any breastfeeding during month 2. SARS-CoV-2 positive women would likely benefit from additional breastfeeding support during pandemic surges.

Keywords: breastfeeding duration; breastfeeding exclusivity; coronavirus disease 2019; pandemic; severe acute respiratory syndrome coronavirus 2

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What's New

Mothers positive for severe acute respiratory syndrome coronavirus 2 before delivery were significantly less likely to initiate breastfeeding and less likely to be breastfeeding through month 2. They appear to require further breastfeeding education and support beyond just additional virtual pediatric contacts, during pandemic surges.

Breastfeeding confers profound advantages to children[1–5] and their mothers,[4,6,7] but suboptimal rates have prompted inclusion of goals aimed at improving breastfeeding duration in Healthy People 2030.[8] Certain demographic characteristics are associated with less breastfeeding: lower rates in Black as compared with White populations and those with Medicaid.[9,10] Shorter postpartum hospital stays also were associated with earlier breastfeeding termination.[11] In contrast, multiparous mothers and women who deliver vaginally are more likely to initiate and maintain breastfeeding,[12,13] including exclusivity compared with their primiparous and caesarian counterparts, respectively.[14] In addition, breastfeeding support at well-baby visits and increased healthcare utilization were associated with improvement in initiation, duration, and exclusivity.[15,16]

The coronavirus disease 2019 (COVID-19) pandemic created unique challenges for health care providers and patients. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is known to cause complications in multiple body systems.[17–19] It is plausible that SARS-CoV-2 positivity might also be associated with breastfeeding. In response, initial guidance from the American Academy of Pediatrics (AAP) in April 2020, suggested that SARS-

CoV-2-positive mothers should probably not directly breastfeed. Subsequent guidance published by the AAP in September of the same year suggested that SARS-CoV-2-positive mothers could still breastfeed and/or provide expressed milk with precautions—including masking.[20,21]

There are no data looking at the independent association of a maternal SARS-CoV-2 infection with breastfeeding. Due to caution about virus transmission, earlier postpartum discharge was being recommended during the pandemic. Reductions in lengths of stay can lead to unreadiness at postpartum discharge[22] and prevent women from receiving adequate lactation support during their hospital stay, contributing to premature termination of breastfeeding.[11] Due to the COVID-19 pandemic, telehealth now serves as a crucial social distancing tool that enables patients to receive safe and timely clinical care without risk of disease exposure.[23] The Centers for Disease Contol and Prevention (CDC) reported a 154% increase in telehealth visits during the last week of March 2020, compared with the same period in 2019.[24] The rapid implementation of telehealth services has been essential in maintaining prenatal and postpartum care for vulnerable women during times of uncertainty.[23,25–27] Telehealth services have shown early success, as virtual baby cafés and prenatal classes have been viewed positively by mothers, as they foster community learning.[27] Telelactation services also have been successfully implemented with a rural underserved population.[28]

The compounding effects of early discharge and limited in-person visits postdischarge also create a need for expanded telehealth services, including virtual lactation support.[1] Given our hypothesis that SARS-CoV-2+ mothers were less likely to breastfeed, the study objective was to compare breastfeeding initiation, exclusivity, and duration between SARS-CoV-2+ and SARS-CoV-2- mothers during the first 2 months of their newborns' lives in the midst of a pandemic surge.

METHODS

In this retrospective cohort study in a large New York health system, a diverse mother-infant dyad population presenting for initial ambulatory postpartum visits from April 7, 2020 (initiation of universal maternal SARS-CoV-2 screening at delivery within our health system) through June 30, 2020, was screened for study eligibility. Our hospital earned the prestigious Baby-Friendly designation from Baby-Friendly USA in July 2019, more than 6 months prior to the onset of the pandemic. During this study period, mothers, including SARS-CoV-2 positive mothers, were not separated from their newborn in the nursery, and mothers were always encouraged to breastfeed with their masks on. If too sick, mothers were instructed to pump and another person provided that milk to the infants. The duration of data collection was based on feasibility considerations during pandemic onset; thus, sample sizes were not based on a priori power calculations. Inclusion criteria were full-term singleton newborns, with postpartum lengths of stay ≤1 week, and mothers with no medical conditions that could affect breastfeeding. Mother-infant dyads were compared based on maternal SARS-CoV-2 positive or negative nasopharyngeal polymerase chain reaction test results. Infants of SARS-CoV-2+ mothers were tested before postpartum discharge.

Northwell Health Institutional Review Board approved the study, including a waiver of consent. Confidentiality of data was ensured by removing personal identifiers and by assigning subject IDs to each mother-infant dyad.

Beginning with the first ambulatory visit, each documented pediatric contact (eg, in-person visit, telephone call, telehealth visit) within the first 90 days of life was reviewed. Pediatric contacts included both in-person and virtual contacts. In-person contacts included both in-person lactation support and nonlactation support visits. Virtual contacts encompassed telehealth, telelactation, and telephone contacts. Telehealth contacts were defined as well-being or acute appointments conducted via 2-way audiovisual technology, telelactation contacts were defined as specific lactation consultations via 2-way audiovisual technology, and telephone contacts were defined as conversations via audio only. We selected 90 days to cover the period inclusive of the 1- and 2-month well-baby visit schedule, accounting for a minimum 2-week window in timing for each of these routine visits. We therefore defined days 1 to 45 as month 1 and days 46 to 90 as month 2 to allow scheduling variability due to the pandemic surge. Maternal demographics (age, self-identified race, self-identified ethnicity, parity, insurance type), delivery characteristics (gestational age, delivery mode, infant sex, birth and discharge dates/times, lengths of hospital stay), and feeding status (breastfeeding only, breastfeeding and formula, formula only, nonspecific feeding language only, or missing) were collected. "Nonspecific feeding language" was defined as any documentation in the patient chart of newborn nutrition, feeding, or feeding practices that did not specifically state the use of breastfeeding only, breastfeeding and formula, and/or formula. Lengths of postpartum hospital stay were defined as the difference between date and time of birth and date and time of discharge. Maternal age was defined as the difference between maternal date of birth and infant date of birth. Maternal insurance type categories included Medicaid, private/commercial, self-pay, or other.

We defined 5 breastfeeding outcome variables. Breastfeeding initiation was defined as breastfeeding within the first 1 to 7 days of life, specifically as recorded at the first pediatric visit. Then, dividing into months 1 and 2 as described above, exclusivity was *only* breastfeeding (ie, no formula supplementation or use) during subsequent contacts, while duration was the continuation of *any* breast milk beyond the first 7 days of life. For the small number of contacts where infant feeding was recorded as "nonspecific feeding language" (124 of 1697 [7%] contacts), we imputed the type of breastfeeding based on the prior and subsequent contacts. For example, if an infant was fed "formula only" at days 5 and 14 and the electronic health record stated "continue current feeding schedule"

at day 12, then the feeding type at day 12 was classified as "formula only." When "nonspecific feeding language" was the last contact, we imputed the type of feeding that occurred from the previous contact. In all other situations, we conservatively noted the contact to be missing.

Descriptive statistics were produced for the full cohort and by maternal SARS-CoV-2 status. Differences between SARS-CoV-2+ and SARS-CoV-2- mothers were evaluated using chi-square tests for categorical variables and Wilcoxon tests for continuous variables (except for maternal age where a 2-sample *t* test was used). Count data (ie, pediatric contact predictors) were analyzed using Poisson regression (with either Pearson scale adjustment or negative binomial regression used to address issues of overdispersion, or zero-adjusted Poisson models to address excess zeros in the data).

Associations of breastfeeding initiation, exclusivity, and duration with maternal SARS-CoV-2 status were assessed using Wald tests from logistic regression models and summarized as the odds ratio (OR) with associated 95% confidence intervals (CI). The same approach was taken to characterize the associations between breastfeeding outcomes and maternal demographics, maternal/infant characteristics and pediatric contacts. Multivariable logistic analyses were conducted to assess the independent contribution of maternal SARS-CoV-2 status to explain breastfeeding initiation, exclusivity and duration, while controlling for delivery characteristics, maternal demographics, and pediatric contacts. We included factors that were identified in the bivariate analyses as being statistically significant ($P < .05$) from the demographic and maternal/infant characteristics. Our model-building strategy also incorporated factors with published breastfeeding associations (race, ethnicity, parity, insurance, delivery mode, and length of stay),[9,12–14,22,29–32] regardless of whether their associations were statistically significant in our study sample. Although recent guidelines have suggested analyzing race and ethnicity as one construct[33,34] the literature suggests that race and ethnicity may be independent predictors of breastfeeding[35] and were collected and analyzed as such in our study. We also investigated the association of healthcare utilization on the relationship between SARS-CoV-2 status and breastfeeding outcomes by running separate multivariable models for 3 pediatric contacts: total contacts, in-person contacts, and virtual contacts, seeking to explore the independent contribution of SARS-CoV-2 status after accounting for the separate effects of pediatric contacts that could influence breastfeeding outcomes. We performed separate models because of the correlation between the 3 predictors (ie, total contacts is the sum of the in-person and virtual contacts). Recognizing that potential for collinearity between SARS-CoV-2 status and in-person and virtual contacts, we calculated the biserial correlation coefficients for SARS-CoV-2 status and virtual contacts (which had the greatest degree of association). We analyzed observed cases and did not impute for missingness. We did not adjust for multiplicity; thus adjusted ORs and 95% CIs are provided, so that clinical interpretation as well as statistical significance can be considered. SAS 9.4 (SAS Institute Inc., Cary, NC) was used to conduct statistical analyses.

RESULTS

STUDY POPULATION

Of the 361 mother-infant dyads assessed for eligibility, 285 (79%) were included in our analysis (Figure). Premature births accounted for 49% of those excluded. Overall, about one fifth of mothers were SARS-CoV-2 positive (n = 54, 19%); all of their infants tested negative before discharge.

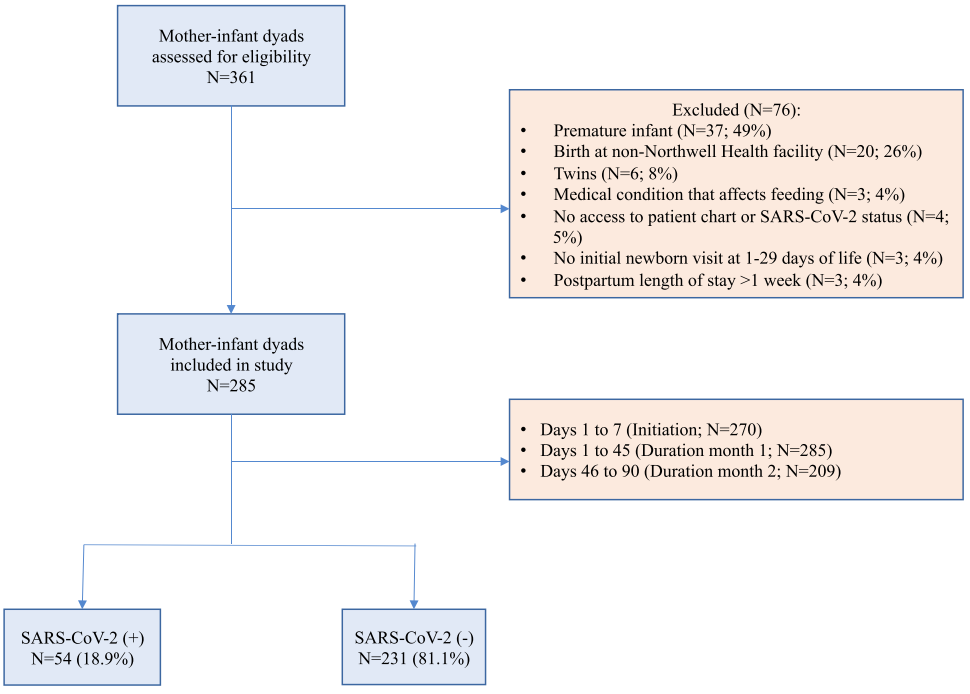

Figure. *Consort diagram of study population.*

MATERNAL DEMOGRAPHICS, MATERNAL/INFANT CHARACTERISTICS, AND PEDIATRIC CONTACTS

Maternal demographics and maternal/infant characteristics were not significantly different between SARS-CoV-2+ vs SARS-CoV-2- mothers (Table 1). Delivery characteristics also were not statistically different, including lengths of stay: median 38.8 hours versus 40.9 hours in SARS-CoV-2+ and SARS-CoV-2- mothers, respectively. In addition, while the overall number of total contacts were similar between the 2 groups, there were significantly fewer in-person contacts (mean 3.7 vs 4.4, relative risk = 1.16, 95% CI: 1.01, 1.33) and more virtual contacts (mean 2.2 vs 1.2, relative risk = 0.53, 95% CI: 0.41, 0.68) among SARS-CoV-2+ compared with SARS-CoV-2- mothers, respectively. The types of virtual contacts notably varied, with the mean numbers of telehealth and telelactation contacts being significantly higher among SARS-CoV-2+ mothers; in contrast, the mean number of telephone contacts was similar between the 2 groups.

BIVARIATE ASSOCIATIONS BETWEEN BREASTFEEDING OUTCOMES AND SARS-COV-2 STATUS

Fewer SARS-CoV-2+ mothers initiated breastfeeding in the first 7 days of life (78%) compared with SARS-CoV-2- mothers (88%) (Table 2). Although the proportion of mothers with SARS-CoV-2 infection who breastfed was less than the proportion of mothers without SARS-CoV-2 for all 5 breastfeeding outcomes, only breastfeeding duration during month 2 (ie, 54% SARS-CoV-2+ vs 76% SARS-CoV-2-) was statistically significant (OR = 0.38, 95% CI: 0.18, 0.79). Similar proportions of SARS-CoV-2+ and SARS-CoV-2- dyads were breastfeeding during month 1, but nearly twice as many SARS-CoV-2- mothers reported exclusivity compared with SARS-CoV-2+ mothers (29% vs 15%, respectively; OR = 0.44, 95% CI: 0.19, 1.04). This association was less apparent during month 2, with 23% of SARS-CoV-2- mothers reporting exclusive breastfeeding vs 14% of SARS-CoV-2+ mothers (OR = 0.56, 95% CI: 0.20, 1.55).

BIVARIATE ASSOCIATIONS BETWEEN BREASTFEEDING OUTCOMES AND MATERNAL DEMOGRAPHIC AND DELIVERY CHARACTERISTICS

To assess the degree to which known predictors of breastfeeding outcomes in the literature were significant in our sample, we explored bivariate relationships of demographic and delivery characteristics on breastfeeding outcomes (data analyses available upon request). Race was a significant predictor of initiation during the first 7 days of life ($P = .04$), potentially driven by the differences between White mothers and their Black counterparts (OR = 0.29, 95% CI: 0.06, 1.13) as well as between White mothers and their multiracial counterparts (OR = 0.25, 95% CI: 0.05, 1.16). Ethnicity was a significant predictor of initiation as Hispanic mothers were 56% less likely to initiate breastfeeding than non-Hispanic counterparts (OR = 0.44, 95% CI: 0.02, 0.98). Regarding delivery characteristics, women with a C-section were 53% less likely to breastfeed by month 2 compared with a vaginal delivery (OR = 0.47, 95% CI: 0.25, 0.91). Length of postpartum stay was associated with exclusivity; each additional 12-hour period spent in the hospital counterintuitively decreased the odds of breastfeeding in month 1 by 24% (OR = 0.76, 95% CI: 0.58, 0.998). In addition, in-person contacts were associated with greater initiation of breastfeeding (OR = 4.63, 95% CI: 2.02, 10.60), while the number of virtual contacts was not associated with initiation (OR = 1.08, 95% CI: 0.66, 1.75). None of the remaining types of contacts were statistically associated with breastfeeding exclusivity or duration.

MULTIVARIABLE ASSOCIATIONS BETWEEN BREASTFEEDING OUTCOMES AND SARS-COV-2 STATUS

The bivariate associations of breastfeeding outcomes and our primary predictor, SARS-CoV-2 infectivity, were largely maintained in multivariable analyses, where we controlled for maternal demographics, maternal/infant characteristics, and either pediatric total, in-person, or virtual contacts (Table 2). Being parsimonious, we only provide the multivariable results for the pediatric virtual contacts from among the 3 models controlling for healthcare utilization. All variables significant in the bivariate analyses, as well as SARS-CoV-2 status and additional variables identified in the literature as potential correlates, were included in the models shown. Of note, SARS-CoV-2 status and the number of virtual visits and in-person visits were correlated, with point-biserial correlation coefficients ranging from -0.08 (for virtual visits during month 2) to 0.35 (for virtual visits during month 1) and from -0.05 (for in-person visits from days 8 to 45) to -0.19 (for in-person visits during days 1−7).

After controlling for race, ethnicity, parity, insurance, delivery mode, infant sex, and hospital length of stay, and virtual contacts during comparable timeframes, SARS-CoV-2+ mothers had lower odds of breastfeeding initiation within 1 to 7 days of life (adjusted odds ratio = 0.40, 95% CI: 0.17, 0.96) and of *any* breastfeeding during month 2 (adjusted odds ratio = 0.37, 95% CI: 0.16, 0.86) compared with SARS-CoV-2- mothers. The other measures of breastfeeding associated with SARS-CoV-2 status remained not statistically significant in multivariable analyses.

DISCUSSION

Our study suggests that maternal SARS-CoV-2 positivity at the time of delivery during a pandemic surge is independently associated with specific adverse outcomes in breastfeeding initiation and duration during the first 2 months of a newborn's life. Although breastfeeding exclusivity rates were similar regardless of SARS-CoV-2 status, multivariable analysis of breastfeeding outcomes demonstrated that breastfeeding initiation within 1 to 7 days of life and at the 2-month marker were significantly lower among SARS-CoV-2+ mothers, when controlling for key maternal demographics, maternal/infant characteristics, and pediatric contacts.

Table 1. Maternal Demographics, Maternal/Infant Characteristics and Pediatric Contacts, Overall and by SARS-CoV-2 Status

Characteristics	Overall N = 285	SARS-CoV-2 (-) N = 231	SARS-CoV-2 (+) N = 54	*P* Value
Race, n (%)				.06
White	35 (12%)	24 (10%)	11 (20%)	
Asian	76 (27%)	68 (29%)	8 (15%)	
Black	97 (34%)	76 (33%)	21 (39%)	
Other/multiracial	77 (27%)	63 (27%)	14 (26%)	
Ethnicity, n (%) *				.69
Hispanic	49 (18%)	39 (17%)	10 (20%)	
Non-Hispanic	228 (82%)	187 (83%)	41 (80%)	
Parity, n (%)				.25
Multiparous	152 (53%)	127 (55%)	25 (46%)	
Primiparous	133 (47%)	104 (45%)	29 (54%)	
Insurance, n (%)				.78
Commercial/private	127 (45%)	102 (44%)	25 (46%)	
Medicaid	158 (55%)	129 (56%)	29 (54%)	
Delivery mode, n (%)				.22
C-section	77 (27%)	66 (29%)	11 (20%)	
Vaginal	208 (73%)	165 (71%)	43 (80%)	
Gestational age, n (%)				.92
37-39 weeks	199 (70%)	161 (70%)	38 (70%)	
≥40 weeks	86 (30%)	70 (30%)	16 (30%)	
Maternal age (years)				.95
Mean (SD)	30.0 (5.6)	30.0 (5.5)	30.0 (6.2)	
Min, max	15, 42	16, 41	15, 42	
Infant sex, n (%)				.12
Male	147 (52%)	114 (49%)	33 (61%)	
Female	138 (48%)	117 (51%)	21 (39%)	
Length of stay (hours)				.51
Median	40.3	40.9	38.8	
(Q1, Q3)	(31.0, 50.8)	(30.8, 50.8)	(32.1, 50.8)	
				Relative Risk (95% CI) *P* Value
Total contacts				1.08 (0.94, 1.23) .26
Median	5	5	6	
(Q1, Q3)	(4, 7)	(4, 7)	(4, 8)	
In-person contacts				0.86 (0.75, 0.98) .03
Median	4	4	4	
(Q1, Q3)	(3, 5)	(3, 5)	(3, 5)	
Virtual contacts				1.89 (1.48, 2.41) <.0001
Median	1	1	2	
(Q1, Q3)	(0, 2)	(0, 2)	(1, 3)	
Telehealth contacts				3.68 (2.71, 5.00) <.0001
Median	0	0	1	
(Q1, Q3)	(0, 1)	(0, 1)	(1, 2)	
Telelactation contacts				2.96 (1.18, 7.46) .02
Median	0	0	0	
(Q1, Q3)	(0,0)	(0, 0)	(0, 0)	
Telephone calls				1.03 (0.70, 1.52) .86
Median	0	0	0	
(Q1, Q3)	(0, 1)	(0, 1)	(0, 1)	

SD indicates standard deviation; Q1 and Q3, first and third quartiles; CI, confidence interval; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; SARS-CoV-2 (-), SARS-CoV-2 negative; and SARS-CoV-2 (+), SARS-CoV-2 positive.

P values are from chi-square tests for categorical variables, Wilcoxon tests for continuous variables, except for maternal age (2-sample *t* test), and Wald tests for Poisson regression of count variables; relative risk describe pediatric contacts for COVID positive relative to COVID negative; pediatric contact variables through month 2.

*Ethnicity is missing for 8 respondents.

Table 2. Association of Breastfeeding Outcomes With SARS-CoV-2 Status, Unadjusted and Adjusted for Maternal Demographics, Maternal/Infant Characteristics and Pediatric Virtual Contacts During Comparable Timeframes

	n (%)		Simple Logistic Regression Model†	Multivariable Logistic Regression Model‡	Multivariable Logistic Regression Model§
Characteristics*	SARS-CoV-2 (-) N = 231	SARS-CoV-2 (+) N = 54	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Initiation within 1−7 days of life	193 (88.1%)	40 (78.4%)	0.49 (0.22, 1.07)	0.46 (0.20, 1.07)	0.40 (0.17, 0.96)
Duration during month 1	177 (86.3%)	40 (81.6%)	0.70 (0.31, 1.60)	0.62 (0.26, 1.51)	0.74 (0.29, 1.88)
Duration during month 2	130 (75.6%)	20 (54.0%)	0.38 (0.18, 0.79)	0.36 (0.16, 0.84)	0.37 (0.16, 0.86)
Exclusivity during month 1	56 (29.0%)	7 (15.2%)	0.44 (0.18, 1.04)	0.38 (0.14, 0.98)	0.48 (0.17, 1.34)
Exclusivity during month 2	36 (22.9%)	5 (14.3%)	0.56 (0.20, 1.55)	0.63 (0.21, 1.91)	0.69 (0.22, 2.13)

SARS-CoV-2 indicates severe acute respiratory syndrome coronavirus 2; SARS-CoV-2 (-), SARS-CoV-2 negative; and SARS-CoV-2 (+), SARS-CoV-2 positive; CI, confidence interval; and OR, odds ratio.

*Breastfeeding outcomes:

Initiation: any breastfeeding reported within 1-7 days of life.

Exclusivity: *only* breastfeeding (ie, no formula supplementation or use).

Duration: continuation of *any* breast milk beyond the first 7 days of life.

†Simple logistic regression models include SARS-CoV-2 status only.

‡Multivariable logistic regression models include SARS-CoV-2 status and adjustment for demographic and maternal/infant covariates: race, ethnicity, parity, insurance, delivery mode, infant sex (only for duration during month 1 and exclusivity during month 1).

§Multivariable logistic regression models include SARS-CoV-2 status and adjustment for demographic and maternal/infant covariates as noted above, and virtual contacts during comparable timeframes to breastfeeding outcomes.

Our observed differences in pediatric contacts between SARS-CoV-2+ and SARS-CoV-2- mothers align with local and national trends of increased telehealth utilization since the onset of the pandemic. A study conducted at NYU Langone Health showed a 683% increase in telemedicine visits in urgent care.[14] On a national scale, the CDC reported a 154% increase in telehealth utilization during the last week of March 2020, in comparison to the last week of March 2019.[8] While there are limited data documenting the specific association of parental SARS-CoV-2 status with primary care telehealth utilization during the initial pandemic surge, it has been noted elsewhere that telemedicine services have safeguarded both healthcare workers and families from infection.[10] Telehealth contacts during the pandemic expanded connectivity between mother-infant dyads and our pediatric primary care practice, although not directly contributing to breastfeeding outcomes in multivariable analyses. Telehealth utilization for breastfeeding mothers during the pandemic, not only increased accessibility to rural populations, but could become a promising tool to increase rates of breastfeeding exclusivity and duration.[28] Overall, telemedicine's ability to overcome geographical barriers and to accommodate patient and provider schedules, specifically in pediatric primary care, could contribute to increased telehealth utilization during the pandemic and beyond.[15]

Of note, for all 5 breastfeeding outcomes, the directionality was the same, with breastfeeding outcomes for SARS-CoV-2+ mothers lagging behind those of SARS-CoV-2- mothers. Our results showed that SARS-CoV-2- mothers were more than twice as likely to exclusively breastfeed than SARS-CoV-2+ mothers during month 1. This difference narrowed by month 2, suggesting that maternal SARS-CoV-2 status may be associated only with early exclusivity, possibly due to concern about virus transmission to the infant. With respect to duration, the difference between SARS-CoV-2+ and SARS-CoV-2- mothers was significant only during month 2, perhaps driven by the early drop-off in exclusivity among SARS-CoV-2+ mothers. This also tracks with typical patterns among breastfeeding mothers, who may be facing competing family responsibilities or returning to work. This difference might also be due to SARS-CoV-2+ mothers being less trustful, given the novelty of the SARS-CoV-2 virus and limited data about virus transmission at that time. In addition, the ability of providers to deliver evidence-based recommendations was increasingly difficult during the study period.

While there are no simple answers about SARS-CoV-2-19's association with poorer breastfeeding outcomes, the evolving nature of available provider guidance may have contributed. However, during our study period, mothers, including those SARS-CoV-2 positive, were not separated from their newborn in the nursery, in contrast to the initial AAP guideline discouraging direct breastfeeding. The AAP guidance initially encouraged SARS-CoV-2+ mothers to separate or maintain distance from infants for at least 72 hours, and to express breastmilk to be fed to the infant by an uninfected caregiver, in contrast to engaging in skin-to-skin contact during breastfeeding.[21] Irrespective of hospital policy, some physicians may have conservatively decided that a "do-no-harm" concept dictated that mothers and infants be separated in the absence of evidence. Parents may have independently adopted the same cautious approach, even if it might negatively influence breastfeeding. Lastly, shorter average lengths of stay among SARS-CoV-2+ mothers in our study may have limited opportunities for postpartum breastfeeding support. Given these various possibilities and changing recommendations, research to explore these findings and develop more targeted breastfeeding support is encouraged.

Two other results are noteworthy: First, independent of SARS-CoV-2 status, women who delivered via C-section were less than half as likely to be breastfeeding during month 2, consistent with studies in the breastfeeding literature.[36,37] It is plausible that mode of delivery in

conjunction with positive maternal SARS-CoV-2 status create an additional barrier to breastfeeding duration, but our moderate sample size precluded analysis of interactions. Second, our results showed disparities in breastfeeding initiation between Black/multiracial and White dyads that are also consistent with the literature.[32] It is important to note that Black women face additional barriers to breastfeeding, such as a lack of exposure to prenatal and early breastfeeding education, susceptibility to provider bias, and exposure to systemic racism that contributes to lower socioeconomic status and adverse social determinants of health.[31,38] Increased advertising of formula in Black communities has also contributed to lower rates of breastfeeding among Black women.[39]

This study is the first look at the critical question of the association between SARS-CoV-2 and breastfeeding. Although retrospective, the use of electronic health records for standard reporting of breastfeeding limited recall bias and non-response. In addition, our study population was diverse, similar to that of studies in New York City,[40,41] that allowed us to examine and uncover SARS-CoV-2 influences on specific characteristics, such as race.

In terms of limitations, overall, our results were based on a modestly sized, retrospective sample of mother/infant dyads over a 3-month pandemic surge at one New York-based health system. Of note, our study population had a 19% maternal SARS-CoV-2 positivity rate, roughly comparable to a New York Presbyterian Hospital (Columbia University) study between March 22 and April 4, 2020[40] and a 2020 Kings County Hospital Brooklyn study.[41] Like these 2 other studies, our study subjects were largely non-White (88%) and disproportionately Medicaid-eligible (55%), less representative of national samples. Future research would benefit from a prospective design, a more representative national sample, and the inclusion of a qualitative component to better look at the experiences of mother/infant dyads.

Second, some potentially important data were simply not available. Although SARS-CoV-2+ mothers lagged behind SARS-CoV-2- mothers for all breastfeeding outcomes in our study population, it is possible that some mothers had appointments outside our practice through month 2, limiting our ability to measure breastfeeding duration. In addition, infant SARS-CoV-2 status was only documented at birth but might have become an important variable affecting breastfeeding outcomes, although the CDC reported a low (0.27%) positivity rate for infants <1 year of age in April 2020.[42] Finally, data exploring the details of breastfeeding support, another covariate of interest, were incomplete in the electronic health record.

Third, small sample size precluded our ability to do more than to assess the independent contribution of SARS-CoV-2 with breastfeeding outcomes as noted, and even this might have been compromised to some extent by our inability to account for all possible predictors, also noted above. Beyond that, small sample size precluded our conducting analyses assessing causality, and therefore causal inferences from these data are speculative, at best.

Further research might examine how generalizable these findings are in additional settings during local surges or in areas with high positivity rates. Further study also might include how results vary with SARS-CoV-2 vaccination and the emergence of new variants, prompting recommendations in flux.

CONCLUSION

Maternal SARS-CoV-2 positivity at delivery during a pandemic surge demonstrated a statistically significant independent association with less breastfeeding initiation and shorter duration, as supported by our model that included SARS-CoV-2 status with adjustment for demographic and maternal/infant covariates and virtual contacts. During future outbreaks or pandemics, breastfeeding promotion and education are still of the utmost importance and breastfeeding guidance should continuously be emphasized. Mothers should be encouraged to breastfeed and not be separated from their newborns while following appropriate mitigation steps, such as masking. If too sick, mothers should be instructed to pump and have another person provide that milk. SARS-CoV-2+ mothers, especially those delivering via C-section or who face adverse social determinants of health, could also benefit from further breastfeeding support beyond additional virtual pediatric contacts.

In sum, pediatricians should continue to emphasize the health and neurodevelopmental benefits of breastfeeding to mothers. Families should be made aware of online support groups for breastfeeding (eg, Baby Cafe USA) and any telephone-based warm lines that provide breastfeeding tips. Board-certified lactation consultants and lactation professionals in the office should be equipped with telehealth. Breastfeeding promotion and protection remain an important concern for patients and clinicians as knowledge rapidly evolves during public health emergencies, such as new SARS-CoV-2 variants.

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