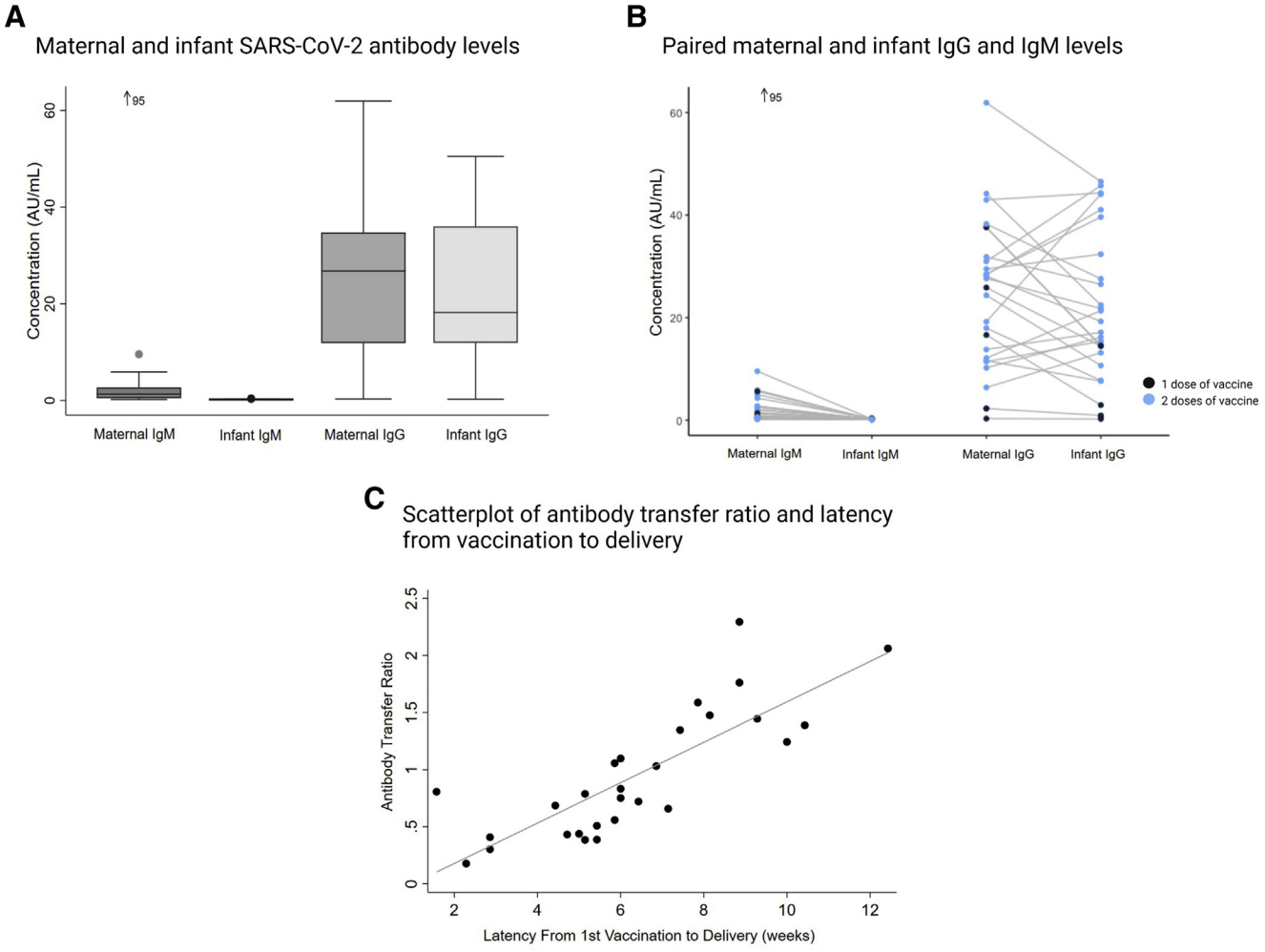
Cord blood antibodies following maternal coronavirus disease 2019 vaccination during pregnancy

OBJECTIVE: Vaccination of pregnant women can be an important strategy to confer protection to neonates and young infants.[1] However, there are limited data on the immunologic response of pregnant women to the messenger RNA (mRNA) coronavirus disease 2019 (COVID-19) vaccinations[2] and the kinetics of transplacental antibody transfer.[3,4] Our objective was to investigate the transfer of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) immunoglobulin G (IgG) to infants following maternal COVID-19 vaccination during pregnancy and the factors associated with an increased efficiency of transfer.

FIGURE
Maternal and infant SARS-CoV-2 antibodies and IgG transfer



A, Anti–SARS-CoV-2 antibody levels in maternal and umbilical cord (infant) blood following maternal COVID-19 vaccination (n=27 mothers, n=28 infants); **B,** Paired maternal and infant IgM and IgG levels of women with 1 dose (n=5) and 2 doses (n=22) of the vaccine during pregnancy. Paired infant IgM was 0.2 for 1 outlier maternal IgM of 95 AU/mL; **C,** The association between the latency (weeks) from first vaccine dose and the antibody transfer ratio (infant IgG to maternal IgG).

COVID-19, coronavirus disease 2019; *Ig*, immunoglobulin; *SARS-CoV-2*, severe acute respiratory syndrome coronavirus 2.

Mithal. Antibody transfer after maternal coronavirus disease 2019 vaccination. Am J Obstet Gynecol 2021.

STUDY DESIGN: This was a prospective case series of pregnant women who delivered at the Prentice Women's Hospital in Chicago, IL (between January 2021 and March 2021). Women who received a COVID-19 vaccination during pregnancy were identified via review of the electronic health records (EHRs). Demographic and clinical information, including the specific vaccine used and the latency from vaccination to delivery was obtained from the EHRs. At the time of the study, 2 mRNA COVID-19 vaccines, the Pfizer (New York, NY) and Moderna (Cambridge, MA) vaccines, had received emergency use authorization, and healthcare workers were the initial qualifying group. Maternal blood and umbilical cord blood (herein referred to as "infant") were retrieved from specimens submitted for blood typing. SARS-CoV-2 IgM and IgG antibody levels were measured from the plasma using the Access SARS-CoV-2 IgG and IgM Antibody tests (DXI Platform, Beckman Coulter, Brea, CA) in a Certified Analytics Professional and Clinical Laboratory Improvement Amendments certified clinical laboratory. The chemiluminescent assay quantitatively reports antibodies against the SARS-CoV-2 receptor binding domain in arbitrary units [AU]/mL, with values of $\geq$1 considered positive. The antibody transfer ratio was calculated as the infant IgG concentration divided by the maternal IgG concentration. Descriptive statistics were calculated. Linear regressions were used to identify factors significantly associated with the antibody transfer ratios and the infant IgG values. This study was institutional review board approved before its initiation.

RESULTS: We collected matched maternal plasma and cord blood from 27 women who received a COVID-19 vaccination during pregnancy; they delivered 28 infants (1 twin pair). The average maternal age was 33±3 (mean±standard deviation) years; race and ethnicity was 75% non-Hispanic White and 11% Hispanic. The average gestational age at first vaccine dose was 33±2 weeks. For the vaccine type, 18 (64%) received the Pfizer vaccine, 6 (18%) received the Moderna vaccine, and 4 (14%) received a vaccine with the manufacturer unknown. Of note, 22 women (74%) received both vaccine doses before delivery with a mean latency of 6±3 weeks. About half of the women (15/27) and none of the infants had a positive IgM test (>1) (Figure, A). All but 1 woman (26/27) had a positive SARS-CoV-2 IgG test at the time of delivery. Only 3 infants did not have positive IgG tests (1 set of twins); these 2 women had received their first vaccine dose less than 3 weeks before delivery. The average maternal to infant IgG transfer ratio was 1.0±0.6 (Figure, B), however, an increased latency from vaccination to delivery (weeks) was associated with an increased transfer ratio (β=0.2; 95% confidence interval [CI], 0.1−0.2) (Figure, C). Correspondingly, having received the second vaccine dose before delivery was significantly associated with increased infant IgG levels (β=19.0; 95% CI, 7.1−30.8). Similarly, latency from vaccination to delivery was associated with increased infant IgG levels (β=2.9; 95% CI, 0.7−5.1).

CONCLUSION: Most pregnant women who received a COVID-19 mRNA vaccine during the third trimester had transplacental transfer of IgG to the infant. The observed mean IgG transfer ratio demonstrated that infant antibody levels are about equal to the maternal levels. This is slightly lower than what has been reported for the pertussis vaccinations (1.19−1.36),[5] but greater than the transfer ratio following SARS-CoV-2 infection (0.72±0.57).[4] A novel finding is that the transfer ratio seems to increase with latency from vaccination. These data suggest, at least among women in their third trimester, that earlier vaccination may produce a greater infant immunity, the immunobiology of which requires further study. Notably, owing to vaccine eligibility and timing, most women included herein were healthcare workers in their third trimester. Future research, including a more diverse cohort of women and women who received vaccination earlier in their pregnancy, is needed. Nevertheless, these results show promising evidence for passive immunity against SARS-CoV-2 in newborns after maternal receipt of COVID-19 mRNA vaccinations. ■

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Decrease in Florida's pregnancy-related mortality from 2009 to 2018: reducing the Black-White disparity

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OBJECTIVE: The US pregnancy-related mortality ratio (PRMR), defined as the number of deaths per 100,000 live births, has increased with evidence of wide racial disparities.[1] Florida's Pregnancy-Associated Mortality Review Committee is a multidisciplinary team that examines pregnancy-related deaths (PRDs) to recommend and promote actions to address patient and community factors, provider and facility practices, and health system issues to prevent these deaths. A PRD is a death during pregnancy or within 1 year of delivery from a pregnancy-related complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition.

STUDY DESIGN: The review committee identifies all pregnancy-associated deaths, deaths from any cause during pregnancy or within 1 year of pregnancy, by linking death certificates of reproductive-aged women to birth and fetal death certificates and Florida-based prenatal screens. From this linkage, possible PRDs are abstracted, reviewed, and assessed. In this study, all the PRDs between 2009 and 2018 were included and analyzed for PRMR trends and for overall causes of death and by race and ethnicity. The data were divided into the following 2 5-year time intervals: PRD occurring between 2009 and 2013 and those occurring between 2014 and 2018. SPSS Statistics version 23 (IBM, Chicago, IL) and OpenEpi were used for analysis.

RESULTS: A total of 2,191,578 live births and 408 PRDs occurred during the study period. Overall, the PRMR in Florida decreased by 29% from the first time period (2009−2013) to the second time period (2014−2018) of this study ($P<.001$). For non-Hispanic Black women, the PRMR decreased by 37%, from 46.6 to 29.4 deaths per 100,000 live births over the same time period ($P=.002$). Similarly, the PRMR decreased by 42%, from 12.8 to 7.4 deaths per 100,000 live births in Hispanic women ($P=.04$). Although not significant, the PRMR among non-Hispanic White women decreased by 8%, from 15.8 to 14.5 deaths per 100,000 live births (See Table). The most common underlying causes of PRDs during the study period included hemorrhage (21.1%), infection (15.4%), hypertensive disorders (11.8%), and other causes; the last 3 showed significant decreases in the ratios over the 2 time periods (each $P<.01$). Although not significant, the hemorrhage ratio decreased after a previous decade of increase. Among Black women, the highest decreases in cause of death were related to hemorrhage, infection, and hypertensive disorders. Among Hispanics, the highest decreases were related to infection, hypertensive disorders, and cardiovascular disorders.

CONCLUSION: In contrast to the overall PRMR in the United States, Florida's PRMR has decreased over the past decade with significant improvements among non-Hispanic Black and Hispanic women. In 2017, Florida's PRMR of 15.7 deaths per 100,000 live births was lower than the US ratio of 17.3 per 100,000 live births.[2] We postulate several reasons for this improvement. First, Florida has a robust mortality review committee that comprehensively reviews all PRDs based on good evidence to show that these committees strengthen public health surveillance.[3] Florida's review committee identified hemorrhage and hypertensive disorders as preventative priorities and developed Urgent Maternal Mortality Messages based on the findings and trends and distributed these to obstetrical providers and hospitals throughout the state. In addition, Florida Perinatal Quality Collaborative and other state partners have launched obstetrical hemorrhage and hypertension quality improvement initiatives. Finally, national initiatives are addressing prevention and system improvements to eliminate preventable maternal