

**COMMENTARY**

The COVID-19 liquid gold rush: Critical perspectives of human milk and SARS-CoV-2 infection

Aunchalee E. L. Palmquist¹ | Ifeyinwa V. Asiodu² | Elizabeth A. Quinn³

¹Department of Maternal and Child Health, Carolina Global Breastfeeding Institute, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

²School of Nursing, University of California San Francisco, San Francisco, California

³Department of Anthropology, Washington University in St. Louis, St. Louis, Missouri

Correspondence

Aunchalee E. L. Palmquist, Department of Maternal and Child Health, Carolina Global Breastfeeding Institute, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA.

Email: apalmquist@unc.edu

Breastfeeding and the provision of human milk are associated with positive maternal and infant health outcomes immediately postpartum, across the life course, and across generations (AAP, 2012; Victora et al., 2016). Over the last two decades, there have been groundbreaking advances in the areas of human milk science and infectious diseases (Colt et al., 2017; Foeller et al., 2020; WHO, 2016). In the wake of COVID-19, clinical case reports, retrospective and prospective studies, and systematic reviews related to perinatal maternal and child transmission of SARS-CoV-2 have been generated at an astonishing rate (Center for Humanitarian Health, 2020). Scientists around the world have united in a liquid gold rush to study human milk and COVID-19. But, to what end?

A majority of the studies have been designed to determine if SARS-CoV-2 can be transmitted to an infant via human milk (WHO, n.d.). Some scientists are investigating maternal immune response to SARS-CoV-2, particularly how milk bioactives may modulate vertical transmission or otherwise affect clinical presentation/disease trajectories of infants (Fox et al., 2020 preprint). Others are engaged in research to ascertain whether Holder pasteurization or other techniques may be used to maintain a safe supply of donor human milk (assuming SARS-CoV-2 is even in the milk). The quest for effective COVID-19 therapeutics raises questions about the possible excretion of drugs into milk, the relative risks of infant exposures to experimental drugs via milk, and the ethics of including pregnant and lactating people in clinical trials for COVID-19 medicines and vaccines.

It is not easy to conduct human milk research during a pandemic. Recent systematic reviews highlight a consistent lack of quality evidence, largely due to small sample size (Lackey et al., 2020; Martins-Filho, Santos, & Santos, 2020). Of the approximately 50 COVID-19+ individuals who have had their milk tested, with some individuals having donated multiple samples, scientists were only able to find viral RNA in a small percentage, and repeat samples from the same individuals did not consistently yield identification of viral RNA. Further, viral RNA does not mean that the milk has any infectious SARS-CoV-2 in it (Chambers et al., 2020 preprint). Collecting milk samples for these kinds of studies is also difficult, given high risk of samples becoming contaminated through droplets the air, skin, or surfaces and containers. Lackey et al. (2020) note there are major gaps in the published methodology, particularly detailing how the milk samples were collected and analyzed, making it difficult to rule out external contagion as the source of viral RNA. Even so, they assert that methodological issues, such as matrix interference in the samples from the milk itself, rather than external sources of contamination probably explain the absence of detectable virus.

An even greater challenge is translating the limited and poor-quality evidence into global public health and clinical practice guidance, a process that is fraught with uncertainty. Because breastfeeding and human milk are so critical to maternal and infant health outcomes, especially during public health emergencies (Gribble, McGrath, MacLaine, & Lhotska, 2011; Gribble 2017, developing recommendations for infant feeding must rely on complex

decision-making in which the risks, benefits, and costs of available alternatives are weighed (Angood, 2017). Currently, the WHO states: "...that mothers with suspected or confirmed COVID-19 should be encouraged to initiate and continue breastfeeding. From the available evidence, mothers should be counselled that the benefits of breastfeeding substantially outweigh the potential risks of transmission." (WHO, 2020, p. 42).

Nevertheless, clinical and laboratory-based COVID-19 studies are being used to cast suspicion on breastfeeding and the "quality" of human milk. For example, Wu et al., 2020 (p. 5) conclude that: "Our advice is against the use of breastfeeding even through breast expression; mothers with COVID-19 should not breastfeed until after full recovery, when breast milk tests negative for the virus." Fan et al. (2020, p. 6): "In our cases, breastfeeding is discouraged even though we did not detect SARS-CoV-2 in consecutive breastmilk samples during follow-up." Groß et al. (2020) suggest that *more* evidence is needed *before* health authorities can recommend "whether mothers with COVID-19 should breastfeed (Groß et al., 2020, p. 1758)" despite inconsistent evidence of SARS-CoV-2 RNA in multiple samples of one person's milk. Even influential global health and healthcare authorities have put forth recommendations that contradict the WHO interim guidance for breastfeeding with COVID-19 infection (Tomori, Gribble, Palmquist, Ververs, & Gross, 2020). Unlike Ebola, there is no consistent evidence yet that infants who acquire SARS-CoV-2 infection will experience severe adverse outcomes, at least if they have access to responsive quality health care (Walker et al., 2020). When critical care is needed and healthcare resources are limited, breastfeeding confers immunological protection to help infants have best chances of survival (WHO, 2020). Given all that is known about passive immunity and the evolutionary significance of human lactation in newborn adaptation to novel infections, and knowing the importance of breastfeeding in emergencies, how do we parse studies that portray breastfeeding and human milk as expendable during this pandemic?

Breastfeeding has long been at the center of infant feeding controversies that are deeply rooted in ideologies about mothers being intrinsically, biologically, a danger to their infants (Hausman, 2011; López, 2019; Palmquist, 2017; Palmquist, 2020; Tomori, 2015; Tomori, Palmquist, & Dowling, 2016). As illustrated above, much of human milk science remains firmly grounded in these ideologies and, wittingly or not, reproduces them. The fact is that simply isolating virus in human milk neither leads to more straightforward infant feeding recommendations (Tomori et al., 2020) nor does it necessarily lead to the desired behavioral

outcomes (Tuthill, Tomori, Natta, & Coleman, 2019; Van Hollen, 2011).

The consequences of promoting breastfeeding cessation among infants at risk of perinatal HIV are instructive for COVID-19. By the mid-1980s human immunodeficiency virus (HIV) had become global pandemic. The initial WHO guidance recommended that breastfeeding continue, particularly in places where lack of access to clean water and a sustainable supply of infant formula would increase the risks of infant death due to diarrheal disease, acute respiratory infections, and malnutrition (WHO 1987). Early clinical studies estimated that the risk of transmission during breastfeeding was 29% to 36%, but that this risk was relative to both the severity and timing of maternal infection (Nduati & John, 1995). In response to a growing number of perinatal HIV cases in Botswana, the Ministry of Health (MoH) implemented a large-scale formula feeding program to prevent HIV transmission through breastfeeding. Safeguards were implemented to offset the risks of formula feeding, such as ensuring caregivers had access to clean water, formula distribution in community clinics, and counseling about safer formula preparation and feeding.

The effects of replacement feeding were not as expected, however. A large randomized control trial for perinatal HIV showed no net benefit of formula feeding in infant morbidity or mortality at 18 months (Thior et al., 2006). Moreover, the unintended consequences of this intervention were cast into sharp relief after a massive flooding event in 2006 where nearly all hospital admissions and deaths were among formula fed infants (Arvelo et al., 2010; Creek et al., 2010; Mach et al., 2009). This dual public health catastrophe raised serious concerns about the relative ethics and safety of replacement feeding for HIV, as well as the need for comprehensive policies, guidance, and programming for infant feeding in emergencies (Angood, 2017). Today, the WHO (2016) recommends that HIV-positive mothers continue to exclusively breastfeed for the first 6 months, along with combined anti-retroviral therapy (cART) whenever available, especially in areas where formula feeding is not *acceptable, feasible, affordable, sustainable, and safe*. Experts have argued more recently that failing to support informed decision-making for breastfeeding in the context of HIV infection, particularly in the U.S. where high-quality HIV testing and cART are readily available, is unethical (Gross, Taylor, Tomori, & Coleman, 2019).

With this said, there tends to be a group of scientists and healthcare professionals that generally operate as if their work is neither political nor biased. Yet, anthropologists and others have produced decades of scholarship describing how science and biomedicine are inherently political and biased (Benton, 2016; Franklin, 1995; Hahn &

Kleinman, 1983; Hardeman, Murphy, Karbeah, & Kozhimannil, 2018; Lock & Nguyen 2010; Martin, 2016; Rhodes, 1990; Sangaramoorthy, 2014; Skloot, 2011; Tallbear, 2013; Wilce Jr., 2003). Black, Indigenous, People of Color (BIPOC) scholars of have also drawn critical attention to how racism and anti-Blackness in science and medicine have been weaponized over centuries to maintain white supremacy through reproductive harm (Bridges, 2011; Davis-Floyd, Gutschow, & Schwartz, 2020; McLemore et al., 2019; Mullings & Wali, 2001; Owens & Fett, 2019; Roberts, 2011; Torres, 2019). COVID-19 has only amplified these biases (Hall et al., 2020), and there is mounting evidence that the science used to support perinatal separation policies for COVID-19, including strongly advising against breastfeeding or provision of human milk with SARS-CoV-2 infection (Tomori et al., 2020) are disproportionately harming BIPOC (Allers, 2020; Davis-Floyd et al., 2020; Furlow, 2020a, 2020b; Thayer this issue). Unequivocal recommendations to disrupt lactation due to COVID-19 reveal a blatant disregard of the potential harms that hang in the balance for parents and infants. It reflects a willingness to make infant feeding recommendations uncritically, ahistorically, and without regard for the basic human right to informed-decision making and patient-centered care (Tomori et al., 2020).

The largest geographic concentration of human milk laboratories and scientific training centers for human milk research are located in North America. Disparities in COVID-19 cases in the U.S. and Canada provide a stark reminder of how racism, colonialism, xenophobia, and all the related structural inequities, which are also embedded in science and medicine, disproportionately harm BIPOC (Hooper, Nápoles, & Pérez-Stable, 2020; Poteat, Millett, Nelson, & Beyrer, 2020; van Dorn, Cooney, & Sabin, 2020). Human milk scientists studying SARS-CoV-2 must reckon with the limitations and unintended, yet predictable, consequences of extractive clinical and laboratory-based studies

that do not adequately account for context, power and privilege, racism, colonialism, or nuance in designing human milk studies and interpreting scientific data. The politics that permeate scientific studies of human milk are made visible by interrogating fundamental assumptions driving the research questions, study methodologies, (in) consistencies in interpretation of findings across the literature, and lack of diversity, equity, and inclusion among the study participants and within investigator teams. Like other science, technology, and engineering fields, the field of human milk research is characterized by inequitable access to capital, resources, laboratory space, institutional infrastructures, to educational and training opportunities, and most importantly, access to human milk. There are serious racial disparities in access, power, and privilege that continue to drive human milk research across this global and interdisciplinary field, which is in many cases is extractive, mired in financial conflicts of interest, and largely disengaged from conversations regarding broader political economic contexts of the work. When the scientific teams of clinical research studies do not include BIPOC as principal investigators, fail to engage in ethical, community-centered, co-creation of biobanks and research studies, and do not articulate a commitment to racial equity in the research enterprises, they risk simply reproducing harmful, and deeply racist scientific enterprises. Anti-racist, decolonized methodologies and ethical funding streams are needed in this work (McLemore et al., 2019; Scott, Bray, & McLemore, 2020).

Perhaps one of the most critical perspectives that anthropology and other disciplines can offer is that studying human milk outside of human lived experiences is not only extremely limited, it is potentially harmful. Anthropologists have long studied both endemic and emergent infectious diseases as one way of understanding the confluence of ecological, biological, and sociocultural factors that have shaped human evolutionary history, biological variation, and contemporary disease patterns (Inhorn &

TABLE 1 Key points for studying human milk in the context of COVID

- 1 Breastfeeding and human milk are critical to maternal and infant health outcomes, especially during public health emergencies; recommendations for infant feeding must rely on complex decision-making in which the risks, benefits, and costs of available alternatives are weighed.
- 2 Of the COVID-19+ individuals who had milk tested, viral RNA was only detected in a small percentage, and repeat samples from the same individuals did not consistently yield identification of viral RNA; there is no evidence that this RNA is infectious.
- 3 There is considerable evidence that the science used to support perinatal separation policies for COVID-19, including strongly advising against breastfeeding or provision of human milk with SARS-CoV-2 infection are disproportionately harming BIPOC.
- 4 Structural racism directly and indirectly perpetuates problematic cultural ideologies about the risks of breastfeeding and human milk, leading to obstetric violence and harm among Black, Indigenous, and People of Color families during the COVID-19 pandemic.
- 5 Human ecological studies of human milk, in which human milk studies are co-created with the people whose milk is under investigation and where study findings are interpreted in the context of human lived experiences, offer conceptual and methodological alternatives to more extractive, reductionistic, and racist scientific approaches.

Brown, 1990; Sangaramoorthy, 2020; Zuckerman, Harper, Barrett, & Armelagos, 2014). Anthropological studies of human milk provide clues to the breadth and depth of human biological diversity and adaptability (Hinde & Milligan, 2011; Klein et al., 2018; Miller 2018; Miller et al., 2013; Power & Schulkin, 2016; Quinn 2016; Quinn & Childs, 2017). Research is needed that more fully contextualizes lactation within the complexity of COVID-19 maternal-infant disease dynamics, in which human milk as part of a more holistic picture of diverse maternal-infant responses to infection (Table 1). Human milk cannot be understood separately from human life and more importantly, human milk cannot be understood separately from breastfeeding (Cassidy & El Tom 2015; Tomori, Palmquist, & Quinn, 2018; Van Esterik, 2015).

AUTHOR CONTRIBUTIONS

Aunchalee Palmquist: Conceptualization; project administration; writing-original draft; writing-review and editing. **Ifeyinwa Asiodu:** Conceptualization; writing-review and editing. **Elizabeth Quinn:** Conceptualization; project administration; writing-original draft; writing-review and editing.

ORCID

Aunchalee E. L. Palmquist  <https://orcid.org/0000-0002-0848-6952>

Ifeyinwa V. Asiodu  <https://orcid.org/0000-0001-8008-9997>

Elizabeth A. Quinn  <https://orcid.org/0000-0001-7212-8271>

REFERENCES

- Allers, K. S. (2020, March 27). Covid-19 restrictions on Birth & Breastfeeding: Disproportionately harming black and native women. *Women's ENews*. Retrieved from <https://womensenews.org/2020/03/covid-19-restrictions-on-birth-breastfeeding-disproportionately-harming-black-and-native-women/>
- American Academy of Pediatrics. (2012). Breastfeeding and the use of human Milk. *Pediatrics*, 129(3), e827–e841. <https://doi.org/10.1542/peds.2011-3552>
- Angood, C. (2017). *Operational Guidance On Infant Feeding in Emergencies (OG-IFE) version 3.0*. Retrieved from www.enonline.net/operationalguidance-v3-2017
- Arvelo, W., Kim, A., Creek, T., Legwaila, K., Puhr, N., Johnston, S., ... Bowen, A. (2010). Case-control study to determine risk factors for diarrhea among children during a large outbreak in a country with a high prevalence of HIV infection. *International Journal of Infectious Diseases: IJID: Official Publication of the International Society for Infectious Diseases*, 14(11), e1002–e1007. <https://doi.org/10.1016/j.ijid.2010.06.014>
- Benton, A. (2016). *HIV exceptionalism: Development through disease in Sierra Leone* (p. 2016. Retrieved from). Minneapolis: University of Minnesota Press. <https://catalog.lib.unc.edu/catalog/UNCb8597861>
- Bridges, K. M. (2011). *Reproducing race: An ethnography of pregnancy as a site of racialization*. Berkeley, CA: London: University of California Press, Retrieved from. <https://catalog.lib.unc.edu/catalog/UNCb8713665>
- Cassidy, T. M., & El Tom, A. (Eds.). (2015). *Ethnographies of Breastfeeding: Cultural Contexts and Confrontations.*, London: Bloomsbury.
- Chambers, C. D., Krogstad, P., Bertrand, K., Contreras, D., Bode, L., Tobin, N., & Aldrovandi, G. (2020). Evaluation of SARS-CoV-2 in breastmilk from 18 infected women. *MedRxiv*, 20127944 *Version 1*.(Preprint.), <https://doi.org/10.1101/2020.06.12.20127944>
- Colt, S., Garcia-Casal, M. N., Peña-Rosas, J. P., Finkelstein, J. L., Rayco-Solon, P., Prinzo, Z. C. W., & Mehta, S. (2017). Transmission of Zika virus through breast milk and other breastfeeding-related bodily-fluids: A systematic review. *PLoS Neglected Tropical Diseases*, 11(4), e0005528. <https://doi.org/10.1371/journal.pntd.0005528>
- Center for Humanitarian Health (2020) COVID-19, Maternal and Child Health, Nutrition repository. Johns Hopkins University, Center for Humanitarian Health. Retrieved <http://hopkinshumanitarianhealth.org/empower/advocacy/covid-19/covid-19-children-and-nutrition/>
- Creek, T. L., Kim, A., Lu, L., Bowen, A., Masunge, J., Arvelo, W., ... Davis, M. K. (2010). Hospitalization and mortality among primarily nonbreastfed children during a large outbreak of diarrhea and malnutrition in Botswana, 2006. *Journal of Acquired Immune Deficiency Syndromes (1999)*, 53(1), 14–19. <https://doi.org/10.1097/QAI.0b013e3181bdf676>
- Davis-Floyd, R., Gutschow, K., & Schwartz, D. A. (2020). Pregnancy, birth and the COVID-19 pandemic in the United States. *Medical Anthropology*, 39(5), 413–427. <https://doi.org/10.1080/01459740.2020.1761804>
- Fan, C., Lei, D., Fang, C., Li, C., Wang, M., Liu, Y., ... Wang, S. (2020). Perinatal transmission of COVID-19 associated SARS-CoV-2: Should we worry? *Clinical Infectious Diseases*, *ciaa226* (preprint), <https://doi.org/10.1093/cid/ciaa226>
- Foeller, M. E., do Valle, C. C. R., Foeller, T. M., Oladapo, O. T., Roos, E., & Thorson, A. E. (2020). Pregnancy and breastfeeding in the context of Ebola: A systematic review. *The Lancet Infectious Diseases*, 20, e158. [https://doi.org/10.1016/S1473-3099\(20\)30194-8](https://doi.org/10.1016/S1473-3099(20)30194-8)
- Fox, A., Marino, J., Amanat, F., Krammer, F., Hahn-Holbrook, J., Zolla-Pazner, S., & Powell, R. L. (2020). Evidence of a significant secretory-IgA-dominant SARS-CoV-2 immune response in human milk following recovery from COVID-19. *MedRxiv*, 20089995 (preprint), <https://doi.org/10.1101/2020.05.04.20089995>
- Franklin, S. (1995). Science as culture, cultures of science. *Annual Review of Anthropology*, 24(1), 163–184. <https://doi.org/10.1146/annurev.an.24.100195.001115>
- Furlow, B. (2020a). US NICUs and donor milk banks brace for COVID-19. *The Lancet Child & Adolescent Health*, 4(5), 355. [https://doi.org/10.1016/S2352-4642\(20\)30103-6](https://doi.org/10.1016/S2352-4642(20)30103-6)
- Furlow, B. (2020b, June 13). *A hospital's secret coronavirus policy separated native American mothers from their newborns.*

- ProPublica. Retrieved from. https://www.propublica.org/article/a-hospitals-secret-coronavirus-policy-separated-native-american-mothers-from-their-newborns?token=UjIpast_oI5NPhtrcuH0nT7LW2b6p1X3
- Gribble, K. D. (2017). Supporting the Most vulnerable through appropriate infant and young child feeding in emergencies. *Journal of Human Lactation*, 34, 40–46. <https://doi.org/10.1177/0890334417741469>
- Gribble, K. D. (2017). Supporting the most vulnerable through appropriate infant and young child feeding in emergencies. *Journal of Human Lactation*, 34(1), 1–7. <https://doi.org/10.1177/0890334417741469>.
- Gribble, K. D., McGrath, M., MacLaine, A., & Lhotska, L. (2011). Supporting breastfeeding in emergencies: Protecting women's reproductive rights and maternal and infant health. *Disasters*, 35(4), 720–738. <https://doi.org/10.1111/j.1467-7717.2010.01239.x>
- Gross, M. S., Taylor, H. A., Tomori, C., & Coleman, J. S. (2019). Breastfeeding with HIV: An evidence-based case for new policy. *The Journal of Law, Medicine & Ethics: A Journal of the American Society of Law, Medicine Ethics*, 47(1), 152–160. <https://doi.org/10.1177/1073110519840495>
- Groß, R., Conzelmann, C., Müller, J. A., Stenger, S., Steinhart, K., Kirchhoff, F., & Münch, J. (2020). Detection of SARS-CoV-2 in human breastmilk. *The Lancet*, 395(10239), 1757–1758. [https://doi.org/10.1016/S0140-6736\(20\)31181-8](https://doi.org/10.1016/S0140-6736(20)31181-8)
- Hahn, R. A., & Kleinman, A. (1983). Biomedical Practice & Anthropological Theory: Frameworks and directions. *Annual Review of Anthropology*, 12, 305–333. Retrieved from. <http://search.proquest.com/docview/61061667?pq-origsite=summon>
- Hall, K. S., Samari, G., Garbers, S., Casey, S. E., Diallo, D. D., Orcutt, M., ... McGovern, T. (2020). Centring sexual and reproductive health and justice in the global COVID-19 response. *Lancet (London, England)*, 395(10231), 1175–1177. [https://doi.org/10.1016/S0140-6736\(20\)30801-1](https://doi.org/10.1016/S0140-6736(20)30801-1)
- Hardeman, R. R., Murphy, K. A., Karbeah, J., & Kozhimannil, K. B. (2018). Naming institutionalized racism in the public health literature: A systematic literature review. *Public Health Reports*, 133(3), 240–249. <https://doi.org/10.1177/0033354918760574>
- Hausman, B. L. (2011). *Viral mothers: Breastfeeding in the age of HIV/AIDS*, Ann Arbor, MI: University of Michigan Press.
- Hinde, K., & Milligan, L. A. (2011). Primate milk: Proximate mechanisms and ultimate perspectives. *Evolutionary Anthropology*, 20(1), 9–23. <https://doi.org/10.1002/evan.20289>
- Hooper, M. W., Nápoles, A. M., & Pérez-Stable, E. J. (2020). COVID-19 and racial/ethnic disparities. *Journal of the American Medical Association*, 323, 2466. <https://doi.org/10.1001/jama.2020.8598>
- Inhorn, M. C., & Brown, P. J. (1990). The anthropology of infectious disease. *Annual Review of Anthropology*, 19(1), 89–117. <https://doi.org/10.1146/annurev.an.19.100190.000513>
- Klein, L. D., Huang, J., Quinn, E. A., Martin, M. A., Breakey, A. A., Gurven, M., ... Hinde, K. (2018). Variation among populations in the immune protein composition of mother's milk reflects subsistence pattern. *Evolution, Medicine, and Public Health*, 2018(1), 230–245. <https://doi.org/10.1093/emph/eoy031>
- Lackey, K. A., Pace, R. M., Williams, J. E., Bode, L., Donovan, S. M., Järvinen, K. M., ... McGuire, M. K. (2020). SARS-CoV-2 and human milk: What is the evidence? *Maternal & Child Nutrition* (preprint), e13032. <https://doi.org/10.1111/mcn.13032>
- López, J. M. d. (2019). Maintaining the flow: Medical challenges to breastfeeding and “risky” bodies in Mexico. *Medical Anthropology Quarterly*, 33(3), 403–419. <https://doi.org/10.1111/maq.12511>
- Lock, M. (1993). Cultivating the body: Anthropology and epistemologies of bodily practice and knowledge. *Annual Review of Anthropology*, 22, 133–155. <https://www.jstor.org/stable/2155843>.
- Lock, M., & Nguyen, V-K. (Eds.). (2010). *An Anthropology of Biomedicine*, Chichester, West Sussex ; Malden, MA: Wiley-Blackwell.
- Mach, O., Lu, L., Creek, T., Bowen, A., Arvelo, W., Smit, M., ... Handzel, T. (2009). Population-based study of a widespread outbreak of diarrhea associated with increased mortality and malnutrition in Botswana, January-March, 2006. *The American Journal of Tropical Medicine and Hygiene*, 80(5), 812–818.
- Martin, E. (2016). Anthropology and the cultural study of science. *Science, Technology & Human Values*. Retrieved from, 23, 24–44. <http://journals.sagepub.com/doi/10.1177/016224399802300102>
- Martins-Filho, P. R., Santos, V. S., & Santos, H. P. (2020). To breastfeed or not to breastfeed? Lack of evidence on the presence of SARS-CoV-2 in breastmilk of pregnant women with COVID-19. *Revista Panamericana de Salud Pública*, 44, 1. <https://doi.org/10.26633/RPSP.2020.59>
- McLemore, M. R., Asiodu, I., Crear-Perry, J., Davis, D. A., Drew, M., Hardeman, R. R., ... Scott, K. A. (2019). Race, research, and Women's health: Best practice guidelines for investigators. *Obstetrics & Gynecology*, 134(2), 422–423. <https://doi.org/10.1097/AOG.0000000000003393>
- Miller, E. (2018). Ecological immunity of human milk: Life history perspectives from the United States and Kenya. *American Journal of Physical Anthropology*, 167(2), 389–399. <https://doi.org/10.1002/ajpa.23639>.
- Miller, E. M., Aiello, M. O., Fujita, M., Hinde, K., Milligan, L., & Quinn, E. A. (2013). Field and laboratory methods in human milk research. *American Journal of Human Biology*, 25(1), 1–11. <https://doi.org/10.1002/ajhb.22334>
- Mullings, L., & Wali, A. (2001). *Stress and resilience: The Social Context of Reproduction in Central Harlem*, New York: Kluwer Academic/Plenum Publishers.
- Nduati, R., & John, G. (1995). Breast milk transmission of HIV-1. *NARESA Monograph, Dec.*, (18), 1–3.
- Owens, D. C., & Fett, S. M. (2019). Black maternal and infant health: Historical legacies of slavery. *American Journal of Public Health*, 109(10), 1342–1345. <https://doi.org/10.2105/AJPH.2019.305243>
- Palmquist, A. E. L. (2017). Consuming immunities: Milk sharing and the social life of passive immunity. In C. Tomori, A. E. L. Palmquist, & E. Quinn (Eds.), *Breastfeeding: New anthropological approaches* (pp. 40–54). London: Routledge.
- Palmquist, A. E. L., Holdren, S. M., & Fair, C. D. (2020). It was all taken away: Lactation, embodiment, and resistance among mothers caring for their very-low-birth-weight infants in the neonatal intensive care unit. *Social Science & Medicine*, 244, 112648. <https://doi.org/10.1016/j.socscimed.2019.112648>.
- Poteat, T., Millett, G. A., Nelson, L. E., & Beyrer, C. (2020). Understanding COVID-19 risks and vulnerabilities among black communities in America: The lethal force of syndemics. *Annals of Epidemiology*, 47, 1–3. <https://doi.org/10.1016/j.annepidem.2020.05.004>

- Power, M. L., & Schulkin, J. (2016). *Milk: The biology of lactation*. Baltimore, Maryland: Johns Hopkins University Press.
- Quinn, E. A., Bista, K. D., & Childs, G. (2016). Milk at altitude: Human milk macronutrient composition in a high-altitude adapted population of Tibetans. *American Journal of Physical Anthropology*, 159(2), 233–243. <https://doi.org/10.1002/ajpa.22871>.
- Quinn, E. A., & Childs, G. (2017). Ecological pressures and milk metabolic hormones of ethnic Tibetans living at different altitudes. *Annals of Human Biology*, 44(1), 34–45. <https://doi.org/10.3109/03014460.2016.1153144>
- Rhodes, L.A. (1990) Studying Biomedicine as a Cultural System. *Medical Anthropology: Contemporary Theory and Method* In C. F. Sargent & T. M. Johnson (Eds.), (pp. 165-180). Westport, CT: Praeger.
- Roberts, D. (2011). *Fatal Invention*. New York: The New Press. Retrieved from <https://thenewpress.com/books/fatal-invention>
- Sangaramoorthy, T. (2014). *Treating AIDS: Politics of difference, paradox of prevention*. New Brunswick, United States: Rutgers University Press. Retrieved from <http://ebookcentral.proquest.com/lib/unc/detail.action?docID=1677574>
- Sangaramoorthy, T. (2020, May 1). From HIV to COVID19: Anthropology, urgency, and the politics of engagement. Retrieved from <http://somatosphere.net/2020/from-hiv-to-covid19-anthropology-urgency-and-the-politics-of-engagement.html/>
- Scott, K. A., Bray, S., & McLemore, M. R. (2020). First, do no harm: Why philanthropy needs to re-examine its role in reproductive equity and racial justice. *Health Equity*, 4(1), 17–22. <https://doi.org/10.1089/heap.2019.0094>
- Skloot, R. (2011). *The immortal life of Henrietta Lacks (1st pbk. Ed.)*. New York: Retrieved from Broadway Paperbacks, c2011. <https://catalog.lib.unc.edu/catalog/UNCb7021913>
- Tallbear, K. (2013). *Native American DNA: Tribal Belonging and the False Promise of Genetic Science*, Ann Arbor, MI: University of Minnesota Press.
- Thior, I., Lockman, S., Smeaton, L. M., Shapiro, R. L., Wester, C., Heymann, S. J., ... Mashi Study Team. (2006). Breastfeeding plus infant zidovudine prophylaxis for 6 months vs formula feeding plus infant zidovudine for 1 month to reduce mother-to-child HIV transmission in Botswana: A randomized trial: The Mashi study. *JAMA*, 296(7), 794–805. <https://doi.org/10.1001/jama.296.7.794>
- Tomori, C. (2015). *Nighttime breastfeeding: An American cultural dilemma*. New York: Berghann Books.
- Tomori, C., Gribble, K., Palmquist, A. E. 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*, e13033, (preprint), <https://doi.org/10.1111/mcn.13033>
- Tomori, C., Palmquist, A. E. L., & Dowling, S. (2016). Contested moral landscapes: Negotiating breastfeeding stigma in breastmilk sharing, nighttime breastfeeding, and long-term breastfeeding in the U.S. and the U.K. *Social Science & Medicine*, 168, 178–185. <https://doi.org/10.1016/j.socscimed.2016.09.014>
- Tomori, C., Palmquist, A. E. L., & Quinn, E. A. (Eds.). (2018). *Breastfeeding: New Anthropological Approaches*, London: Routledge.
- Torres, J. B. (2019). Race, rare genetic variants, and the science of human difference in the post-genomic age. *Transforming Anthropology*, 27(1), 37–49. <https://doi.org/10.1111/traa.12144>
- Tuthill, E. L., Tomori, C., Natta, M. V., & Coleman, J. S. (2019). “In the United States, we say, ‘no breastfeeding,’ but that is no longer realistic”: Provider perspectives towards infant feeding among women living with HIV in the United States. *Journal of the International AIDS Society*, 22(1), e25224. <https://doi.org/10.1002/jia2.25224>
- van Dorn, A., Cooney, R. E., & Sabin, M. L. (2020). COVID-19 exacerbating inequalities in the US. *Lancet (London, England)*, 395(10232), 1243–1244. [https://doi.org/10.1016/S0140-6736\(20\)30893-X](https://doi.org/10.1016/S0140-6736(20)30893-X)
- Van Esterik, P. (2015). What flows through us: Rethinking breastfeeding as product and process. In T. M. Cassidy & A. El Tom (Eds.), *Ethnographies of Breastfeeding: Cultural Contexts and Confrontations* (pp. xv–xxiii), London: Bloomsbury Press.
- Van Hollen, C. (2011). Breast or bottle? HIV-positive women's responses to global health policy on infant feeding in India. *Medical Anthropology Quarterly*, 25(4), 499–518.
- Victora, C. G., Bahl, R., Barros, A. J. D., Franca, G. V. A., Horton, S., Krasevec, J., ... Rollins, N. C. (2016). Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. *The Lancet*, 387(10017), 475–490. [https://doi.org/10.1016/S0140-6736\(15\)01024-7](https://doi.org/10.1016/S0140-6736(15)01024-7)
- 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: An International Journal of Obstetrics & Gynaecology*, 1471-0528.16362. <https://doi.org/10.1111/1471-0528.16362>
- WHO (2016). *Guideline: Infant feeding in areas of Zika virus transmission*. Geneva: World Health Organization. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK374141/>
- WHO (2020). *Guidelines for the management of pregnant and breastfeeding women in the context of Ebola virus disease*. Geneva: World Health Organization. Retrieved from <http://www.who.int/reproductivehealth/publications/ebola-pregnant-and-breastfeeding-women/en/>
- WHO (n.d.) COVID-19 Research. Retrieved from http://www.who.int/maternal_child_adolescent/research/covid-19/en/
- WHO Special Programme on AIDS (1987). Breast-feeding/breast milk and human immunodeficiency virus. *Article WHO/SPA/INF/87.8*, <https://apps.who.int/iris/handle/10665/60788>.
- Wilce, J. M., Jr. (2003). *Social and Cultural Lives of Immune Systems*, London, New York: Routledge.
- 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: An International Journal of Obstetrics and Gynaecology*, 127, 1109–1115. <https://doi.org/10.1111/1471-0528.16276>
- Zuckerman, M. K., Harper, K. N., Barrett, R., & Armelagos, G. J. (2014). The evolution of disease: Anthropological perspectives on epidemiologic transitions. *Global Health Action*, 7, 23303. <https://doi.org/10.3402/gha.v7.23303>

How to cite this article: Palmquist AEL, Asiodu IV, Quinn EA. The COVID-19 liquid gold rush: Critical perspectives of human milk and SARS-CoV-2 infection. *Am J Hum Biol*. 2020; e23481. <https://doi.org/10.1002/ajhb.23481>