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Literature Review of Mothers Diagnosed With COVID-19 and the Impact on Breastfeeding Their Newborns

Stacey A. Warner & Jessica L. Arevalo

ABSTRACT: In early 2020, newborns were separated from their mothers who were diagnosed with COVID-19 infection. The purpose of this literature review is to examine the current evidence to determine if the transmission of COVID-19 infection to the neonate increases if newborns are directly breastfed by mothers who are positive for COVID-19 infection. There were 28 studies conducted in seven countries, with 10 of those studies conducted in the United States. In total, 5,123 neonates were born to mothers diagnosed with COVID-19, with 3,872 neonates determined to have been breastfed or provided mixed feeding including breast milk. Overall, 2.35% (91/3,872) of the newborns tested positive, and all recovered from COVID-19 infection. As frontline health care providers, nurses are instrumental in offering support and education on the risks and benefits of breastfeeding for individuals diagnosed with COVID-19.

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The Centers for Disease Control and Prevention (CDC) reported the first case of novel coronavirus (SARS-CoV-2) infection in the United States in Washington state (CDC, 2020a). In March 2020, a pandemic was declared by the World Health Organization (WHO; 2020a) for COVID-19.

Recommendations from the American Academy of Pediatrics and the CDC at the beginning of the pandemic were for hospitals to separate mothers diagnosed with COVID-19 infection from their newborns because of the possible risk of neonatal infection and to feed expressed breast milk, donor

CLINICAL IMPLICATIONS

- Nurses can provide childbearing families with health education on the benefits and risks of breastfeeding during a COVID-19 infection.
- Guidance should include information on precautions such as wearing a mask, handwashing before and after breastfeeding, and maintaining distance from the newborn after feedings.
- Considering the risk of infection, nurses can continue to advocate for an individual's autonomy to breastfeed, which supports maternal bonding with a newborn.

milk, or infant formula to the neonate by a healthy caregiver with mask and gloves worn (Amatya et al., 2020; Puopolo et al., 2020; Wu et al., 2020). At the time of this writing, the American College of Obstetricians and Gynecologists (ACOG; 2022) encourages individuals diagnosed with COVID-19 infection to feed their newborns breast milk and to continue active discussions with their health care providers if they are planning to breastfeed their newborns.

Background

Breast milk provides numerous benefits for neonates, including intake of colostrum rich in immunoglobulin (Ig) A, which provides immune support for the newborn for up to 2 years (Costa et al., 2020; Czosnykowska-Lukacka et al., 2020). Decreases in upper and lower respiratory tract infections and obesity in children have also been associated with breastfeeding in infancy (Anderson et al., 2020; Tromp et al., 2017). Researchers investigating COVID-19 at the beginning of the pandemic reported that the expressed breast milk transmission from mothers with COVID-19 to their neonates was 4.7% (7/148; Deniz & Tezer, 2020; Walker et al., 2020). The purpose of this literature review is to examine the current evidence to determine if the transmission of COVID-19 infection to neonates increases if newborns are directly breastfed by their mothers diagnosed with COVID-19 infection.

Literature Review

Search Methods and Sources

The search included peer-reviewed research published between December 2019 and January 31, 2022 and found in the MEDLINE, CINAHL, and PubMed databases for different variations of the Medical Subject Heading keywords "COVID-19 positive mothers," "breastfeeding," and "newborns," as well as the inclusion criteria of newborns tested by real-time reverse transcriptase polymerase chain reaction (RT-PCR) nasopharyngeal swab. After further review, exclusion criteria

consisted of reviews, guidelines, duplicates, a study in a foreign language, studies not related to breastfeeding or mother diagnosed with COVID-19, case reports with fewer than four neonates, studies that separated the mother and newborn during their hospital stay and neonatal period; studies where it could not be determined that neonates were tested for COVID-19 or breastfed, and survey studies collected outside of the hospital. The reference sections for all inclusion articles were reviewed and cross-referenced for further inclusion studies, with four inclusion studies found and discussed as follows.

Study Selection and Data Collection

The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA; Page et al., 2021) flowchart displays the search of 272 articles (see Figure 1). There were 248 study articles excluded with descriptions in the flowchart. After screening the articles, 24 studies met the inclusion criteria, and an additional four studies were included through cross-references, for a total of 28 studies for mothers diagnosed with COVID-19 infection who breastfed their newborns. The 28 articles were analyzed for mother and infant COVID-19 infection status, neonatal feeding, direct breastfeeding, and infection protocol (see Supplementary Table S1). Studies were ranked based on their level of evidence and quality rating in accordance with the Johns Hopkins Nursing Evidence-Based Practice: Levels of Evidence, with all 28 articles ranked as Level III: low quality, descriptive, observational studies, or case series articles (Dang et al., 2022).

Results

The 28 studies were conducted in seven countries, including the United States, Italy, India, Israel, Portugal, Spain, and Sweden. In total, 5,123 neonates were born to mothers diagnosed with COVID-19, with 70% ($n = 3,872$) of the newborns determined to have been breastfed. Overall, 2.35% (91/3,872) of the breastfed newborns tested positive for COVID-19 infection confirmed by RT-PCR nasopharyngeal swab. The majority of the 91 newborns were asymptomatic, with one admitted for a short duration in the NICU for acute respiratory distress, two with gastrointestinal symptoms, two requiring ventilation because of prematurity, nine for unrelated diagnoses, and two who had mild noted desaturations. All of the newborns recovered and were discharged home from the hospital.

In the 10 studies conducted in the United States, 886 newborns were born to mothers diagnosed with COVID-19. Overall, 59% (516/877) of mothers chose to breastfeed while diagnosed with COVID-19 infection. Seventeen breastfed newborns who tested positive for COVID-19 by RT-PCR swab after birth. Of the 3.29% (17/516) who tested positive, 11 were asymptomatic; one newborn was sent to the NICU for prematurity, not because of COVID-19 infection; two had mild gastrointestinal symptoms or fever; two had mild desaturation episodes early after birth; and one newborn had severe

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Researchers in the United States reported that mothers diagnosed with COVID-19 infection who implemented face mask use, handwashing, and washing of the breasts before breastfeeding did not transmit the virus to their neonates

COVID-19 signs and symptoms requiring respiratory support and isolation (see [Supplementary Table S1](#)). Overall, no neonatal deaths were reported in this group, and all infants were reported to have recovered.

There were eight studies conducted in Italy, with 81.4% (659/810) of the mothers choosing to breastfeed their newborns. Of the breastfed newborns, 4.86% (32/659) tested positive, with the majority having mild to no symptoms, two with gastrointestinal signs and symptoms, and one newborn needing brief intensive care support for respiratory distress, but all recovered. Four studies conducted in India reported that 87.7% of the participant mothers breastfed (391/446). The overall percentage of neonates who tested positive for COVID-19 was 4.86% ($n = 19/391$). Specifically, [Kalamdani et al. \(2020\)](#) found that 12 neonates were exclusively breastfed and tested positive for COVID-19, although they were asymptomatic or had mild symptoms, and all 12 infants were reported healthy by 2 months of age. [Anand and colleagues \(2021\)](#) reported that 13% (7/51) of neonates tested positive and were asymptomatic, with one requiring brief respiratory support for distress due to prematurity, and all recovered.

The studies conducted in Spain were limited to three studies conducted with different percentages of infection. In Spain, there was a 64% (314/489) rate of breastfeeding among participants, with 0.6% (2/314) of newborns testing positive for COVID-19. [Solís-García and colleagues \(2021\)](#)

reported that newborns breastfed by mothers diagnosed with COVID-19 infection did not contract the virus when tested after 14 days; however, one newborn tested positive and was asymptomatic 2 weeks later. There were single studies from Israel, Portugal, and Sweden during the search period, with researchers from Israel and Portugal reporting no coinfection to newborns with breastfeeding, and those from Sweden reporting that 1.1% (21/1,888) of newborns tested positive for COVID-19 infection after breastfeeding.

When the data are considered as a whole (see [Supplementary Table S1](#)), 93% (26/28) of the articles in this review provided information on the infection protocol implemented during the study, including infection control and education to parents. Researchers in the United States reported that mothers diagnosed with COVID-19 infection who implemented face mask use, handwashing, and washing of the breasts before breastfeeding did not transmit the virus to their neonates ([Breslin et al., 2020](#); [Dumitriu et al., 2021](#); [Popofsky et al., 2020](#); [Salvatore et al., 2020](#)). [Bertino et al.](#) stated that the risks and benefits were addressed with the mother and that ultimately the mother would make the decision to breastfeed. Specifically, [Dumitriu and colleagues](#) reported that one newborn tested positive because of an unmasked symptomatic mother. [Malhotra et al. \(2021\)](#) and [Pace et al. \(2021\)](#) found that of the newborns diagnosed with COVID-19, only one newborn in each study was symptomatic briefly and fully recovered.

Limitations

There are limitations to this review. The 28 studies needed a thorough review and discussion between the authors of this review for the count of neonates who were breastfed and the neonates who were reported diagnosed with COVID-19 infection. Overall, there was a low number of participants in the studies, the level of measurement of the studies was exploratory and descriptive in analysis, and the low-quality ranking of these studies does not provide evidence of causation. Another limitation is the limited diversity in the samples. The participants in the United States were predominantly reported as White or unknown/other races, with the exception of one study in which 40% of the participants identified as Latino/Hispanic and 22% as Black/non-Hispanic ([Malhotra et al., 2021](#)). COVID-19 information and protocols were evolving, which may have affected the identification of infants who were at risk for COVID-19.

Discussion

Early in 2020, reports of COVID-19 infection severity in pregnant women was a concern, especially because there was a reported 4.7% ($n = 7/148$) chance of horizontal transmission of the infection from the mother diagnosed with COVID-19 to the newborn; however, no neonatal deaths were reported ([Deniz & Tezer, 2020](#); [Walker et al., 2020](#)). At the start of the pandemic, mothers were separated from their newborns, and formula was often the choice for feedings ([Brown & Shenker,](#)

2021; Deniz & Tezer, 2020; Lavizzari et al., 2021; Walker et al., 2020). A CDC (2020c) survey of hospital practices later in 2020 showed that 32.8% of hospitals discouraged or did not support active breastfeeding, with hesitancy by providers, nurses, expectant mothers, or family for support for breastfeeding. More than 70% of breastfeeding mothers stopped breastfeeding because of a lack of support during the pandemic (Brown & Shenker, 2021).

Some benefits of breastfeeding include the provision of micro- and macronutrients, immunologic protection, and a positive impact on bonding between a mother and infant (Bartick et al., 2021; Holdren et al., 2019; Kim & Yi, 2020; Yang et al., 2019; Young & McGuire, 2020). Fox and colleagues (2020) reported that the breast milk of mothers diagnosed with COVID-19 infection contains IgA and IgM antibodies and COVID-19 infection–neutralizing qualities. Pace and colleagues (2021) reported that 80% of breast milk samples had SARS-CoV-2–specific IgG and IgA.

Researchers have also reported that the overall impact of separation of the newborn from their mother during the pandemic affects not only the newborn but the mother as well (Conti et al., 2021; Popofsky et al., 2020; Tomori et al., 2020). According to Wang et al. (2020), a 35-day separation of newborns from their mothers diagnosed with COVID-19 infection led to neonatal impairments in communication, gross motor, and personal–social development skills and that there was no evidence of transmission during breastfeeding. The infant formula marketing, shortage, and increased cost in the early stage of the pandemic may have been factors when mothers considered their options to breastfeed even with active COVID-19 infection (Mialon et al., 2021; van Tulleken et al., 2020).

Before the pandemic, worldwide, many mothers, including in the United States, were not breastfeeding infants for the first 2 years of a child’s life as recommended by the WHO (Bhattacharjee et al., 2021; WHO, 2020b). Before the pandemic, approximately 58.3% of mothers exclusively breastfed for at least the first 6 months of an infant’s life in the United States (CDC, 2020b). Although neonatal breastfeeding rates were essentially unchanged during the pandemic, there are no longitudinal data on continuity rates as the pandemic continued.

Villar et al. (2021) compared individuals who were pregnant and diagnosed with COVID-19 infection to those without infection and found increased morbidity and mortality for those diagnosed with COVID-19 infection. Pregnant women noted as overweight during their first visit for antenatal care and then diagnosed with COVID-19 infection had an increased risk for mortality, relative risk (RR) = 1.81, 95% confidence interval (CI) [1.48, 2.21] (Villar et al., 2021). Additionally, researchers reported increased risk of stillbirth (OR = 2.11; 95% CI [1.14, 3.90]) and preterm birth (OR = 1.82; 95% CI [1.38, 2.39]) in those pregnant and diagnosed with COVID-19 infection (Wei et al., 2021).

There were six vaccine manufacturers for COVID-19 considered for use in the United States, but pregnancy was an exclusion from initial clinical trials (Rasmussen et al., 2021).

Providing ongoing education to childbearing families on the benefits and risks of vaccination for COVID-19 is recommended

There were unintended vaccinations in those pregnant occurring in the Moderna and Pfizer trials; because the pregnancies and births are not yet complete, the results and discussion are not available at this time (Rasmussen et al., 2021). Currently, BioNTech is sponsoring a Phase 2/3 randomized trial that started in February 2021 for a SARS-CoV-2 RNA vaccine for women who are pregnant with results pending for August 2022 (BioNTech, 2021).

Implications for Nursing Practice

The Academy of Breastfeeding Medicine (2020) does support breastfeeding with safety measures to limit the spread of COVID-19 as a choice for parents and their newborns. The current recommendations from the CDC and WHO promote rooming-in, the initiation of breastfeeding within the first hour of life, and implementing infection control practices (CDC, 2021b; WHO, 2020a). To minimize the transmission of COVID-19 infection from the mother to the neonate, mothers who actively breastfeed should use infection control measures of (a) handwashing, (b) breast washing, and (c) mask wearing while caring for their newborns (Sullivan and Thompson, 2020).

ACOG and other major national organizations support the use of vaccination for COVID-19 in pregnancy (ACOG, 2021; AWHONN, 2021). The CDC also recommends vaccination for anyone pregnant, lactating, or attempting pregnancy (CDC, 2021a). According to Rottenstreich et al. (2022), there was a decreased risk for adverse outcomes for neonates born to mothers who were vaccinated. Therefore, nurses and other health care providers need to be aware of the need for support, education, and safety for neonates and breastfeeding individuals who are diagnosed with COVID-19 infection. Providing ongoing education to childbearing families on the benefits and risks of vaccination for COVID-19 is recommended.

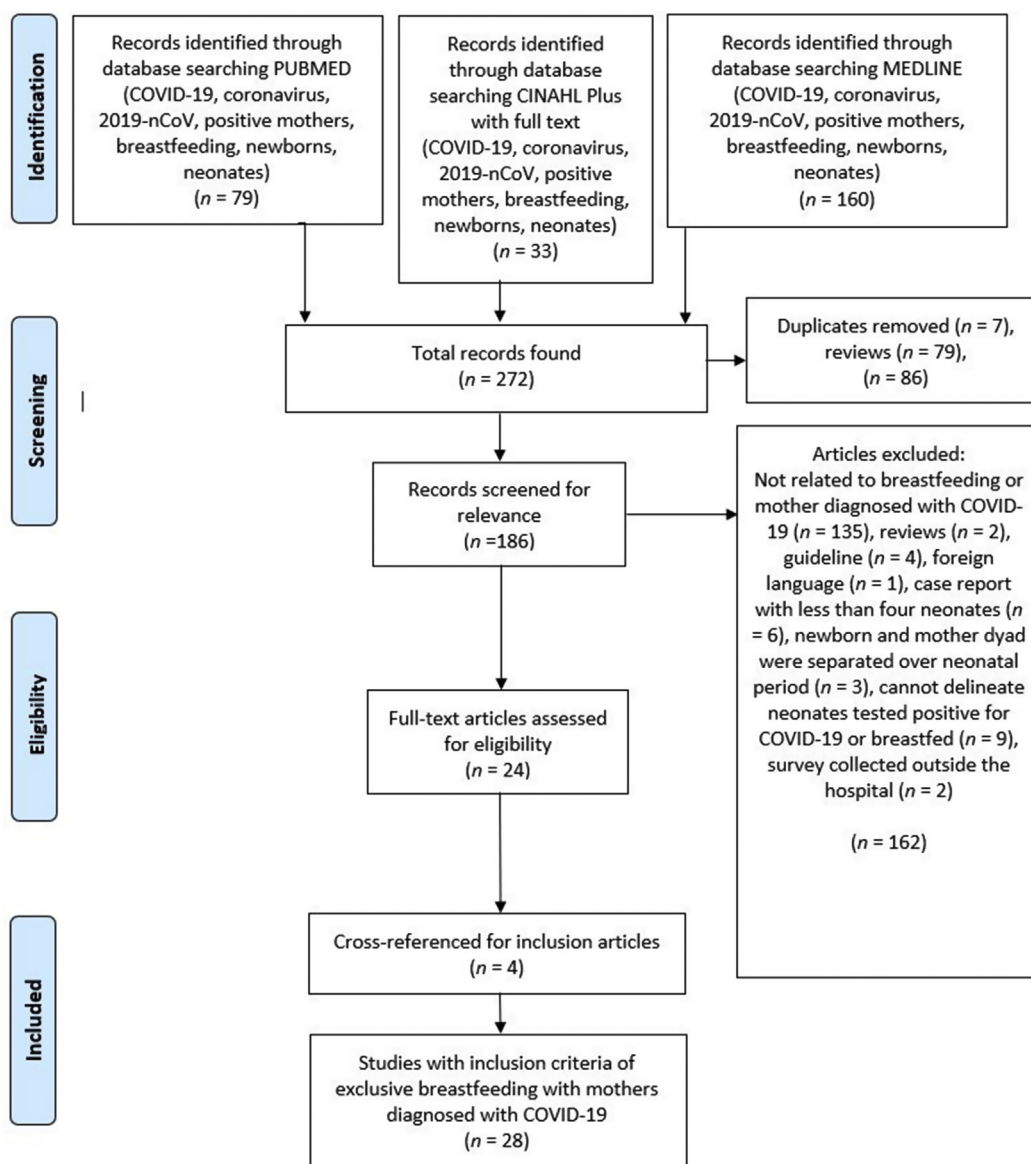
Implications for Future Research

Future research with longitudinal and randomized case–cohort studies is recommended to document and analyze risk factors in relation to health status for newborns. To learn more about the extent to which COVID-19 infection affects neonates in the United States, studies using repeat serologic testing, larger sample sizes in diverse populations, consistent neonatal testing mode and time, and statistical analyses for significance need to be conducted.

Conclusion

At the start of the pandemic, mothers diagnosed with COVID-19 infection were separated from their newborns,

FIGURE 1 FLOW DIAGRAM FOR THE LITERATURE SEARCH



and breastfeeding was not encouraged because of the potential risk of transmission (Amatya et al., 2020; Puopolo et al., 2020; Wu et al., 2020). As information regarding COVID-19 has evolved, these practices have changed, and less rigid protocols are in place. Women should be encouraged to discuss the risks of a COVID-19 infection during pregnancy and lactation with their health care providers. Because vaccination is widely available in the United States and recommended by all major health care organizations, all individuals of reproductive age should be encouraged to complete vaccination and participate in COVID-19 safety measures as appropriate. Nurses need to be aware of rapidly changing information

and provide current evidenced-based information to child-bearing families.

Supplementary Materials

Note: To access the supplementary material that accompanies this article, visit the online version of *Nursing for Women's Health* at <http://nwhjournal.org> and at <https://doi.org/10.1016/j.nwh.2022.03.010>.

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References

*References marked with an asterisk indicate studies included in the supplementary materials.

- Academy of Breastfeeding Medicine. (2020, March 10). *ABM statement on coronavirus 2019 (COVID-19)*. <https://www.bfmed.org/abm-statement-coronavirus>
- Amatya, S., Corr, T. E., Gandhi, C. K., Glass, K. M., Kresch, M. J., Mujsce, D. J., ... Kaiser, J. R. (2020). Management of newborns exposed to mothers with confirmed or suspected COVID-19. *Journal of Perinatology*, 40(7), 987–996. <https://doi.org/10.1038/s41372-020-0695-0>
- American College of Obstetricians and Gynecologists. (2021, December 21). *Covid-19 vaccination during pregnancy is key to saving lives, medical experts urge*. Retrieved January 22, 2022, from <https://www.acog.org/news/news-releases/2021/12/covid-19-vaccination-during-pregnancy-is-key-to-saving-lives-statement>
- American College of Obstetricians and Gynecologists. (2022, January 26). *Coronavirus (COVID-19), pregnancy, and breastfeeding: A message for patients*. ACOG. Retrieved January 30, 2022, from <https://www.acog.org/womens-health/faqs/coronavirus-covid-19-pregnancy-and-breastfeeding>
- Anand, P., Yadav, A., Debata, P., Bachani, S., Gupta, N., & Gera, R. (2021). Clinical profile, viral load, management and outcome of neonates born to COVID 19 positive mothers: A tertiary care centre experience from India. *European Journal of Pediatrics*, 180(2), 547–559. <https://doi.org/10.1007/s00431-020-03800-7>
- Anderson, C. E., Whaley, S. E., Crespi, M., Wang, M. C., & Chaparro, M. P. (2020). Every month matters: Longitudinal associations between exclusive breastfeeding duration, child growth and obesity among WIC-participating children. *Journal of Epidemiology and Community Health*, 74(10), 785–791. <https://doi.org/10.1136/jech-2019-213574>
- Association of Women's Health, Obstetric and Neonatal Nurses. (2021, November 3). *COVID-19 vaccination if you are pregnant or breastfeeding* [Consensus statement]. https://i7g4f9j6.stackpathcdn.com/wp-content/uploads/2021/11/10165751/COVID_vaccine_Patients_UPDATED_11-03-21_ENGLISH.pdf
- Bartick, M. C., Valdés, V., Giusti, A., Chapin, E. M., Bhana, N. B., Hernández-Aguilar, M., ... Feldman-Winter, L. (2021). Maternal and infant outcomes associated with maternity practices related to COVID-19: The COVID mothers study. *Breastfeeding Medicine*, 16(3), 189–199. <https://doi.org/10.1089/bfm.2020.0353>
- Bertino, E., Moro, G. E., De Renzi, G., Viberti, G., Cavallo, R., Coscia, A., ... Collaborative Research Group on SARS-CoV-2 in Human Milk. (2020). Detection of SARS-CoV-2 in milk from COVID-19 positive mothers and follow-up of their infants. *Frontiers in Pediatrics*, 8, Article 597699. <https://doi.org/10.3389/fped.2020.597699>
- Bhattacharjee, N. V., Schaeffer, L. E., Hay, S. I., & Local Burden of Disease Exclusive Breastfeeding Collaborators. (2021). Mapping inequities in exclusive breastfeeding in low- and middle-income countries, 2000–2018. *Nature Human Behaviour*, 5, 1027–1045. <https://doi.org/10.1038/s41562-021-01108-6>
- *Biasucci, G., Cannalire, G., Raymond, A., Capra, M. E., Benenati, B., Vadacca, G., ... Bonini, R. (2020). Safe perinatal management of neonates born to SARS-CoV-2 positive mothers at the epicenter of the Italian epidemic. *Frontiers in Pediatrics*, 8, Article 565522. <https://doi.org/10.3389/fped.2020.565522>
- BioNTech. (2021, February 15). *Study to evaluate the safety, tolerability, and immunogenicity of SARS COV-2 RNA vaccine candidate (BNT162b2) against COVID-19 in healthy pregnant women 18 years of age and older*. ClinicalTrials.gov. Retrieved January 23, 2022, from <https://clinicaltrials.gov/ct2/show/results/NCT04754594>
- Breslin, N., Baptiste, C., Gyamfi-Bannerman, C., Miller, R., Martinez, R., Bernstein, K., ... Goffman, D. (2020). Coronavirus disease 2019 infection among asymptomatic and symptomatic pregnant women: Two weeks of confirmed presentations to an affiliated pair of New York City hospitals. *American Journal of Obstetrics & Gynecology MFM*, 2(2 Suppl), Article 100118. <https://doi.org/10.1016/j.ajogmf.2020.100118>
- Brown, A., & Shenker, N. (2021). Experiences of breastfeeding during COVID-19: Lessons for future practical and emotional support. *Maternal & Child Nutrition*, 17(1), Article e13088. <https://doi.org/10.1111/mcn.13088>
- *Capozza, M., Salvatore, S., Baldassarre, M. E., Inting, S., Panza, R., Fanelli, M., ... Laforgia, N. (2021). Perinatal transmission and outcome of neonates born to SARS-CoV-2-positive mothers: The experience of 2 highly endemic Italian regions. *Neonatology*, 118(6), 665–671. <https://doi.org/10.1159/000518060>
- Centers for Disease Control and Prevention. (2020a, January 21). *First travel-related case of 2019 novel coronavirus detected in the United States*. <https://www.cdc.gov/media/releases/2020/p0121-novel-coronavirus-travel-case.html>
- Centers for Disease Control and Prevention. (2020b, Sept. 17). *Breastfeeding report card: United States, 2020*. <https://www.cdc.gov/breastfeeding/data/reportcard.htm>
- Centers for Disease Control and Prevention. (2020c, November 27). *Implementation of hospital practices supportive of breastfeeding in the context of COVID-19 — United States, July 15–August 20, 2020*. *MMWR. Morbidity and Mortality Weekly Report*, 69(47), 1767–1770. <https://doi.org/10.15585/mmwr.mm6947a3>
- Centers for Disease Control and Prevention. (2021a, December 2). *Covid-19 vaccines while pregnant or breastfeeding*. Retrieved March 3, 2022, from <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/pregnancy.html>
- Centers for Disease Control and Prevention. (2021b, December 12). *Breastfeeding and caring for newborn if you have COVID-19*. <https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/pregnancy-breastfeeding.html>
- *Congdon, J. L., Kair, L. R., Flaheman, V. J., Wood, K. E., LoFrumento, M. A., Nwabasi-Iwuh, E., & Phillip, C. A. (2021). Management and early outcomes of neonates born to women with SARS-CoV-2 in 16 U. S. hospitals. *American Journal of Perinatology*, 38, 622–631. <https://doi.org/10.1055/s-0041-1726036>
- Conti, M. G., Natale, F., Stolfi, I., Pedicino, R., Boscarino, G., Ajassa, C., ... Terrin, G. (2021). Consequences of early separation of maternal-newborn dyad in neonates born to SARS-CoV-2 positive mothers: An observational study. *International Journal of Environmental Research and Public Health*, 18(11), Article 5899. <https://doi.org/10.3390/ijerph18115899>
- Costa, A., Goes, C., & Gama, P. (2020). Breastfeeding importance and its therapeutic potential against SARS-CoV-2. *Physiological Reports*, 9(3), Article e14744. <https://doi.org/10.14814/phy2.14744>
- Czosnykowska-Lukacka, M., Lis-Kuberka, J., Królak-Olejnik, B., & Orczyk-Pawilowicz, M. (2020). Changes in human milk immunoglobulin profile during prolonged lactation. *Frontiers in Pediatrics*, 8, Article 428. <https://doi.org/10.3389/fped.2020.00428>
- Dang, D., Dearholt, S., Bissett, K., Ascenzi, J., & Whalen, M. (2022). *In Johns Hopkins evidence-based practice for nurses and healthcare professionals: Model and guidelines* (4th ed.). Sigma Theta Tau International.

- Deniz, M., & Tezer, H. (2020). Vertical transmission of SARS-CoV-2: A systemic review. *Journal of Maternal-Fetal & Neonatal Medicine*. <https://doi.org/10.1080/14767058.2020.1793322>
- *Donati, S., Corsi, E., Salvatore, M. A., Maraschini, A., Bonassisa, S., Casucci, P., ... Zullino, S. (2021). Childbirth care among SARS-CoV-2 positive women in Italy. *International Journal of Environmental Research and Public Health*, 18(8), Article 4244. <https://doi.org/10.3390/ijerph18084244>
- Dumitriu, D., Emeruwa, U. N., Hanft, E., Liao, G. V., Ludwig, E., Walzer, L., ... Gyamfi-Bannerman, C. (2021). Outcomes of neonates born to mothers with severe acute respiratory syndrome coronavirus 2 infection at a large medical center in New York City. *JAMA Pediatrics*, 175(2), 157–167. <https://doi.org/10.1001/jamapediatrics.2020.4298>
- *Farghaly, M. A. A., Kupferman, F., Castillo, F., & Kim, R. M. (2020). Characteristics of newborns born to SARS-CoV-2-positive mothers: A retrospective cohort study. *American Journal of Perinatology*, 37(13), 1310–1316. <https://doi.org/10.1055/s-0040-1715862>
- *Ferrazzi, E., Frigerio, L., Savasi, V., Vergani, P., Prefumo, F., Barresi, S., ... Cetin, I. (2020). Vaginal delivery in SARS-CoV-2-infected pregnant women in northern Italy: A retrospective analysis. *BJOG*, 127(9), 1116–1121. <https://doi.org/10.1111/1471-0528.16278>
- *Ferreira, M., Garcia, C., & Barroso, R. (2021). Characteristics of newborns from mothers with SARS-CoV-2 infection in a Portuguese hospital. *Acta Médica Portuguesa*, 34(10), 650–656. <https://doi.org/10.20344/amp.16180>
- Fox, A., Marino, J., Amanat, F., Krammer, F., Hahn-Halbrook, J., Zolla-Pazner, S., & Powell, R. L. (2020). Robust and specific secretory IgA against SARS-CoV-2 detected in human milk. *iScience*, 23(11), Article 101735. <https://doi.org/10.1016/j.isci.2020.101735>
- Holdren, S., Fair, C., & Lehtonen, L. (2019). A qualitative cross-cultural analysis of NICU care culture and infant feeding in Finland and the U.S. *BMC Pregnancy and Childbirth*, 19, Article 345. <https://doi.org/10.1186/s12884-019-2505-2>
- Kalamdani, P., Kalathingal, T., Manerkar, S., & Mondkar, J. (2020). Clinical profile of SARS-CoV-2 infected neonates from a tertiary government hospital in Mumbai, India. *Indian Pediatrics*, 57(12), 1143–1146. <https://doi.org/10.1007/s13312-020-2070-9>
- Kim, S. Y., & Yi, D. Y. (2020). Components of human breast milk: From macronutrient to microbiome and microRNA. *Clinical and Experimental Pediatrics*, 63(8), 301–309. <https://doi.org/10.3345/cep.2020.00059>
- *Kunjumon, B., Wachtel, E. V., Lumba, R., Quan, M., Remon, J., Louie, M., ... Hanna, N. (2021). Breast milk and breastfeeding of infants born to SARS-CoV-2 positive mothers: A prospective observational cohort study. *American Journal of Perinatology*, 38(11), 1209–1216. <https://doi.org/10.1055/s-0041-1731451>
- Lavizzari, A., Klingenberg, C., Profit, J., Zupancic, J. A. F., Davis, A. S., Mosca, F., ... The International Neonatal COVID-19 Consortium. (2021). International comparison of guidelines for managing neonates at the early phase of the SARS-CoV-2 pandemic. *Pediatric Research*, 89, 940–951. <https://doi.org/10.1038/s41390-020-0976-5>
- Malhotra, Y., Knight, C., Patil, U. P., Sutton, H., Sinclair, T., Rossberg, M. C., ... Hand, I. (2021). Impact of evolving practices on SARS-CoV-2 positive mothers and their newborns in the largest public healthcare system in America. *Journal of Perinatology*, 41(5), 970–980. <https://doi.org/10.1038/s41372-021-01023-8>
- *Mejía Jiménez, I., Salvador López, R., García Rosas, E., Rodríguez de la Torre, I., Montes García, J., de la Cruz Conty, M. L., ... Spanish Obstetric Emergency Group. (2021). Umbilical cord clamping and skin-to-skin contact in deliveries from women positive for SARS-CoV-2: A prospective observational study. *BJOG*, 128(5), 908–915. <https://doi.org/10.1111/1471-0528.16597>
- Mialon, M., Pinsky, I., & Schmidt, L. (2021). How food and beverage companies leveraged the great recession: Lessons for the COVID-19 pandemic. *BMJ Global Health*, 6(9), Article e007146. <https://doi.org/10.1136/bmjgh-2021-007146>
- *Nayak, M. K., Panda, S. K., Panda, S. S., Rath, S., Ghosh, A., & Mohakud, N. K. (2021). Neonatal outcomes of pregnant women with COVID-19 in a developing country setup. *Pediatrics and Neonatology*, 62(5), 499–505. <https://doi.org/10.1016/j.pedneo.2021.05.004>
- *Norman, M., Navér, L., Söderling, J., Ahlberg, M., Hervius Askling, H., Aronsson, B., ... Stephansson, O. (2021). Association of maternal SARS-CoV-2 infection in pregnancy with neonatal outcomes. *JAMA*, 325(20), 2076–2086. <https://doi.org/10.1001/jama.2021.5775>
- *Olivini, N., Calò Carducci, F. I., Santilli, V., De Ioris, M. A., Scarselli, A., Alario, D., ... Campana, A. (2020). A neonatal cluster of novel coronavirus disease 2019: Clinical management and considerations. *Italian Journal of Pediatrics*, 46(1), Article 180. <https://doi.org/10.1186/s13052-020-00947-9>
- Pace, R. M., Williams, J. E., Järvinen, K. M., Belfort, M. B., Pace, C., Lackey, K. A., ... McGuire, M. K. (2021). Characterization of SARS-CoV-2 RNA, antibodies, and neutralizing capacity in milk produced by women with COVID-19. *mBio*, 12(1), Article e03192-20. <https://doi.org/10.1128/mBio.03192-20>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, Article n71. <https://doi.org/10.1136/bmj.n71>
- Popofsky, S., Noor, A., Leavens-Maurer, J., Quintos-Alagheband, M. L., Mock, A., Vinci, A., ... Krilov, L. (2020). Impact of maternal severe acute respiratory syndrome coronavirus 2 detection on breastfeeding due to infant separation at birth. *Journal of Pediatrics*, 226, 64–70. <https://doi.org/10.1016/j.jpeds.2020.08.004>
- Puopolo, K. M., Hudak, M. L., Kimberlin, D. W., & Cummings, J. (2020, April 2). Initial guidance: Management of infants born to mothers with COVID-19. *American Academy of Pediatrics Committee on Fetus and Newborn, Section on Neonatal Perinatal Medicine, and Committee on Infectious Diseases*. https://www.tn.gov/content/dam/tn/health/documents/cedep/novel-coronavirus/AAP_COVID-19-Initial-Newborn-Guidance.pdf
- Rasmussen, S. A., Kelley, C. F., Horton, J. P., & Jamieson, D. J. (2021). Coronavirus disease 2019 (COVID-19) vaccines and pregnancy. *Obstetrics & Gynecology*, 137(3), 408–414. <https://doi.org/10.1097/aog.0000000000004290>
- *Ronchi, A., Pietrasanta, C., Zavattoni, M., Saruggia, M., Schena, F., Sinelli, M. T., ... Pagni, L. (2021). Evaluation of rooming-in practice for neonates born to mothers with severe acute respiratory syndrome coronavirus 2 infection in Italy. *JAMA Pediatrics*, 175(3), 260–266. <https://doi.org/10.1001/jamapediatrics.2020.5086>
- Rottenstreich, M., Sela, H. Y., Rotem, R., Kadish, E., Wiener-Well, Y., & Grisaru-Granovsky, S. (2022). Covid-19 vaccination during the third trimester of pregnancy: Rate of vaccination and maternal and neonatal outcomes, a multicentre retrospective cohort study. *BJOG*, 129(2), 248–255. <https://doi.org/10.1111/1471-0528.16941>
- *Sabharwal, V., Bartolome, R., Hassan, S. A., Levesque, B. M., Camelo, I. Y., Wachman, E. M., ... Parker, M. G. (2021). Mother–infant dyads with covid-19 at an urban, safety-net hospital: Clinical manifestations and birth outcomes. *American Journal of Perinatology*, 38(7), 741–746. <https://doi.org/10.1055/s-0041-1726429>
- Salvatore, C. M., Han, J. Y., Acker, K. P., Tiwari, P., Jin, J., Brandler, M., ... DeLaMora, P. (2020). Neonatal management and outcomes during the COVID-19 pandemic: An observation cohort study. *The Lancet. Child & Adolescent Health*, 4(10), 721–727. [https://doi.org/10.1016/S2352-4642\(20\)30235-2](https://doi.org/10.1016/S2352-4642(20)30235-2)
- *Shlomai, N. O., Kasirer, Y., Strauss, T., Smolkin, T., Marom, R., Shinwell, E. S., ... Eventov-Friedman, S. (2021). Neonatal

- SARS-CoV-2 infections in breastfeeding mothers. *Pediatrics*, 147(5), Article e2020010918. <https://doi.org/10.1542/peds.2020-010918>
- Solís-García, G., Gutiérrez-Vélez, A., Pescador Chamorro, I., Zamora-Flores, E., Vigil-Vázquez, S., Rodríguez-Corrales, E., & Sánchez-Luna, M. (2021). Epidemiology, management and risk of SARS-CoV-2 transmission in a cohort of newborns born to mothers diagnosed with COVID-19 infection. *Anales de Pediatría*, 94(3), 173–178. <https://doi.org/10.1016/j.anpede.2020.12.006>
- Sullivan, S. E., & Thompson, L. A. (2020). Best practices for COVID-19–positive or exposed mothers—Breastfeeding and pumping milk. *JAMA Pediatrics*, 174(12), Article 1228. <https://doi.org/10.1001/jamapediatrics.2020.3341>
- *Thanigainathan, S., Kaliyaperumal, V., Sivanandan, S., Rengaraj, S., Dhodapkar, R., & Bethou, A. (2021). Is SARS-CoV-2 transmitted through breastfeeding?. *Indian Journal of Pediatrics*, 88(8), 800–801. <https://doi.org/10.1007/s12098-021-03681-0>
- Tomori, C., Gribble, K., Palmquist, A. L., Ververs, M. T., & Gross, M. S. (2020). When separation is not the answer: Breastfeeding mothers and infants affected by COVID-19. *Maternal & Child Nutrition*, 16(4), Article e13033. <https://doi.org/10.1111/mcn.13033>
- Tromp, I., Kieft-de Jong, J., Raat, H., Jaddoe, V., Franco, O., Hofman, A., ... Moli, H. (2017). Breastfeeding and the risk of respiratory tract infections after infancy: The Generation R study. *PLOS ONE*, 12(2), Article e0172763. <https://doi.org/10.1371/journal.pone.0172763>
- van Tulcken, C., Wright, C., Brown, A., McCoy, D., & Costello, A. (2020). Marketing of breastmilk substitutes during the COVID-19 pandemic. *The Lancet*, 396(10259), Article e58. [https://doi.org/10.1016/S0140-6736\(20\)32119-X](https://doi.org/10.1016/S0140-6736(20)32119-X)
- *Vila-Candel, R., Mena-Tudela, D., Gómez-Seguí, A., Asensio-Tomás, N., Cervera-Gasch, A., & Herraiz-Soler, Y. (2021). Manejo del parto, el puerperio y la lactancia en mujeres positivas para SARS-CoV-2. Estudio multicéntrico en la Comunidad Valenciana [Management of labour, puerperium, and lactation in SARS-CoV-2 positive women. Multicentric study in the Valencian community]. *Enfermería Clínica*, 31(3), 184–188. <https://doi.org/10.1016/j.enfcli.2021.01.006>
- Villar, J., Ariff, S., Gunier, R. B., Thiruvengadam, R., Rauch, S., Kholin, A., ... Papageorghiou, A. T. (2021). Maternal and neonatal morbidity and mortality among pregnant women with and without COVID-19 infection. *JAMA Pediatrics*, 175(8), 817–826. <https://doi.org/10.1001/jamapediatrics.2021.1050>
- Walker, K. F., O'Donoghue, K., Grace, N., Dorling, J., Comeau, J. L., Li, W., & Thornton, J. G. (2020). Maternal transmission of SARS-CoV-2 to the neonate, and possible routes for such transmission: A systematic review and critical analysis. *BJOG*, 127(11), 1324–1336. <https://doi.org/10.1111/1471-0528.16362>
- Wang, Y., Chen, L., Wu, T., Shi, H., Li, Q., Jiang, H., ... Qiao, J. (2020). Impact of Covid-19 in pregnancy on mother's psychological status and infant's neurobehavioral development: A longitudinal cohort study in China. *BMC Medicine*, 18(1), Article 347. <https://doi.org/10.1186/s12916-020-01825-1>
- Wei, S. Q., Liu, S., & Auger, N. (2021). The impact of COVID-19 on pregnancy outcomes: A systemic review and meta-analysis. *CMAJ: Canadian Medical Association Journal*, 193(16), E540–E548. <https://doi.org/10.1503/cmaj.202604>
- World Health Organization. (2020a, March 11). *WHO Director-General's opening remarks at the media briefing on COVID-19—11 March 2020*. <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020>
- World Health Organization. (2020b, June). *Breastfeeding and COVID-19*. <https://www.who.int/news-room/commentaries/detail/breast-feeding-and-covid-19>
- Wu, Y., Liu, C., Dong, L., Zhang, C., Chen, Y., Liu, J., ... Huang, H. (2020). Coronavirus disease 2019 among pregnant Chinese women: Case series data on the safety of vaginal birth and breastfeeding. *BJOG*, 127, 1109–1115. <https://doi.org/10.1111/1471-0528.16276>
- Yang, Y., Brandon, D., Lu, H., & Cong, X. (2019). Breastfeeding experiences and perspectives on support among Chinese mothers separated from their hospitalized preterm infants: A qualitative study. *International Breastfeeding Journal*, 14, Article 45. <https://doi.org/10.1186/s13006-019-0242-9>
- Young, L., & McGuire, W. (2020). Immunologic properties of human milk and clinical implications in the neonatal population. *NeoReviews*, 21(12), e809–e816.