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Anti—severe acute respiratory syndrome coronavirus 2 antibodies induced in breast milk after Pfizer-BioNTech/BNT162b2 vaccination

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OBJECTIVE: In December 2020, 2 lipid nanoparticle-formulated, nucleoside-modified messenger RNA—based vaccines received emergency use authorization by the US Food and Drug Administration, after their trials demonstrated 94% to 95% efficacy in preventing coronavirus disease 2019 (COVID-19).[1] Although no lactating people were included in the vaccine trials, national organizations support vaccination of this population, suggesting potential infant protection by passive transfer of maternal antibodies.[1,2] However, there are no published data to support this theoretical benefit. We sought to characterize breast milk levels of anti—severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibodies in lactating people undergoing COVID-19 vaccination.

STUDY DESIGN: Participants were prospectively recruited during phase IA rollout of the COVID-19 vaccine at a tertiary care center, after institutional review board approval. Inclusion criteria included lactation and planned vaccination with the Pfizer-BioNTech (Pfizer, Inc, New York, NY)/BNT162b2 vaccine (BioNTech SE, Mainz, Germany). After obtaining informed consent, participants provided frozen breast milk samples at the following time points of vaccination: before, within the first 24 hours, and the following week. Samples were assessed for SARS-CoV-2 RNA by quantitative real-time polymerase chain reaction and antispike immunoglobulin (Ig) G and IgA by an enzyme-linked immunosorbent assay.

RESULTS: A total of 5 subjects and 29 human milk samples were included in the analysis. Subject characteristics are reported in Figure 1, A. All prevaccine milk samples tested negative for SARS-CoV-2 RNA, as defined by the cycle threshold value of >40 for the N1 target (Figure 1, B). Antispike IgG and IgA levels were significantly elevated relative to the prevaccine baseline at all time points. Antispike protein IgG remained sustained at a significant elevation beginning at 20 days after the first dose compared with the prevaccine baseline (P=.0061), through the final milk sample (day 30—39 P=.0095, >40 days P=.0040; (Figure 1, C). Levels of antispike protein IgA were significantly elevated from baseline, starting 2 weeks after the first dose (P=.0286) through to the final sample (day 20—29 P=.0121, day 30—39 P=.0095, >40 days P=.0040); however, individual level data suggest a possible gradual decline in antispike IgA in human milk over time after the second dose (Figure 1, D).

CONCLUSION: We characterize longitudinal breast milk levels of antispike IgG/A following Pfizer-BioNTech/BNT162b2 vaccination, demonstrating sustained elevation of IgG/IgA levels. This response is similar to previous studies on maternal vaccination, which have shown high levels of breast milk IgA/G production for up to 6 months after vaccination for influenza and pertussis.[3,4] A concurrent decrease in infant respiratory illness rates suggest that maternal vaccination confers protection against infection in breastfed infants.[3] Thus, the Pfizer-BioNTech/BNT162b2 vaccination may also confer protection against COVID-19 to breastfed infants as well. Although vaccination remains one of the most crucial interventions to control infection spread, vaccine hesitancy remains a barrier to widespread uptake.[5] Our study is limited by a small number of participants, but we report data that suggest a potential immune benefit to infants of lactating people up to 80 days after COVID-19 vaccination. Further studies are needed to characterize the length of antibody production in breast milk and the effect on infant infection rates after maternal COVID-19 vaccination. ■

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FIGURE
Breast milk levels of anti–SARS-CoV-2 antibodies after Pfizer-BioNTech/BNT162b2 vaccination

A

Self-reported characteristics of study participants.

Subject	Age (years)	Race	Medical conditions	Medications	Immuno-suppressed condition or medication	Prior test-confirmed COVID-19 infection	Gestational age at delivery (weeks)	Current age of infant (months)
1	31	White	Depression, obesity	Escitalopram	No	No	39	10
2	43	Black	Colitis, eczema	Adalimumab	Yes	No	39	24
3	34	Asian	None	Birth control	No	No	38	5
4	26	White	Depression	Fluoxetine	No	No	34	9
5	31	White	Anxiety	Anti-anxiety medication, birth control	No	No	38	1

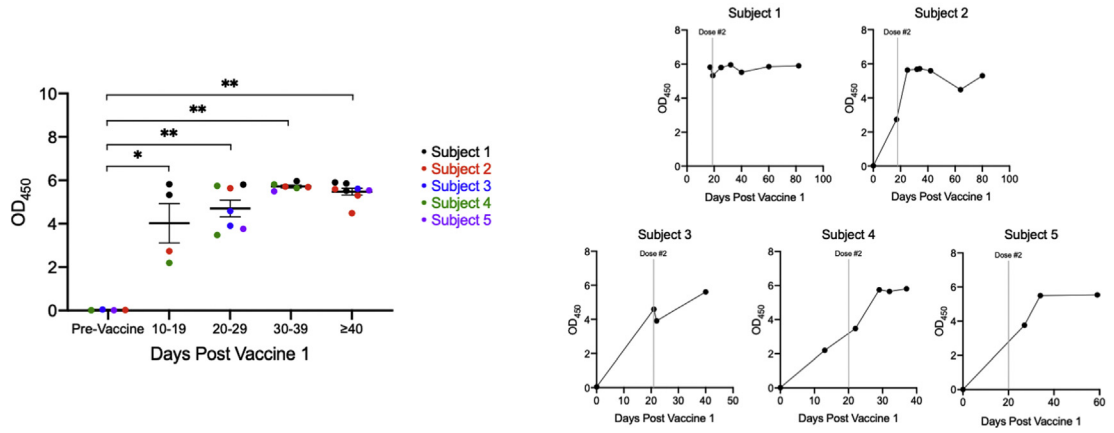
B

SARS-CoV-2 *N1* mRNA expression prior to vaccination.

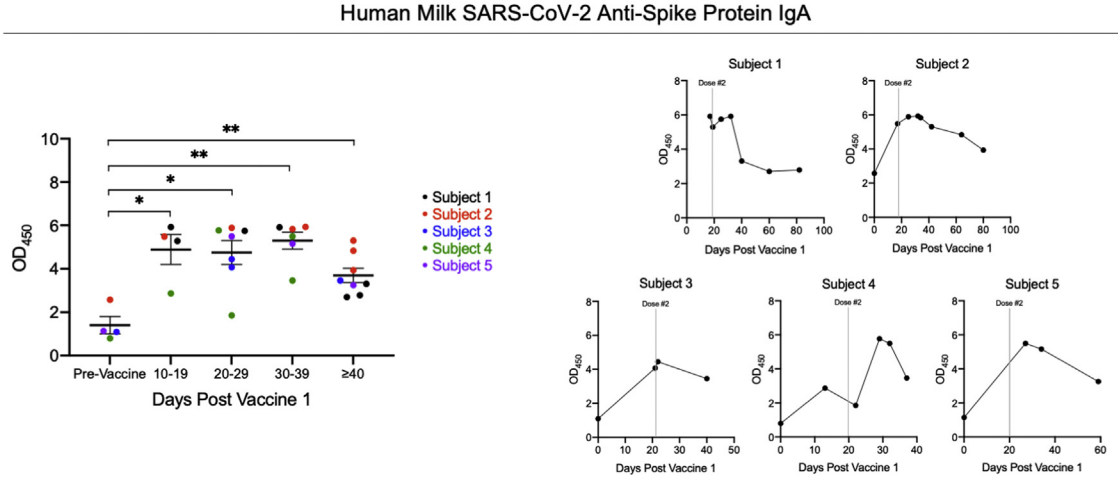
Subject	C_t Value*
1+	>40
2	>40
3	>40
4	>40
5	>40

*C_t value greater than 40 denotes no detection of SARS-CoV-2 in breast milk sample.
+Sample obtained after vaccine dose 1, but prior to dose 2.

C



D



A total of 5 lactating women who received 2 doses of the Pfizer-BioNTech BNT162b2 vaccine were included in the analysis. **A,** Self-reported clinical data of the study subjects are shown, with Subject 2 identifying as immunocompromised; **B,** Prevaccine baseline milk samples were analyzed for SARS-CoV-2 RNA using the N1 target compared with RNAse P, with undetectable viral RNA defined as Ct>40. Antispike protein (**C**) IgG and (**D**) IgA antibody levels in human milk were analyzed at serial time points following the first and second vaccine doses. Delipidated human milk samples were diluted at a 1:1 ratio with sample diluent and tested in duplicate for IgG and IgA against SARS-CoV-2 full-length spike protein using ELISA Kits from Cell Signaling Technology (Catalog #20154C for IgG and Catalog #58873C for IgA). Antibody signal detections were analyzed by spectrophotometric absorbance at 450 nm. Gray *vertical lines* represent the timing of the administration of the second dose. Of note, the first sample from Subject 1 was obtained 17 days after the first vaccine. Data are displayed as mean±SEM and were analyzed using the Mann-Whitney *U* test. The *single asterisk* represents $P<.05$; the *double asterisk* represents $P<.01$.

Ct, cycle threshold; *ELISA*, enzyme-linked immunosorbent assay; *Ig*, immunoglobulin; *SARS-CoV-2*, severe acute respiratory syndrome coronavirus 2; *SEM*, standard error of the mean.

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Severe acute respiratory syndrome coronavirus 2 immunity: infective and naive incidence in fertility clinics after lockdown

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OBJECTIVE: The outbreak and second wave of the coronavirus disease 2019 (COVID-19) pandemic pose a concern to the public, including couples wishing to conceive and pregnant women.[1] During the pandemic, many fertility clinics suspended treatment. When reopening was undertaken, routine triage, social distancing, and masks were necessary. However, this may be insufficient, because there is a 5-day asymptomatic window until infection becomes evident and 30% of infected people are asymptomatic.[2] This study aimed to report the incidence of immune, infected, and naive status for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) among asymptomatic clinical staff and patients in 2 fertility centers located in Massachusetts and Utah, states with different COVID-19 prevalence rates.

STUDY DESIGN: This prospective study enrolled 339 asymptomatic individuals, from June 18 to July 30, 2020. After a routine symptom-based screening, exclusively asymptomatic individuals attending or working in the 2 clinics were tested by reverse transcription polymerase chain reaction (RT-PCR) on nasopharyngeal swab for SARS-CoV-2 RNA detection (Thermo Fisher Scientific, Waltham, MA) and for immunoglobulin G (IgG) detection on blood samples (Abbott, Scarborough, ME), following the Food and Drug Administration Emergency Use Authorization protocols. In clinic A (Utah Fertility Center) located in a low-prevalence state (312 cases per 100,000 during the study), 154 individuals were analyzed, whereas in clinic B (Boston IVF) (1462 cases per 100,000 during the study), 185 individuals were tested. The study was approved by an independent review board and registered in ClinicalTrials.gov (ID NCT 04466644). All results were reported to the applicable health authority.

RESULTS: From the 339 asymptomatic individuals, the percentage of informativity was 100% for RT-PCR and 99.4%