RESEARCH LETTER

Evaluation for SARS-CoV-2 in Breast Milk From 18 Infected Women

Concern has been raised that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may be transmitted to infants by breastfeeding. A number of organizations advise that women infected with SARS-CoV-2 may choose to breastfeed with protections to prevent transmission of the virus through respiratory droplets. Of 24 case reports on breast milk samples from women infected with SARS-CoV-2, viral RNA was detected in 10 samples from 4 women.[1-6] In some cases, environmental contamination or retrograde flow from an infected infant could not be ruled out. Detection of viral RNA by reverse transcriptase–polymerase chain reaction (RT-PCR) does not equate with infectivity. To date, SARS-CoV-2 has not been isolated from breast milk, and there are no documented cases of transmission of infectious virus to the infant through breast milk. However, potential for viral transmission through breast milk remains a critical question for women infected with SARS-CoV-2 who wish to breastfeed.

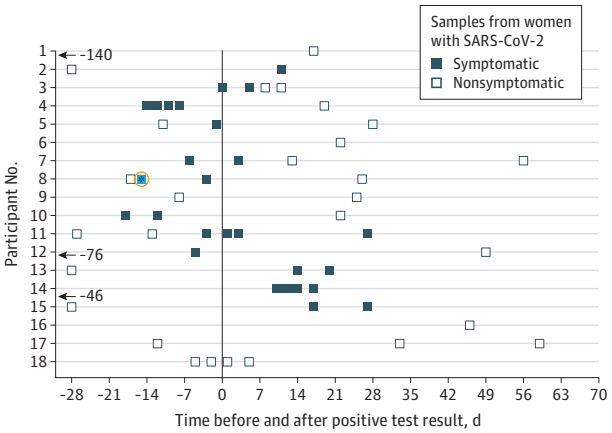
Supplemental content

Methods | Beginning in March 2020, women residing anywhere in the US who reported being symptomatic, having been exposed to an infected person, or having a confirmed SARS-CoV-2 infection and who were currently breastfeeding were invited to participate in the study using a variety of methods including media awareness, website, and clinician referral. Only women who tested positive by RT-PCR tests were included. The University of California San Diego Institutional Review Board approved the study, and women provided oral and written informed consent. Clinical data were collected by phone interview. Breast milk samples were self-collected and mailed to the study center according to a standard protocol. In some cases, women also provided stored samples collected prior to enrollment (eAppendix in the Supplement).

A quantitative RT-PCR assay for SARS-CoV-2 in breast milk was established and validated. Tissue culture methods to detect replication-competent SARS-CoV-2 in breast milk were developed (eAppendix in the Supplement).

Additionally, conditions of Holder pasteurization commonly used in human milk banks were mimicked by adding SARS-CoV-2 (200 × median tissue culture infectious dose 50% [$TCID_{50}$]) to breast milk samples from 2 different control donors who provided milk samples prior to onset of the pandemic. The samples were heated to 62.5 °C for 30 minutes and then cooled to 4 °C. Following this procedure, the samples were added to the tissue culture. Nonpasteurized aliquots of the same 2 milk-virus mixtures were cultured in parallel.

Figure. Breast Milk Sampling Relative to Time of Positive SARS-CoV-2 Test Result



All samples were tested for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral RNA by reverse transcriptase–polymerase chain reaction (RT-PCR). The blue data point outlined in red represents a participant who had tested positive by RT-PCR but negative by infectivity assay.

SPSS version 25 and Prism version 8.4.3 (GraphPad) were used for analyses.

Results | Between March 27 and May 6, 2020, we enrolled 18 women who had confirmed SARS-CoV-2 infection (77.7% White non-Hispanic, mean age, 34.4 years [SD, 5.2 years]). Their offspring ranged in age from newborn to 19 months. Women provided between 1 and 12 samples, with a total of 64 samples collected at varying time points before and after the positive SARS-CoV-2 RT-PCR test result. All but 1 woman had symptomatic disease (**Figure**). One breast milk sample had detectable SARS-CoV-2 RNA. The positive sample was collected on the day of symptom onset; however, 1 sample taken 2 days prior to symptom onset and 2 samples collected 12 and 41 days later tested negative for viral RNA. The breastfed infant was not tested. No replication-competent virus was detectable in any sample, including the sample that tested positive for viral RNA.

Following Holder pasteurization, viral RNA was not detected by RT-PCR in the 2 samples that had been spiked with replication-competent SARS-CoV-2, nor was culturable virus detected. However, virus was detected by culture in nonpasteurized aliquots of the same 2 milk-virus mixtures.

Discussion | Although SARS-CoV-2 RNA was detected in 1 milk sample from an infected woman, the viral culture for that sample was negative. These data suggest that SARS-CoV-2 RNA does not represent replication-competent

virus and that breast milk may not be a source of infection for the infant. Furthermore, when control samples spiked with replication-competent SARS-CoV-2 virus were treated by Holder pasteurization, no replication-competent virus or viral RNA was detectable. These findings are reassuring given the known benefits of breastfeeding and human milk provided through milk banks. Limitations include the small sample size, nonrandom sample with possible selection bias, self-report of RT-PCR positivity, and self-collection of milk samples, some before the standard protocol was instituted.

Christina Chambers, PhD, MPH
Paul Krogstad, MD
Kerri Bertrand, MPH
Deisy Contreras, PhD
Nicole H. Tobin, MD
Lars Bode, PhD
Grace Aldrovandi, MD, CM

Author Affiliations: University of California, San Diego, La Jolla (Chambers, Bertrand, Bode); University of California, Los Angeles (Krogstad, Contreras, Tobin, Aldrovandi).

Corresponding Author: Christina Chambers, PhD, MPH, University of California, San Diego, 9500 Gilman Dr, MC0828, La Jolla, CA 92093 (chchambers@health.ucsd.edu).

Accepted for Publication: August 3, 2020.

Published Online: August 19, 2020. doi:10.1001/jama.2020.15580

Author Contributions: Drs Chambers and Krogstad had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Chambers, Krogstad, Bertrand, Tobin, Bode, Aldrovandi.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Chambers, Krogstad, Bertrand, Bode.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Chambers, Bertrand.
Obtained funding: Chambers, Bertrand, Bode, Aldrovandi.
Administrative, technical, or material support: Chambers, Krogstad, Bertrand, Contreras, Tobin, Aldrovandi.
Supervision: Chambers, Bertrand, Aldrovandi.

Conflict of Interest Disclosures: Dr Chambers reported receiving grants from the University of California (UC) Office of the President Emergency COVID-19 Research Program and from the National Institutes of Health (NIH) National Center for Advancing Translational Sciences and receiving nonfinancial support from Medela Corporation and the Mothers' Milk Bank at Austin. Dr Krogstad reported receiving support from the UC Los Angeles AIDS Institute, the James B. Pendleton Charitable Trust, and the McCarthy Family Foundation. Dr Bode reported serving as the UC San Diego Chair of Collaborative Human Milk Research, which is endowed by the Family Larsson-Rosenquist Foundation. Dr Aldrovandi reported receiving support from the International Maternal Pediatric Adolescent AIDS Clinical Trials (IMPAACT) Network. No other disclosures were reported.

Funding/Support: The IMPAACT Network is supported by grants UM1AI068632 (Leadership and Operations Center), UM1AI068616 (Statistical and Data Management Center), and UM1AI106716 (Laboratory Center) from the National Institute of Allergy and Infectious Diseases, cofunding from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, and the National Institute of Mental Health. Medela Corporation provided milk sample collection materials for this study. The Family Larsson-Rosenquist Foundation provided an unrestricted COVID-19 emergency gift fund. The Mothers' Milk Bank at Austin, an accredited milk bank and member of the Human Milk Banking Association of North America, paid for shipping costs.

Role of the Funder/Sponsor: The sponsors had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Disclaimer: The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

Additional Contributions: We thank the women who participated in this study and who gave so generously of their time and effort to provide milk samples and clinical information.

1. Chen H, Guo J, Wang C, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *Lancet*. 2020;395(10226):809-815. doi:10.1016/S0140-6736(20)30360-3

2. Wu Y, Liu C, Dong L, et al. Coronavirus disease 2019 among pregnant Chinese women: case series data on the safety of vaginal birth and breastfeeding. *BJOG*. Published online May 5, 2020. doi:10.1111/1471-0528.16276

3. Costa S, Posteraro B, Marchetti S, et al. Excretion of SARS-CoV-2 in human breast milk. *Clin Microbiol Infect*. Published online June 2, 2020. doi:10.1016/j.cmi.2020.05.027

4. Groß R, Conzelmann C, Müller JA, et al. Detection of SARS-CoV-2 in human breastmilk. *Lancet*. 2020;395(10239):1757-1758. doi:10.1016/S0140-6736(20)31181-8

5. Tam PCK, Ly KM, Kernich ML, et al. Detectable severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in human breast milk of a mildly symptomatic patient with coronavirus disease 2019 (COVID-19). *Clin Infect Dis*. Published online May 30, 2020. doi:10.1093/cid/ciaa673

6. Liu W, Wang J, Li W, Zhou Z, Liu S, Rong Z. Clinical characteristics of 19 neonates born to mothers with COVID-19. *Front Med*. 2020;14(2):193-198. doi:10.1007/s11684-020-0772-y

SARS-CoV-2 Infection Among Community Health Workers in India Before and After Use of Face Shields

The transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is believed to be predominantly through respiratory droplets from infected persons in close proximity to uninfected persons,[1] although airborne transmission may also play a role.[2,3] Face shields have been proposed to prevent transmission in the community,[4] but data are lacking. We describe transmission in a community setting before and after the use of face shields.

Methods | Beginning May 3, 2020, community health workers from a research network in Chennai, India, were assigned to counsel asymptomatic family contacts of patients who had tested positive for SARS-CoV-2 at their residence. The workers were housed in separate rooms of hostels and provided food; they did not visit their homes or public places outside work. Prework training was done with no more than 3 persons attending any session. Workers communicated with each other by phone. All workers' nasopharyngeal swabs taken on May 1, 2020, tested negative for SARS-CoV-2 by reverse transcriptase–polymerase chain reaction (RT-PCR).

Each worker traveled in a small van with a steel partition to prevent air exchange between the driver and back cabin where the worker sat. Workers maintained constant masking and social distancing when interacting with the driver. Personal protective equipment included alcohol hand rub, 3-layered surgical masks, gloves, and shoe covers. Family members assembled in the front room of each house, and the worker, standing 6 ft away, explained the principles of quarantine, mask use, social distancing, handwashing, and symptoms of SARS-CoV-2 illness. Family members were asked to wear face masks during the conversation, although workers reported that some did not.