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COMMENTARY

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Maternal and child health during the COVID-19 pandemic: Contributions in the field of human biology

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1 | INTRODUCTION

The COVID-19 pandemic has substantially impacted the lives and health of people worldwide; with millions of confirmed cases and thousands of deaths, the immediate medical effects of the pandemic are obvious and substantial. However, the COVID-19 pandemic will likely continue to negatively impact human health for years to come, especially among individuals experiencing pandemic-related stress during sensitive periods of the life course, including pregnancy and early development. In this brief commentary, we focus on how the COVID-19 pandemic is currently disrupting maternity care and affecting well-being among pregnant women, thereby increasing the risk of poor future health for both mother and child.

Human biologists have long been interested in understanding the pathways by which early life experience—including in utero—can impact future health outcomes (eg, metabolic and cardiovascular disease later in life), especially if experienced during key developmental periods (Kuzawa & Quinn, 2009). Pregnancy represents an especially vulnerable period, with women at an increased risk for developing mood disorders (eg, depression) and health conditions (eg, gestational diabetes, preeclampsia) that can impair longer-term mental and physical health (Bauer, Knapp, & Parsonage, 2016; Damm et al., 2016; Nahum Sacks et al., 2018). Moreover, evidence indicates that adverse conditions experienced during pregnancy—such as high levels of psychosocial stress—are linked with increased risk of negative birth outcomes (Aizer, Stroud, & Buka, 2016; Kinsella & Monk, 2009; Nepomnaschy et al., 2006; Pike, 2005; Thayer, Bécares, & Atatoa Carr, 2019). Cumulatively, these exposures can also increase the risk of poor offspring health (eg, elevated stress reactivity, higher body mass index, and greater chronic disease risk) and increased mortality risk across the life course (Dancause et al., 2015; Farewell, Thayer, Tracer, & Morton, 2018; Gluckman, Hanson, & Beedle, 2007; Thayer & Kuzawa, 2015).

Elevated psychosomatic stress linked with the COVID-19 pandemic may therefore negatively impact maternal and infant health; however, these effects are currently not well understood. The few existing maternal and infant health studies have predominantly focused on treatment of pregnant women suffering from COVID-19 (Liang & Acharya, 2020; Pereira et al., 2020; Rasmussen, Smulian, Lednicky, Wen, & Jamieson, 2020), the risk of virus transmission from mother to baby (Chen et al., 2020; Pereira et al., 2020; Qiao, 2020; Rasmussen et al., 2020; Schwartz, 2020), and the biological effects of COVID-19 during pregnancy (Shanes et al., 2020). While there is currently little evidence of vertical viral transmission or poor birth outcomes (eg, restricted growth or premature birth) as a result of maternal SARS-CoV-2 infection (Pereira et al., 2020; Qiao, 2020; Schwartz, 2020; Shanes et al., 2020; Walker et al., 2020), recent work indicates that COVID-19 may be linked with increased risk for placental injury, preeclampsia, preterm birth, and low birth weight (Abbas, Ahmed, & Shaltout, 2020; Narang et al., 2020; Shanes et al., 2020). These emerging findings led the CDC to add pregnancy as a risk factor for severe COVID-19 symptoms on June 25, 2020 (CDC, 2020).

However, given that most studies to date have been small and focused on immediate health outcomes, additional work is needed to understand how the pandemic may shape maternal and infant health, aside from the direct effects of the virus itself. A biocultural perspective will be especially important, as pandemic-related

economic and social changes will likely shape prenatal and early life experiences in ways that alter later health. For example, the pandemic has drastically strained the American healthcare system (Emanuel et al., 2020). These strains have had substantial effects on access to quality prenatal care for pregnant women, an important determinant of maternal health and birth outcomes (Kozhimannil, Hardeman, & Henning-Smith, 2017; Loveland Cook, Selig, Wedge, & Gohn-Baube, 1999).

A shift to telehealth appointments, the loss of in-person labor and delivery courses, and restrictions on the ability for support persons to attend prenatal appointments may prevent women from feeling well-informed and supported by their providers and others. In addition, crowded hospitals, overworked staff, and a lack of medical equipment have led to drastic changes in the experience of labor and delivery. These changes include reduced support persons in labor and, in some instances, separation of newborns from their mothers in the case of suspected or confirmed maternal COVID-19 status (Davis-Floyd, Gutschow, & Schwartz, 2020; de Carvalho et al., 2020). Yet the mental and physical health effects of COVID-19 associated maternity care changes have not been adequately addressed, despite the clear implications for maternal and infant well-being.

Negative maternal and infant health outcomes linked with the pandemic are likely to disproportionally impact ethnic minority communities, including Black, Indigenous, and People of Color (BIPOC). For instance, COVID-19-associated disruptions to prenatal care, lack of access to the technology or safe spaces needed to facilitate telehealth, loss of medical insurance, and inability to access preferred and trusted care providers are all expected to increase the risk of poor birth outcomes and differentially affect BIPOC (Minkoff, 2020; Onwuzurike, Meadows, & Nour, 2020). Racism, which shapes birth experiences and outcomes even outside of the pandemic (Conching & Thayer, 2019; McLemore et al., 2018; Thayer et al., 2019; Vedam et al., 2019), can have important consequences on COVID-19-related policy decisions as well.

In a particularly egregious instance documented in a piece of investigative journalism, women described as having a Native American "appearance" and who were found to be living in a zip code associated with one of New Mexico's Pueblo reservations were treated as a "person under investigation" for COVID-19 and separated from their newborns at birth if still awaiting COVID-19 test results, even when mothers exhibited no symptoms (Furlow, 2020). Maternal separation from newborns can negatively affect both maternal and newborn health, including temperature regulation for newborns, increased risk for postpartum depression for mothers, and decreased breastfeeding success (Stuebe, 2020). Additional work is needed to identify the different ways that the COVID-19 pandemic has differentially affected maternal and child health among socially disadvantaged groups.

Here, we present the COVID-19 and Reproductive Effects (CARE) project as a case study documenting the complex COVID-19-linked factors impacting prenatal care and birth experiences. We also discuss other human biology studies that similarly use biocultural approaches to understand the impacts of the COVID-19 pandemic. Finally, we consider future research needed to document the downstream health effects of the COVID-19 pandemic on pregnant women and their children.

2 | THE CARE STUDY

The CARE study is a longitudinal study designed to evaluate how the pandemic has affected pregnant women's prenatal care decisions and birth experiences. Data are collected through an online survey administered to a convenience sample primarily recruited over social media (Facebook, Twitter), and distributed via email to contacts working in maternity care. Pregnant women over 18 years of age and living in the United States are eligible to participate. Prenatal questionnaires have been completed by over 2300 women, with 91% of women agreeing to be re-contacted for a follow-up postnatal questionnaire.

Analyses using early respondents (n = 1400) found that 45.2% of participants anticipated altering some aspect of their birth plan because of COVID-19 (Gildner & Thayer, 2020). Commonly reported changes included shortened hospital stays, switching to an out-of-hospital delivery to avoid exposure to the virus in the hospital, and laboring with fewer support people (either due to hospital restrictions or the fact that their partner must now care for their other children instead of attending the delivery). Future analyses will determine how these planned changes impact birth outcomes. Aside from altering birth plans, preliminary evidence suggests the pandemic is impacting maternal mental health. For instance, pandemic-related financial stress was significantly associated with increased depression symptoms and increased likelihood of a clinically significant depression score, as measured by the well-validated Edinburgh Postnatal Depression Scale. These effects remained after adjusting for covariates, including household income, suggesting that financial stress caused by the COVID-19

pandemic may increase depression symptoms in pregnancy, which could impact birth outcomes and long-term offspring health (Thayer & Gildner, 2020a).

In addition to measuring how the pandemic is affecting maternity care access and depression risk, an overarching goal of the CARE study is to develop educational handouts based on study results for participants, care providers, and policy makers. For example, study results indicate that 40% of participants reported not having received any information from their provider on how the pandemic would influence their maternity care in pregnancy, labor, and delivery (including 25% in their third trimester of pregnancy). Women who were less educated and who had lower income were significantly less likely to report having received information about how the pandemic would affect their care. A reported lack of provider information sharing was associated with significantly lower satisfaction with provider (Thayer & Gildner, 2020b).

In response to this lack of reported information sharing, we created a handout outlining unanswered COVID-19-related care questions commonly reported by women in the prenatal study questionnaire. This handout is designed to serve as a conversation starting point, facilitating more productive communication between women and their care providers. It was disseminated through the same virtual means as participant recruitment and posted to our study website. Given the urgency of the moment, we have approached disseminating study findings to participants as being of utmost importance. Information sharing is crucial to provide individuals with the information needed to make informed decisions regarding behavioral responses and medical care during the COVID-19 pandemic.

Building upon this preliminary work, future analyses are planned to examine how the COVID-19 pandemic affected birth experiences and outcomes, as well as which socioeconomic and geographic factors most strongly influence whether women are able to access preferred providers and delivery facilities during the pandemic. Additional analyses will also explore shifting social attitudes toward maternity care norms, including altered preferences (eg, for out-of-hospital deliveries) that may persist beyond the pandemic. Assessment of minimally-invasive biomarkers from children enrolled in the study is also planned in order to understand some of the longer term biological effects of COVID-19-associated stressors. Overall, the results produced by this project can be used in conjunction with existing and future data from other sources to tease apart the myriad pandemic-related factors that influence maternal and infant health.

3 | ADDITIONAL HUMAN BIOLOGY STUDIES EXAMINING THE EFFECTS OF COVID-19 ON MATERNAL AND CHILD HEALTH

While the CARE study highlights some potential ways that the COVID-19 pandemic may negatively impact maternal and child health, it is by no means the only project using a biocultural approach to understand the health impacts of the pandemic. Given the scope of the unfolding pandemic, no single study can capture every lived experience and health outcome directly linked with the social, political, and economic damage caused by COVID-19. A wide array of studies using diverse data collection and analysis techniques are needed to better understand the full extent of COVID-19-related maternal and child health effects.

Fortunately, several human biologists have launched studies documenting the effects of the ongoing pandemic on maternal and child health. The data collected by these projects will highlight how the pandemic has shaped various aspects of prenatal care, birth experiences, breastfeeding practices, and early development. Table 1 highlights some of these projects, including a description of the study sample, type of data collected, and research foci. Cumulatively, each of these projects will contribute novel information to the growing dataset required to holistically examine the complex health effects of the pandemic. Ideally collaboration among studies will facilitate a more comprehensive understanding of long-term pandemic impacts. Studies in outside the United States are also needed to measure the full range of pandemic-related effects on maternal and infant health.

4 | FUTURE DIRECTIONS

While the immediate medical impacts of COVID-19 are important to understand, it is becoming increasingly clear that this pandemic will also exert long-term social and economic effects that will shape health outcomes for years to come. A biocultural perspective is needed to clarify how the lived experience of the COVID-19 pandemic, coupled with anticipated lifestyle changes due to a destabilized economy and shifts in cultural practices, may shape later health.

Longitudinal cohort studies monitoring maternal and child health over time are required. These data will document the cross-cultural and intergenerational effects of COVID-19, as well as clarify how the pandemic has differentially affected certain groups (eg, socioeconomically and ethnically marginalized groups) within a given

TABLE 1 Current COVID-19 human biology studies examining how the pandemic affects maternal and child health

Study name (principal investigators; website if available)	Participants and location	Data collected and research foci
The COVID-19 And Reproductive Effects (CARE) Study (Drs Zaneta Thayer and Theresa Gildner; https://sites.dartmouth.edu/care2020)	Women in the United States pregnant during the COVID-19 pandemic and over 18 years old	Prenatal and postpartum questionnaires focused on pandemic-related effects on maternity care, COVID-19 related worries, birth outcomes, and postpartum experiences; ethnographic interviews from a subset of study participants
COVID-19 Pregnancy and Postpartum Experiences (COPE) Study (Drs Kylea Liese and Julienne Rutherford)	Women in the United States over 18 years old who are currently pregnant or have given birth since January 2020	Mixed methods (qualitative and quantitative) study assessing pandemic effects on maternity care decisions, the effects of social isolation, and pandemic-related changes to pregnancy and birth expectations
Seattle Mother-Infant COVID-19 Study (Drs Melanie Martin, Eleanor Brindle, and Dan Eisenberg; https://sites.google.com/uw.edu/seattle-mom-covid-19/home)	COVID-19 positive mothers (over 18 years old) and young children up to 4 years of age from the greater Seattle area; data are also collected from other family members	Biological samples (finger-prick blood, saliva) and interview data to study dynamics of infection and immunity within families
RAPID Collaborative Research: COVID-19, human milk and infant feeding (Drs Shelley Mcguire, Courtney Meehan, Melanie Martin, and Sylvia Ley; https://wsu.edu/covid-19-infant-feeding/)	COVID-19 positive mothers in the United States (over 18 years old) and infants 0-24 months of age	Biological samples (breast milk, stool samples, blood spots) and interview data to examine dynamics of infection risk, resilience, and immune responses in breastfeeding and nonbreastfeeding mother-infant dyads in the 2 months following a maternal diagnosis
Infant feeding during the 2020 COVID-19 Pandemic (Drs EA Quinn, Cecilia Tomori, and Aunchalee Palmquist)	Any person who has given birth in the United States in the last 2 years and currently has a living infant	Interview data on type of infant feeding, decision making about what types of food to use, milk sharing practices, and information sources used to examine how the pandemic is impacting infant feeding practices

population. By tracking prenatal stressors, birth outcomes, and developmental patterns, researchers can assess the effects of the pandemic on later health. Additionally, immediate or later collection of anthropometric measures and biomarker samples—in a way that maintains participant and researcher safety—may provide another important data source. For example, measures of child growth and stress reactivity can be used to test how prenatal and early postpartum experiences during the pandemic shape growth patterns and development of the physiological stress response, which are predicted to be affected by early life exposures and may influence future disease risk (Dancause et al., 2015; Thayer, Wilson, Kim, & Jaeggi, 2018).

The collection of these data across diverse populations will help us to understand how the COVID-19 pandemic has acted across different socioeconomic, ecological, and cultural contexts to shape lived experience and health. However, for the time being, ethical concerns regarding travel during the pandemic will appropriately limit data collection to field settings where remote data collection (eg, online or mailed survey and sample collection) is feasible. Ultimately, the varied toolkit of human biology is well suited to collect these important data and to answer questions related to the impact of the pandemic on long-term well-being, information needed to better address the continuing consequences of the COVID-19 pandemic and to prepare for the effects of other future global health challenges.

AUTHOR CONTRIBUTIONS

Theresa Gildner: Conceptualization; writing-original draft; writing-review and editing. **Zaneta Thayer:** Conceptualization; writing-original draft; writing-review and editing.

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