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Erica Fuller Date

The Impact of the COVID-19 Pandemic on Postpartum Health Behaviors and Outcomes, PRAMS 2016-2020

By

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Master of Public Health

Global Epidemiology

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By

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Bachelor of Science in Public Health
Tulane University
2018

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An abstract of
A thesis submitted to the Faculty of the
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Abstract

The Impact of the COVID-19 Pandemic on Postpartum Health Behaviors and Outcomes, PRAMS 2016-2020

By Erica Fuller

Background
The onset of the COVID-19 pandemic brought swift and unprecedented changes in policy and behaviors that profoundly influenced how those who were pregnant and postpartum interacted with the healthcare system. While factors such as uncertainty, stress, increased responsibility, social isolation, supply chain disruptions, and reallocation of providers might have negatively impacted postpartum outcomes, expansion of telehealth services, increased family time, and resiliency may have mitigated negative effects.

Methods
We analyzed 2016-2020 data from the Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based survey for women following a live birth to evaluate whether the first 10 months of the COVID-19 pandemic impacted selected postpartum indicators: breastfeeding, contraceptive use, postpartum check-up attendance, and postpartum depression. Log-binomial regression was used to estimate state-adjusted prevalence ratios (aPR) and 95% confidence intervals (95% CI) for these associations across 41 PRAMS sites (unweighted analytic sample = 187,262).

Results
Overall, the onset of the COVID-19 pandemic did not influence breastfeeding initiation, postpartum contraceptive use, or postpartum check-up attendance. There was, however, a small increase in the prevalence of PPD during the COVID-era (aPR = 1.12; 95% CI: 1.11-1.13). This association was amplified for those with a prior history of depression (aPR = 9.0; 95% CI: 8.9-9.1).

Conclusion
Those with a previous depression diagnosis were particularly vulnerable to the changes that occurred early in the COVID-19 pandemic. Further research into the long-term impacts of the COVID-19 pandemic on postpartum well-being is needed.

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Table of Contents

Background

On March 13th, 2020, then-President Trump issued Proclamation 9994 declaring COVID-19 a national emergency [1]. In the weeks following this proclamation, a series of federal, state, and local policies changed the ways in which individuals and communities interacted. Early mitigation strategies involved the restriction of travel and governors in nearly all states implementing stay-at-home orders, restricting the movement of non-essential workers [2, 3]. Non-essential businesses were closed in Spring 2020 which led to the loss of jobs in the United States. The shutdown of industry globally led to supply chain issues for many medical and household goods [2]. Nationwide shortages of personal protective equipment and a lack of knowledge regarding viral transmission routes in the early days caused uncertainty and misinformation [2]. Public health officials in April and May 2020 focused on flattening the curve and slowly some states began to lift lockdown orders, allowing for the gradual re-opening of businesses [2]. Mask mandates, social distancing, quarantine, isolation, and contract tracing allowed for further control of the transmission of COVID-19. However, the implementation and enforcement of policies designed to curb the spread of COVID-19 varied greatly by state [3].

Hospitals became overwhelmed with severe COVID-19 cases which led to the reassignment of many providers to COVID-19 efforts. Non-essential health services were delayed. Telehealth/virtual visits emerged as an effective way for providers to continue to provide care while limiting patient exposure to the COVID-19 virus. Hospitals implemented policies restricting visitation and fast-tracking patient discharge for non-COVID cases [3]. While the development of a vaccine offered hope to better control the pandemic, rising incidence in Fall 2020 and limited vaccine access caused many states to re-implement containment policies. The policies implemented in the United States as a result of the COVID-19 pandemic had profound and wide-reaching impacts: social isolation, job loss, childcare instability, and virtual communication through platforms such as Zoom for work, school, healthcare, and social connection [3].

While much of early research focused on the impact of SARS-CoV-2 on pregnant and lactating individuals, there has been less investigation into how the changes brought on by the pandemic have

influenced attitudes, behaviors, and health during the postpartum period. The postpartum period represents a major change in mothers' lives as they bond with their child, adjust to their role as a parent, and slowly recover from childbirth. These changes were drastically amplified for postpartum women who were exposed to the vast social, medical, and structural changes that occurred with the onset of the COVID-19 pandemic in the United States. The COVID-19 pandemic brought unprecedented changes to the birthing and postpartum period as mothers, particularly in the early pandemic, experienced disruptions to their birth plan, increased isolation and restrictions to visitors, and a higher probability of being separated from their baby following birth [4].

Breastfeeding

Breastfeeding, while better known for its benefits to the infant, can also have a profound impact on the short-term and long-term health of the mother [5]. During the early days of the COVID-19 pandemic, there was uncertainty for mothers who tested positive for SARS-CoV-2 about the safety of breastfeeding or pumping [6-9]. This uncertainty led several hospitals to separate SARS-CoV-2 positive women from their infants, which limited a mother's ability to initiate breastfeeding and delayed lactation support [6, 9]. Among all postpartum individuals, changes to socialization may have negatively influenced a mother's desire or ability to breastfeed. Recommendations to limit social interactions led to the cancellation of many peer-to-peer breastfeeding support groups [6-8, 10]. Of those that continued in a virtual format, the groups were perceived as less effective than those offered in-person [6]. Less formal sources of breastfeeding knowledge and encouragement such as familial support was also limited due to changes in policies regarding visitation at hospitals and recommendations for social distancing [6, 7, 11]. Postpartum individuals who reported that they lacked support were less likely to breastfeed and more likely to formula feed [7].

Following birth and during the postpartum period, social distancing, concerns of SARS-CoV-2 infection, shorter hospital stays, and changes in healthcare staffing decreased the amount of professional lactation support received [6-10, 12-15]. Many postpartum individuals opted to leave the hospital before their milk had replaced the colostrum, which is when most lactation difficulties arise [11]. This difficulty

in accessing lactation consultation services disproportionately impacted Black mothers, Hispanic mothers, the under/uninsured, those who did not speak English as their first language, and those who had COVID-19 [6, 10]. While the emergence of telehealth allowed for the restoration of some lactation support services, telehealth brought its own challenges. As many healthcare visits became virtual, newborn weights were not taken consistently which impeded a pediatrician's ability to ascertain infant growth and increased the number of referrals for formula use [6]. Some mothers shared that virtual telehealth sessions were less effective and in-person sessions were preferred [6, 7, 12, 13]. Difficulty assisting with latch and positioning virtually, problems positioning the phone while breastfeeding, lowered ability to connect socially, and privacy concerns were cited as reasons for the perceived lower quality of telehealth lactation sessions [6, 16]. In addition to challenges finding adequate support, breastfeeding may have been hampered by competing priorities such as increased childcare responsibilities for older children [7, 11], increased stress, fear, anxiety, isolation, and uncertainty caused by the pandemic [6-8]. While some individuals were able to work at home during the pandemic, essential workers encountered increased work demands, stress, unsupportive work policies around pumping, and concerns over the safety of pumping at work that could have impacted their ability and desire to breastfeed [11].

While COVID-19 added barriers and challenges to breastfeeding, hospital policies that limited visitation due to COVID-19 lessened the burden for the family to entertain visitors and allowed for more family time [13, 17]. Most studies found that this allowed nurses to spend more time and better engage with both parents on the topic of breastfeeding [13, 14, 17]. Pandemic-related supply chain breakdowns incited fear among new parents of a potential formula shortage, which encouraged prolonged breastfeeding for some mothers [6, 7, 10]. Some parents were also motivated to breastfeed due to the potential immunological benefits of human milk [6, 10]. While essential workers experienced barriers to breastfeeding [11], some mothers who worked in other sectors found that social distancing facilitated finding the time and desired privacy necessary to breastfeed [6, 7, 10, 11]; in fact, breastfeeding during

the pandemic became a coping mechanism or necessary relational link in an overwhelming and isolated reality [11].

While a survey of lactation professionals showed that about 70% of professionals felt that the COVID-19 pandemic had impacted breastfeeding initiation and duration, their perception of the direction of change was mixed [6]. One study concluded that giving birth during the peak of the COVID-19 pandemic was associated with poor birth experiences, which is associated with lower rates of exclusive breastfeeding [18]. Another study found that the prevalence of exclusive breastfeeding during delivery hospitalization increased during the pandemic overall and among White and Asian women [9]. In contrast, another study did not find a statistically significant difference in breastfeeding initiation when comparing the pre-pandemic period to the early or late pandemic [10]. Overall, due to various positive and negative influences of the pandemic, the impact of the COVID-19 pandemic on breastfeeding initiation and duration is unclear.

Contraceptive Use

Postpartum contraceptive use is important to limit the number of unintended pregnancies and increase the spacing between conceptions [19]. Just as supply chain breakdowns led to concerns about availability of formula, there were also concerns about the global availability of contraceptives. Lockdown measures caused many manufacturers in Asia, such as the world's largest condom distributor Karex Bhd, to halt or reduce the production of contraceptives [20]. In addition to decreased supply, border closures and trade restrictions furthered supply issues. For example, India restricted a large producer of intrauterine devices (IUDs) from exporting products containing progesterone [21].

In addition to changes to the supply, the use of telehealth influenced postpartum contraceptive decision-making. As LARC usage requires in-person examination and insertion, the rise of telehealth and limited in-person appointments made long-acting reversible contraceptive (LARC) receipt less feasible, and thus impacted postpartum contraception choices [22]. Some studies reported LARC usage declined during the pandemic [23, 24] while another found similar rates of LARC usage overall but an increase in inpatient LARC provision and a decrease in outpatient LARC provision [25]. In addition to potential

changes in LARC usage, one study found that compared to the pre-pandemic period, during the pandemic postpartum individuals attended fewer contraceptive visits for tubal ligations within three months of childbirth [24]. Rates of postpartum contraceptive use varied by race and interaction with the health system. Those who attended a postpartum visit were more likely to initiate outpatient contraceptive use, while does who did not attend a postpartum visit were less likely to receive LARC in the outpatient setting, but more likely to report outpatient LARC provision and receive LARC immediately postpartum [25]. A study found that postpartum contraceptive use, especially inpatient short-acting reversible contraceptive use, increased among Black women relative to White women [25]. Despite changes in methods and provision and fewer individuals reporting having a postpartum plan for contraceptive use during the pandemic as compared to pre-pandemic period [26], the total use of any contraceptives remained relatively unchanged from the pre-pandemic era [25].

Postpartum Depression

Postpartum depression (PPD) can affect the well-being of the entire family and impact the future health of the mother and baby [27]. The COVID-19 pandemic created new stressors and amplified existing concerns. Postpartum individuals reported experiencing stressful situations such as job loss, exposure to COVID, contact with individuals who did not practice social distancing, SARS-CoV-2 diagnoses, and increased childcare responsibilities during the pandemic [12, 28]. The burden of caring for a newborn and dealing with these COVID-19 related challenges increased overall stress levels and were associated with higher rates of PPD [12, 28]. One study found that Black, indigenous, and people of color were more likely to experience stress during the pandemic and often reported lowered resiliency compared to White counterparts [29]. In addition to stress, worry over COVID's potential impact on pregnancy, childbirth, parenting and the health of loved ones may have increased the risk for PPD [12, 27, 30, 31]; one study only found PPD to be associated with increased prenatal COVID-19 pregnancy worry in the third trimester [27]. COVID-19 related grief, increased feelings of loneliness and isolation, and diminishing family and community support due to social distancing negatively impacted postpartum individuals' mental wellbeing. COVID-19 infection prevention protocols, and COVID-19 related loss

reportedly increased feelings of helpless and depression and potential risk for PPD [8, 12, 30, 32-34]. Giving birth during the COVID-19 pandemic represented a unique and often stressful time for mothers. Those who delivered during the peak pandemic reported lower birth satisfaction, which is associated with greater perceived depression symptoms [18]. Those who experienced profound and lingering distress resulting from COVID-related trauma from experiences during birth such as separation from a partner and/or infant due reported increased symptoms of depression [4, 12].

In contrast to factors increasing the risk of PPD, the COVID era also created unique situations that supported the mental well-being of mothers. A qualitative study found that changes in socialization patterns may have been protective against PPD, as most individuals spent more time at home which enhanced family bonding and partner caregiving support, while saving money and decreasing feelings of missing out socially [32]. Pandemic-related changes to breastfeeding rates may also influence PPD as existing evidence suggests that breastfeeding may be protective against postpartum depression symptoms [31, 35]. However, the cause and effect of this relationship may be difficult to determine as patients who experience postpartum depression are less likely to breastfeed [31].

Before the pandemic, rates of postpartum depression in the United States stayed between 10% and 15% [35]. Two studies found that the pandemic increased the prevalence of postpartum depression [30, 31], but one found that rate remained the same [36]. Those with prior mental illness had greater postpartum depression rates during the pandemic [30, 35]. As the COVID-19 pandemic conditions and restrictions evolved, the changes in PPD rates may have fluctuated as well. One study found that only the first month of the pandemic was associated with increased postpartum depressive symptoms, [37] while other work has suggested that postpartum depression symptoms increased throughout the pandemic [38]. Changes in PPD during the pandemic varied by state. States with lower rates of pre-pandemic PPD and smaller unemployment rates had greater increases in PPD after the onset of the pandemic [38]. Those who reported having postpartum depression expressed greater severity and greater prevalence of symptoms compared to those who had PPD during the pre-pandemic period [34]. Despite studies finding higher rates of PPD and worse symptoms during the pandemic, some work suggests postpartum women reported a

lower likelihood of accessing a postpartum depression screening [23]. This paired with a reported decrease in access to mental health services due to increased need during the pandemic places women reporting PPD, particularly at risk [12].

Postpartum Visit

Postpartum visits are vital to assess the postnatal recovery and overall social, emotional, mental, and physical well-being of postpartum individuals and to provide necessary treatment and/or support services. The pandemic and the subsequent job loss left some individuals without insurance [39]. While policies like the Medicaid disenrollment freeze kept postpartum women on Medicaid throughout the country, poor communication of benefits, uncertainty about the coverage of the virtual visit, and the reassignment of healthcare providers to COVID-19 relief efforts may have negatively impacted postpartum visit attendance [15, 39]. However, the COVID-19 pandemic amplified the usage of telemedicine for postpartum care, especially in the early pandemic, when most visits were conducted virtually [15, 23, 25, 26, 40]. Telehealth provided an opportunity for populations who had prior issues accessing healthcare due to transportation concerns, issues accessing childcare, or competing priorities to better access services. However, telehealth was not the best solution for all parties. Some providers mentioned that telehealth increased their workload and they felt ill-equipped to utilize the technology [40]. Some patients lacked access to or knowledge of necessary technology while others had concerns about finding a private place to conduct a virtual visit and the safety of their health information [41]. While one study found that most technology barriers went away over time, both patients and providers expressed a preference for in-person care [40]. While virtual care was viewed as appropriate and acceptable during the COVID-19 pandemic, the perceived quality of care, particularly regarding measurements or physical exams, was not the same [40, 41]. In general, studies found that postpartum visit attendance decreased during the COVID era [23, 25].

Rationale for Study

While some studies have examined the impact of the COVID-19 pandemic on postpartum behaviors and well-being, further research into the topic is needed. Existing studies tend to only look at

one aspect of women's health, rather than assessing postpartum health more broadly. This is particularly important as many aspects of postpartum health are often interrelated. The current studies assessing the relationship between the COVID-19 pandemic and postpartum health indicators such as breastfeeding, postpartum depression, contraceptive use, and attendance of the postpartum check-up visit have limited data. Only a handful of studies have assessed postpartum contraceptive use or visit attendance. The studies published often include a short time frame or a particular period of the COVID-19 pandemic, focusing on the acute stress caused by COVID-19 rather than chronic stress. The existing literature consists mainly of qualitative studies or quantitate studies with small, geographically limited study populations recruited through convenience sampling, limiting the generalizability of results. While a handful of meta-analyses exist, these papers often include research from various countries that fail to reflect the vast differences in COVID-19 policies, culture, and perspectives across regions. In addition, some studies combine pregnant and postpartum individuals, which prevents distinguishing the pandemic's effects between these two populations. While the pandemic and related policies have evolved since 2020, outcomes of the pandemic still influence the health of women today. Analysis of the effect of the COVID-19 pandemic on postpartum behaviors and well-being could still provide valuable information on how to help those who gave birth during this time and may give a better idea of how to care for postpartum women in future pandemics.

Methods

Data Source

The study population included individuals who completed the Pregnancy Risk Assessment Monitoring System (PRAMS) Phase 8 questionnaire between 2016 and 2020. PRAMS is a surveillance project conducted by the Centers for Disease Control and Prevention (CDC) in conjunction with site health departments that examines maternal behaviors, attitudes, and experiences before, during, and shortly after pregnancy [42]. The PRAMS survey uses a system of stratified sampling, which oversamples select groups, such as mothers of low-birth weight infants, those who live in high-burden geographic areas, and racial/ethnic minorities. Each site collects data from mothers on a set of core questions, but

sites are allowed to tailor the survey to meet their needs by changing the survey appearance, supplemental topics, and sampling and stratification plan [42].

Site-specific data must meet a minimum response rate threshold to be released, which changed during the study period. From 2016 to 2017, the minimum response rate threshold was 55% and was lowered to 50% from 2018 onward [43]. Data were available from 48 sites for at least one of the years between 2016 to 2020 with a range of 31 to 43 sites with available data for release each year. Annual sample sizes per site ranged from approximately 500 to 2500 individuals. New mothers were contacted 2 to 6 months after birth via scheduled mail and/or follow-up phone calls to administer the survey [42]. PRAMS responses are linked to birth certificate data, which allows for the inclusion of select clinical variables. Birth certificate data are also used to generate analysis weights for sampling, nonresponse adjustment, noncoverage [42].

Exposure

Given the interest in evaluating the impact of the COVID-19 pandemic on postpartum outcomes, the exposure was assigned according to the month and year of infant birth as reported on the linked birth certificate. Individuals who gave birth between January 1st, 2016, and February 28th, 2020, were classified as not exposed to the COVID-19 pandemic, whereas births occurring between March 1st and December 31st, 2020, were classified as having been exposed to the COVID-19 pandemic. This cut-off for COVID-19 pandemic exposure was determined on March 13th, 2020, when then-President Donald J. Trump issued Proclamation 9994 declaring the COVID-19 outbreak in the United States a national emergency, beginning March 1st, 2020 [1]. While individuals who gave birth prior to March 2020 may have had some of their postpartum period overlap with the COVID-19 pandemic, such exposure is likely to be very different from those whose entire postpartum period occurred during the pandemic, and thus they were classified as unexposed.

Outcomes

This analysis examined the impact of the COVID-19 pandemic on four key indicators of postpartum maternal wellbeing: breastfeeding, contraception after delivery, postpartum depression

symptoms, and attendance of a postpartum check-up. All outcomes were reported categorically and assessed using responses to the PRAMS Phase 8 core questions.

To ascertain whether respondents had ever breastfed their babies, they were asked: “Did you ever breastfeed or pump breast milk to feed your new baby, even for a short period of time?” Those who responded “yes” to this question were classified has ever having breastfed, while those who responded “no”, were classified as not ever having breastfed. Postpartum individuals who reported that their baby was not alive or that their baby did not live with them at the time of the survey were not asked about breastfeeding initiation.

Postpartum contraception use was assessed using the question: “Are you or your husband or partner doing anything now to keep from getting pregnant?” Those who responded “yes” to this question were classified as using postpartum contraceptives, while those who responded “no”, were classified as not using postpartum contraceptives. Those who reported using birth control methods were then asked “What kind of birth control are you or your husband or partner using now to keep from getting pregnant? Check ALL that apply.” Birth control options included: female sterilization, vasectomy, condoms, birth control pills, contraceptive patches, vaginal rings, shots/injections, intrauterine devices (IUDs), contraceptive implants in the arm, natural family planning, withdrawal, abstinence, or other methods.

Postpartum contraceptive usage was further assessed by categories: LARC, sterilization, highly effective contraception, moderately effective contraception, and least effective contraception. LARC usage included individuals who reported using implants and/or IUDs. Sterilization usage examined participants who reported female and/or male sterilization (tubal ligation, vasectomy) as a postpartum contraceptive method. The categories of highly, moderately, and least effective contraceptive were assigned based on efficacy ratings by the American College of Obstetrics and Gynecology. Mostly effective contraception includes methods that result in less than 1 pregnancy in 100 women per year (implant, IUD, and male or female sterilization). Moderately effective contraception includes methods that result in 6 to 12 pregnancies in 100 women per year (3-month injection, pills, patch, and vaginal

ring). Least effective contraception includes methods that result in 18 or more pregnancies in 100 women per year (male condom, female condom, withdrawal, rhythm method, and abstinence) [44].

To assess the presence of postpartum depression symptoms, respondents were asked: “Since your new baby was born, how often have you felt down, depressed, or hopeless?” and “Since your new baby was born, how often have you had little interest or little pleasure in doing things you usually enjoyed?” Responses were recorded using a Likert scale with responses of “always,” “often,” “sometimes,” “rarely,” or “never.” Participants who responded “always” or “often” to both questions were classified as having symptoms of postpartum depression. This strategy has been used in previous research to classify individuals as experiencing postpartum depression symptoms [45].

Having had a postpartum check-up was assessed using the question “Since your new baby was born, have you had a postpartum checkup for yourself?” Those who responded “yes” to this question were classified as attending a postpartum visit, while those who responded “no”, were classified as not having attended a postpartum visit. An associated prompt identified a postpartum checkup as a regular checkup occurring 4 - 6 weeks after birth. Surveys were sent to postpartum women 2-6 months postpartum so by this definition, most postpartum check-ups should have already occurred prior to survey completion.

In addition to whether an individual attended their postpartum visit, a sub-analysis of individuals who reported attending a postpartum check-up examined the topics discussed. Respondents selected “yes” or “no” that the following activities occurred during the postpartum check-up: discussion about supplementation of folic acid; discussion about healthy eating, exercise, and losing weight gained during pregnancy; talk about how long to wait before getting pregnant again; conversation on birth control methods that can be used postpartum; provision of a contraceptive method such as the pill, patch, shot, ring, or condoms; insertion of an IUD or a contraceptive implant; assessment of current cigarette usage; evaluation of emotional or physical abuse; screening for depression; or test for diabetes.

Covariates

Covariates of interest included maternal age, body mass index (BMI), race, ethnicity, number of previous live births, education, marital status, postpartum insurance, delivery type, health conditions during pregnancy, infant mortality, and gestational age. Birth certificate data was used to find maternal age, number of live births (0, 1, 2, 2-5, or 6), gestational age (<=27 weeks, 28 – 33 weeks, 34 – 36 weeks, 37 – 42 weeks, or 43+ weeks), maternal education (<= 8th Grade, 9-12 Grade (no diploma), high school grad/GED, some college (no degree/associate degree), or Bachelors/Masters/Doctorate/Professional Degree), marital status (married v. other), and maternal ethnicity (Hispanic v. non-Hispanic). The PRAMS questionnaire collected self-reported data on maternal height (feet/inches or centimeters), maternal weight (pounds or kilograms), maternal race, postpartum insurance, health conditions during pregnancy (depression, diabetes, high blood pressure, none), delivery type (c-section v. vaginal birth), infant mortality (alive v. not alive), and state. Self-reported height and weight were used to calculate BMI values and categories. The month of last menstrual period was used to generate a clinical estimate of gestational age. For the racial variable, due to small sample size. Chinese, Filipino, Japanese, and Native Hawaiian were individually collected but collapsed into Asian (grouped). Alaska Native and American Indian were also collected separately and combined. Postpartum insurance type was collected by specific insurance source but categorized into three types for analysis: private, public, or no insurance.

Analytic Strategy

Sociodemographic characteristics and prior health history among women with and without exposure to the COVID-19 pandemic were compared using a chi-squared test for categorical variables and a t-test for continuous variables. Unadjusted and adjusted log binomial regression models were used to calculate the prevalence ratios and associated 95% confidence intervals (CIs) for the association between the COVID-19 pandemic and each of the four outcomes.

Covariates of interest were selected based on a review of related literature. A priori criteria and directed acyclic graphs (DAGs) were used to assess whether these covariates met the criteria to be considered as potential confounders. Based on this assessment, only the PRAMS site was determined to

be a confounder as the experience of the COVID-19 pandemic depended on state and the policies that were enacted to limit the spread of the virus varied by state. State may also be associated with the outcomes of interest (breastfeeding, postpartum contraceptive use, PPD, and postpartum visits) as access, health promotion campaigns, and general health behaviors can vary by state. No other covariates were hypothesized to plausibly impact the policies that were enacted after the onset of the COVID-19 pandemic. All other covariates were evaluated as potential effect modifiers. Effect measure modification was assessed by comparing stratified measures of association, these were also further evaluated for statistical interaction by evaluating the statistical significance associated with the product terms in the regression models. Analyses were performed in SAS 9.4 using complex survey procedures to account for the weighting and survey design.

Exclusion Criteria

The study sample included 206,080 individuals who participated in and completed the PRAMS survey during the 2016 to 2020 Phase 8 collection period. Due to the state variation in COVID-19 policies and norms, participants from states without available information for both non-exposed and exposed periods were excluded from the analysis. This resulted in the exclusion of seven states: Arizona, which lacked pre-pandemic PRAMS data; and Indiana, North Carolina, New York State, Oklahoma, Rhode Island, and Texas, which did not have available PRAMS data from the COVID-19 era. Exclusion of these seven sites eliminated 18,818 individuals from the study. The 187,262 remaining participants represented a weighted population of 9,137,840.

Results

A total of 187,262 individuals had available data for at least one of the measured outcomes in the pre-COVID-19 or COVID-19 era and were included in the analysis. Not every participant provided data for each outcome of interest or effect modifiers, so models included between 175,823 and 187,262 individuals.

Maternal demographic characteristics such as age, race, ethnicity, marital status, and education level were fairly similar between the pre-COVID and COVID eras. Additionally, delivery characteristics

such as number of previous live births, mode of delivery, gestational age, and infant mortality were similar across the two time periods. There were some small differences in indicators of maternal health between the pre-COVID era and the COVID era: compared to those who delivered in the pre-COVID era, those who gave birth between March and December 2020 had higher rates of obesity (32.1% v. 29.9%), depression both before (15.6% v. 13.8%) and during (15.4% v. 13.2%) pregnancy, and gestational diabetes (11.1% v. 9.5%). Additionally, compared to the pre-COVID cohort, participants who gave birth in the COVID-19 era had higher rates of public insurance (42.0% v. 36.3%) and lower rates of un-insurance (7.1% v. 10.0%) (Table 1).

After adjusting for state, there were no meaningful changes in the overall prevalence of ever having breastfed, using postpartum contraception, and attending a postpartum visit between the pre-COVID and COVID eras. However, the COVID era was associated with an increased prevalence of postpartum depression (aPR = 1.15; 95% CI: 1.14 - 1.16).

There were a few differences in the relationship between the COVID-19 pandemic and our outcomes of interest by race. Asian Americans and Native Hawaiians' use of postpartum contraceptives decreased during the pandemic while other racial groups usage remained similar to pre-pandemic levels (aPR for Asian Americans and Native Hawaiians = 0.85; 95% CI: 0.85 - 0.86). The COVID-19 pandemic was associated with increased prevalence of postpartum depression among Mixed Race (aPR = 1.47; 95% CI: 1.42 - 1.52) and American Indians and Alaskan Natives (aPR = 1.44; 95% CI: 1.34 - 1.54) while Asian Americans and Native Hawaiians reported decreased prevalence of postpartum depression symptoms (aPR = 0.65; 95% CI: 0.62 - 0.68).

The impact of the pandemic on postpartum depression was substantially elevated among those with a prior history of depression. Among those with a history of depression either in the 3 months before conception or during pregnancy, the prevalence of postpartum depression among those exposed to the COVID-19 pandemic was nine times that of those who were not exposed (aPR = 9.04; 95% CI: 8.94 - 9.14).

The pandemic's influence on postpartum check-up attendance varied by insurance status. Those without insurance were less likely to attend a postpartum check-up during the COVID-era compared to the pre-COVID era (aPR = 0.88; 95% Ci: 0.88 - 0.88).

A sub-analysis was conducted to determine whether the pandemic influenced the type of contraceptive used (LARC and sterilization) or effectiveness of contraceptive used (highly, moderately or least effective). Overall, there were no meaningful differences in the type or effectiveness of contraceptives used in the COVID era compared to the pre-COVID era. When stratified by race and ethnicity, however, Asian Americans and Native Hawaiians were more likely to report using least effective contraceptive methods during the COVID-era (aPR: 1.31; 95% CI: 1.30 - 1.32) than they did during the pre-pandemic era.

Another sub-analysis evaluated whether there were differences in the topics discussed at postpartum check-ups between the two time periods. Among those who attended a postpartum check-up, were no overall differences between the pre-COVID and COVID eras in reporting having talked with their healthcare provider about abuse and postpartum depression. However, among those who self-identified as Black, American Indian/Alaskan Native, Hispanic or reported not having insurance, there was an increase in reporting of talking about abuse during a postpartum visit (aPR Black = 1.34, 95% CI: 1.34 - 1.35) (aPR American Indian/Alaskan Native = 1.27, 95% CI: 1.26 - 1.28) (aPR Hispanic = 1.34, 95% CI: 1.33 - 1.34) (aPR no insurance = 1.22; 95% CI: 1.22 - 1.22).

Discussion

The COVID-19 pandemic created many social, behavioral, and economic changes in the United States that had the potential to influence postpartum well-being and healthcare decision-making. Overall, this analysis shows that the onset of the pandemic did not have a meaningful influence on the prevalence of breastfeeding, postpartum contraceptive use, or postpartum check-up attendance. However, as might be expected, there were some subsets of the postpartum population who were more vulnerable to the impacts of the pandemic.

When stratifying by race, a more nuanced understanding of the relationship between the COVID-19 pandemic and postpartum contraceptive use emerged. While overall postpartum contraceptive use did not meaningfully change, Asian Americans and Native Hawaiians experienced a decrease in their use of contraceptives postpartum during the pandemic. Moreover, they were the only racial group to be more likely to report using the least effective contraceptive methods during the COVID-era despite access to postpartum check-ups remaining the same. While Asian Americans did experience more racism during the COVID-19 pandemic which may have influenced their experience with healthcare providers [46], more research into the impact of the pandemic on access to and attitudes towards postpartum contraception is needed to understand this change.

Racial differences were also observed in rates of postpartum depression. The COVID-19 pandemic was associated with decreased prevalence of PPD among Asian Americans and Native Hawaiians. Despite the increased racial discrimination experienced by Asian Americans during the pandemic [46], lower rates of PPD could be potential be explained by strong social supports. Asian Americans are more likely to reside in a multigenerational household [47] which may have limited isolation and increased family support during the pandemic. In contrast, American Indians and Alaskan Natives reported higher rates of postpartum depression symptoms during the pandemic. American Indians/Alaskan Natives had higher rates of COVID-19 mortality. Grief from increased deaths paired with an underfunded healthcare system, higher rates of uninsurance, and greater financial insecurity may account for the increased PPD [48].

The most striking finding of our study was that those who self-reported experiencing depression in the 3 months prior conception and/or during pregnancy had nine times the prevalence of PPD during the COVID-era compared to the pre-pandemic period. COVID-19 and its associated disruptions to socialization created a surge of demand for mental health services during the pandemic that overwhelmed the mental health system [49]. Postpartum mothers with a history of depression were particularly vulnerable to the sudden changes brought on by the pandemic, and an overall surge in the need for mental health care services likely made resources less available to them at a time when they needed them most.

Consistency with the Broader Literature

Given the lack of existing information on the impact of a global pandemic like COVID-19 on postpartum health outcomes and decisions, much of the early research on this topic utilized study designs that could rapidly generate information. These included qualitative studies, surveys that employed convenience sampling, and short-term, geographically restricted cohorts. While all of these methodologies yielded critical information during a period of rapidly changing circumstances, they were limited in their generalizability. With the advantage of having some additional time since the onset of the pandemic, this analysis has afforded a broader look at the influence of the pandemic on these key postpartum health indicators.

Among the existing literature that assessed changes to breastfeeding behaviors during the pandemic, only a few examined the effect of the COVID-19 pandemic on overall breastfeeding rates. A **c**ross-sectional study of electronic medical records at two New York City hospitals examined disparities in exclusive breastfeeding rates between a pandemic period (April 1 - July 31, 2020) and a pre-pandemic period (January 1, 2019 - February 28, 2020). Exclusive breastfeeding was defined as only breastmilk during delivery hospitalization, regardless of the route of administration. This study found an increase in **t**he percentage of mothers whom exclusively breastmilk fed during the pandemic as compared to the pre-pandemic period (33.5% to 37.7%; $p<0.001$). When breaking down by race, the increase was only statistically significant among White (40.8% to 46.6%, $p<0.001$) and Asian (27.9% to 35.8%, $p=0.004$) women [9]. In contrast, a cross-sectional opt-in survey among 1,617 individuals in the U.S. who used Ovia's parenting app found that when comparing the pre-pandemic (August 1 – December 31, 2020) to the early pandemic period (March 1 – May 31, 2020) and pre-pandemic to the later pandemic (June 1 – August 31, 2021) period did not statistically significant differences in breastfeeding initiation rates (94% to 92%; $p=0.08$; 94% to 94%; $p=0.16$) [10]. Our results were consistent with the DeYoreo et al. study that found no difference in rates of breastfeeding initiation between the pre-pandemic and pandemic periods. While the Glazer et al. study differed from our study in their finding of an overall increase in exclusive breastfeeding during delivery hospitalization and specifically among White and Asian individuals, the

difference in classification of the exposure period, study population, and slightly different outcome of breastfeeding initiation versus exclusive breastfeeding during delivery hospitalization could explain differences.

More research on contraceptive use in the COVID-era focused on trends in the general, rather than the postpartum population. These studies found decreases in general contraceptive use, especially LARC and emergency contraceptives, during the pandemic [50]. However, contraceptive decisions during the postpartum period differ from those outside the postpartum period [51]. A retrospective cohort study examined the postpartum contraceptive decisions of patients who received prenatal care at 1 of 5 academic obstetrical practices in Chicago and then who delivered at Northwestern Memorial Hospital before the COVID-19 pandemic (September 1, 2018 - January 1, 2019) or during the pandemic (February 1 - May 15, 2020). After adjusting for marital status, preexisting diabetes, gestational diabetes, BMI >30 kg/m^2 at delivery, and hypertensive disorders during pregnancy, the study found that postpartum individuals who had delivered during the COVID-19 pandemic were significantly less likely to use LARCs within 3 months of delivery (aOR = 0.67; 95% CI: 0.53−0.84). Individuals who used LARC during the COVID-era were more likely to have had them placed during delivery hospitalization compared to those who used LARC during the pre-pandemic period (24% to 11%; p<.01) [23]. Another study reviewed health insurance claims submitted through software from Symphony Health Claims Clearinghouse used by ~16,000 health plans in the U.S. before (May 1, 2019 - March 31, 2020) and during the COVID-19 pandemic (April 1 to December 31, 2020). The research concluded that the percentage of individuals who had a tubal ligation within three months postpartum declined by 1.0 percentage point (95% CI: 0.8-1.2) and LARC within three months postpartum declined by 2.0 percentage points (95% CI: 1.7 – 2.2) at the start of the pandemic while usage of other methods stayed the same [24]. These studies differed from the results of our investigation as we did not find a meaningful difference in LARC or sterilization during the pandemic. Differences in study population may account for the differences between our study results and the two studies that reported differences in type of contraceptive usage during the pandemic. A final cohort study at a single urban academic medical center

reviewed electronic medical records to assess the total use of postpartum contraception at 12 weeks postpartum in a COVID cohort (March 1 – June 15, 2020) and comparison group (March 1 – June 15, 2019). In this cohort, the total use of postpartum contraceptives remained nearly the same between the COVID and non-COVID groups (30.4% to 29.6%; p=0.69). The study also found overall LARC usage to be the same in the COVID and non-COVID groups (13.9% to 15.3%; p=0.4) [25], which is consistent with our findings.

With regards to postpartum depression, the majority of published studies align with our findings that the prevalence of postpartum depression symptoms increased during the pandemic, but the time frame in which postpartum depression increased varied by study. In Central New Jersey, research that used the Edinburgh Postnatal Depression Scale and vital statistics found that after matching by time and month, postpartum individuals in March 2020 reported higher levels of depressive symptoms compared to the pre-pandemic period (September 1, 2019 – February 28, 2020), but that this difference was not present in the second month of the pandemic (April 2020) [37]. This result contrasts with a study that looked at the mood of Flo mobile health app users within 90 days postpartum pre-pandemic (January 1, 2018 – February 28, 2020) and at three different points during the pandemic (March 1 – May 30, 2020; June 1 – August 31, 2020; September 1 – November 30, 2020; December 1, 2020 – March 31, 2021) which found that rates of postpartum depression symptoms increased from 6.5% to 6.9% during the pandemic period and the continued to increase over the course of the pandemic [38]. Another study recruited survey participants on social media websites who gave birth between March 1 - September 30, 2020, and assessed depression using a 7-item Postpartum Depression Screening Scale-Short Form. It found that women who reported a past history of mental illness had higher depression (PDSS-SF) scores than those without a history of mental illness ($F(1,259) = 29.92$, $p = <.001$) [35]. This increase in postpartum depression symptoms during the pandemic among postpartum individuals with a history of mental illness echoes our study's finding.

Emerging evidence surrounding postpartum check-up attendance during the COVID-19 pandemic has generally found that postpartum visits declined during the pandemic, relative to the pre-pandemic

period. The cohort study at a single urban academic medical center that looked at contraceptive use in COVID (March 1 – June 15, 2020) and pre-COVID (March 1 – June 15, 2019) found that 12 weeks after delivery the attendance of any postpartum visit had decreased during the pandemic (74.7% to 64.0%; $p<0.01$) [25]. Similarly, the cohort study of patients who received prenatal care at 1 of 5 academic obstetrical practices in Chicago and who delivered at Northwestern Memorial Hospital before (September 1, 2018 – January 1, 2019) and during (February 1 – May 15, 2020) the pandemic found that patients who delivered during the pandemic were less likely to attend any postpartum visit compared to those who delivered prior to the pandemic (87.7% to 90.4%; $p=0.036$) [23]. The time period of the pandemic assessed and date that postpartum check-up attendance was asked may account for the difference between our results and these studies. A research letter that also examined PRAMS data from 2016 to 2020 did report a decline in postpartum visit attendance by 5.8 percentage points (95% CI: -6.4 to -5.2) during the pandemic with greater declines among non-Hispanic Black (−9.9 percentage points; 95% CI: −11.6 to −8.1) and individuals with no insurance coverage postpartum (-11.4 percentage points; 95% CI: -14.3 to -8.3) [52]. While our study did find that individuals without postpartum insurance coverage declined disproportionately during the pandemic, differences in the states included in the analysis, analysis type, confounders, and different definitions of the COVID-19 exposure (April 2020 v. March 2020) might explain the different conclusions. Overall, it was hard to compare our results to existing literature due to limited existing research and discrepancies in definitions of COVID-19 exposure.

Strengths & Limitations

Strengths of using PRAMS data to assess the impact of the COVID-19 pandemic on select postpartum outcomes (breastfeeding initiation, postpartum contraceptive use, postpartum depression, and postpartum check-up attendance) include the scope and detail of questions asked. PRAMS collects national data about the postpartum period which is not captured in other surveillance systems. Its consistency and use of standardized recruitment and data collection procedures allow direct comparison between states and across years with the same questionnaire. Given that a majority of states participate in

PRAMS, and the analytic weighting, this sample population can be treated as a representative sample of births within the United States.

This study is not without limitations. PRAMS is a cross-sectional study that only collects data at one time, thus, results only reflect how the COVID-19 pandemic had impacted postpartum individuals up until the time that they completed the survey. While we used the date of March 1, 2020 to operationalize exposure to the COVID-19 pandemic, this may have led to misclassification of the exposure. PRAMS did not collect any information regarding perceived exposure to COVID-19 pandemic changes. To best approximate the exposure variable and to remain consistent with existing literature on the COVID-19 pandemic, our study selected a cut-off date based on when the COVID-19 pandemic might have impacted the birth experience to classify the periods before (January 1st, 2016 – February 28th, 2020) and during the pandemic (March 1st, 2020 – December 31st, 2020). However, the cut-off point selection varied amongst studies and as some individuals gave birth before the cut-off date but had majority of their postpartum experience after COVID-19 had been declared a national emergency in the U.S., misclassification of the exposure may have occurred particularly in the first few months of 2020.

Other potential study limitations include misclassification of the outcomes. Data in PRAMS are based on self-report so there is a potential for recall bias or social desirability bias that might influence an individual's response. Postpartum depression symptoms are a matter of perception and self-report of depression symptoms might not correlate with clinical diagnosis. Postpartum depression was measured in the PRAMS survey using the two Whooley questions [45]. A meta-analysis that examined the accuracy of the tool for diagnosing depression among perinatal women found a pooled sensitivity of 0.95 (95% CI: 0.81 - 0.99) and a pooled specificity of 0.60 (95% CI: 0.44 - 0.74) which is comparable to other screening tools for depression [53]. It is unknown whether the degree of misclassification of these symptoms would differ between the pre-pandemic and COVID eras. While breastfeeding, contraceptive use, and postpartum check-up attendance are less subjective, there is still a potential for misclassification of these outcomes. Other potential causes of misclassification of the outcome come from the PRAMS question about postpartum check-up attendance. A prompt in the questions defines a postpartum checkup as a

regular visit around 4-6 weeks postpartum. This prompt may cause individuals who were instructed by their providers to come back early due to a complication or high factor or individuals who delayed their postpartum check due to pandemic restrictions to report that they did not attend a postpartum checkup due to the narrow definition. This would lead to differential misclassification of the outcome since this would only impact participants who gave birth during the COVID-19 pandemic.

Another limitation of our study is the timing of data collection for PRAMS survey. Most surveys are collected between 2-9 months after delivery. The response of an individual who is 2 months postpartum and 9 months postpartum may differ for breastfeeding, postpartum contraceptive use, and postpartum depression. Since the possible duration of breastfeeding was not the same for all respondents (e.g., survey completion at 9 months versus 2 months postpartum), breastfeeding initiation (rather than duration) was evaluated, despite long-term exclusive breastfeeding having a larger impact on postpartum and infant health. For birth control, only current contraceptive use and method are assessed in the postpartum period. Depending on what period of the postpartum period an individual is in, their response to the question may differ. Ovulation can occur as early as 25 days postpartum in non-breastfeeding individuals, but the CDC recommends waiting until 42 days postpartum for combined hormonal contraception for some women [54]. Some women may practice abstinence during the early postpartum period or rely on lactational amenorrhea by exclusively breastfeeding for up to six months, and others might opt for non-hormonal options when breastfeeding [55-57]. As such, comparing postpartum contraceptive use and method using PRAMS data is difficult. Postpartum depression also becomes difficult to assess given the range of data collection times in PRAMS as outcomes may not have developed yet. Women further into their postpartum period have a higher change of screening positive for PPD and have higher depression scores [31, 33]. Thus, participants who completed the survey later may have more accurate rates of PPD than those screened earlier. Postpartum visit attendance might also be affected by the length of time from delivery to survey completion as individuals who respond earlier might have plans to attend a postpartum visit but have been delayed beyond the normal schedule of a visit 4-6 weeks postpartum. Nevertheless, we expect variation in how much time has elapsed between delivery

and survey completion both before and after the pandemic. So long as there were no differences in the timing of response, this is unlikely to impact our estimates.

Finally, we were not able to include all of the different racial groups as they were collected by PRAMS. While additional racial categories such Chinese, Filipino, Japanese, Native Hawaiian, Alaska Native, and American Indian were available, these categories needed to be collapsed in the analysis due to insufficient sample size. Additionally, maternal outcomes may further vary between the racial categories collected. For example, the impact of COVID-19 pandemic on African Americans and African immigrants may differ. Another limitation is that our study examines the first 10 months of the pandemic. A more detailed analysis of shorter time intervals may reveal how specific policies or decisions influenced maternal health.

Public Health Implications

Despite these limitations, our study provides an overview of changes in postpartum health outcomes and decisions during the first 10 months of the COVID-19 pandemic. While the COVID-19 pandemic does not currently have the same restrictions and social, emotional, and financial impacts that it did early on, these findings remain important as they highlight groups who were most vulnerable and who may continue to require support to recover from the damage caused during COVID-19. Given the potential for future pandemics or natural disasters, these findings can serve as a guide for early identification of at-risk groups when these disasters strike. Investigations into how particular policies implemented or time periods during COVID-19 influenced postpartum well-being could provide a more nuanced look into the effects of the pandemic and provide insight into ways to mitigate damage or protect postpartum populations in the future. While our study examined the acute effects of the onset of the pandemic, an investigation into the long-term impacts based by chronic anxiety or stress due to COVID-19 may further elucidate the association between the pandemic and maternal health outcomes.

Conclusion

The COVID-19 pandemic had a profound impact on the lives of postpartum women in the United States. Our study found a link between the COVID-19 pandemic and PPD which was particularly strong

among those who dealt with depression during pregnancy or 3 months prior to conception. While COVID-19 has a more limited impact on the lives of individuals today, further research into the long-term impacts of the COVID-19 pandemic on postpartum well-being is needed. Given the potential for a similar pandemic or catastrophic event in the future, research into strategies to support and screen postpartum individuals for PPD can prevent subsequent negative health outcomes among postpartum individuals.

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Tables

Table 1. Select Characteristics of PRAMS Participants (2016-2020) Stratified by Exposure		
	Pre-COVID Era (Jan 2016 – Feb 2020) Count (Weighted Percentage) n = 152,786	**COVID-19 Era** (Mar 2020 – Dec 2020) Count (Weighted Percentage) n = 34,476
Maternal Demographic Information		
Maternal Age		
<=17 years old	1,867 (1.1)	381 (1.1)
18 - 19 years old	5,189 (3.1)	1,067 (3.0)
20 –24 years old	27,907 (18.3)	6,077 (17.7)
25 – 29 years old	44,538 (29.2)	9,670 (28.4)
30 – 34 years old	44,766 (29.7)	10,468 (30.6)
35 – 39 years old	23,218 (15.3)	5,505 (15.6)
40 + years old	5,294 (3.4)	1,307 (3.6)
Maternal Race		
Alaska Native	1,375 (0.1)	245 (0.1)
American Indian	4,746 (0.7)	1,546 (0.8)
Asian Other	7,248 (3.9)	1,782 (3.7)
Black	29,137 (16.5)	6,541 (16.7)
Chinese	1,933 (1.2)	409 (1.0)
Filipino	1,249 (0.6)	390 (0.6)
Japanese	348 (0.1)	95 (0.1)
Native Hawaiian	78 (0.02)	23 (0.02)
Mixed Race	7,872 (2.9)	2,354 (3.3)
Other Race	7,100 (5.3)	1,643 (6.2)
White	86,663 (68.7)	18,524 (67.5)
Ethnicity		
Hispanic	26,041 (16.9)	6,006 (18.6)
Non-Hispanic	27,495 (83.1)	121,977 (81.4)
Marital Status		
Married	90,716 (61.9)	20,106 (60.4)
Other	61,958 (38.2)	14,345 (39.6)
Maternal Education		
<= 8th Grade	4,499 (3.1)	944 (3.1)
9-12th Grade, No Diploma	14,176 (8.5)	2,938 (7.9)
High School, Graduate/GED	36,897 (24.8)	8,599 (25.9)
Some College, No Degree/Associate Degree	43,417 (26.9)	9,535 (25.9)
Bachelors or Higher	52,563 (36.8)	12,194 (37.2)

Table 1. Select Characteristics of PRAMS Participants (2016-2020) Stratified by Exposure (continued)

	Pre-COVID Era (Jan 2016 – Feb 2020) Count (Weighted Percentage) n = 152,786	**COVID-19 Era** (Mar 2020 – Dec 2020) Count (Weighted Percentage) n = 34,476
Maternal Health		
Number of previous live births		
0	59,281 (38.8)	13,757 (39.8)
1	48,293 (33.1)	10,563 (32.5)
2	25,202 (16.4)	5,605 (16.4)
3-5	17,944 (10.7)	4,043 (10.4)
6+	1,831 (1.1)	445 (1.0)
Maternal BMI[1]	26.98 (6.9)	27.38 (7.0)
Underweight	13,528 (9.0)	2,749 (8.2)
Normal	65,985 (46.6)	14,266 (44.8)
Overweight	20,984 (14.6)	4,874 (14.9)
Obese	45,266 (29.9)	10,938 (32.1)
Pre-pregnancy health condition[2]	29,530 (17.6)	7,683 (19.6)
Depression	22,378 (13.8)	5,897 (15.6)
Diabetes	5,085 (3.1)	1,156 (2.8)
High Blood Pressure	9,302 (5.2)	2,286 (5.4)
Pregnancy health condition	49,525 (29.5)	12,711 (33.1)
Depression	21,884 (13.2)	5,760 (15.4)
Gestational Diabetes	15,282 (9.5)	4,045 (11.1)
High Blood Pressure[3]	23,292 (13.1)	6,050 (14.8)

[1] Reported as unweighted mean (unweighted standard deviation)

[2] Health condition reported as present 3 months before pregnancy. Includes eclampsia and pre=eclampsia

[3] Started during pregnancy

Table 1. Select Characteristics of PRAMS Participants (2016-2020) Stratified by Exposure (continued)

	Pre-COVID Era (Jan 2016 – Feb 2020) Count (Weighted Percentage) n = 152,786	**COVID-19 Era** (Mar 2020 – Dec 2020) Count (Weighted Percentage) n = 34,476
Characteristics of Delivery/Postpartum Period		
Infant Alive		
Alive	151,832 (99.8)	34,274 (99.9)
Dead	733 (0.2)	154 (0.1)
Delivery Type		
C-section	50,047 (30.6)	11,553 (31.4)
Vaginal	102,636 (69.4)	22,892 (68.6)
Gestational age		
<=27 weeks	2,207 (0.6)	528 (0.55)
28 – 33 weeks	7,444 (1.9)	1,621 (1.7)
34 – 36 weeks	16,784 (6.6)	4,061 (7.0)
37 – 42 weeks	126,156 (91.0)	28,224 (90.8)
43+ weeks	23 (0.02)	8 (0.03)
Postpartum Insurance Source		
Public Insurance	62,234 (36.3)	15,950 (42.0)
Private Insurance	77,394 (53.8)	17,220 (52.7)
Other Insurance	5,973 (4.3)	1,057 (3.3)
No Insurance	14,033 (10.0)	2,088 (7.1)
Postpartum Outcomes[4]		
Ever Breastfed	130,481 (87.7)	29,548 (87.7)
Contraceptive Use	116,949 (78.4)	25,940 (77.3)
Postpartum Depression Symptoms	5,946 (3.4)	1,500 (3.9)
Attended Postpartum Check-Up	133,729 (90.2)	29,751 (88.9)

[4] Reported as number of participants who responded affirmatively.

Table 2. Postpartum Behaviors and Outcomes Comparing the COVID-19 Pandemic to the Pre-Pandemic Period[1]

	Ever Breastfed n = 181,631	Postpartum Contraceptive Use n = 183,038	Postpartum Depression Symptoms n = 187,262	Postpartum Check-up Attendance n= 183,638
Overall PR	1.00 (1.00 - 1.00)	0.98 (0.98 - 0.98)	1.12 (1.11 - 1.13)	0.99 (0.99 - 0.99)
Race[2]	n = 175,823	n = 177,242	n = 181,301	n = 177,805
American Indian/Alaskan Native	0.95 (0.95 - 0.96)	0.92 (0.91 - 0.93)	1.44 (1.34 - 1.54)	0.85 (0.84 - 0.86)
Asian & Native Hawaiian	1.02 (1.02 - 1.02)	0.85 (0.85 - 0.86)	0.65 (0.62 - 0.68)	0.99 (0.99 - 0.99)
Black	0.90 (0.90 - 0.90)	0.92 (0.92 - 0.92)	1.13 (1.11 - 1.16)	0.94 (0.94 - 0.94)
Mixed Race	0.97 (0.96 – 0.97)	0.96 (0.96 - 0.97)	1.47 (1.42 - 1.52)	0.93 (0.93 - 0.94)
Other Race	0.98 (0.98 - 0.98)	0.97 (0.97 - 0.98)	1.05 (1.02 - 1.09)	0.89 (0.89 - 0.89)
White	1.01 (1.01 – 1.01)	0.98 (0.98 - 0.98)	1.15 (1.14 - 1.17)	0.99 (0.99 - 0.99)
Ethnicity[2]	n = 176.038		n = 181,519	n = 178,021
Hispanic	1.02 (1.01 - 1.01)	-	0.83 (0.82 - 0.85)	0.93 (0.93 - 0.93)
Non-Hispanic	1.01 (1.01 - 1.02)	-	0.89 (0.87 - 0.92)	1.02 (1.02 - 1.02)
Prior Pregnancy intent		n = 183,038		
Desired	-	0.98 (0.98 - 0.99)	-	-
Not Desired at Time/Ever	-	1.06 (1.06 - 1.07)	-	-
Unsure	-	1.01 (1.00 - 1.01)	-	-
Infant Alive			n = 187,262	
Yes	-	-	0.62 (0.62 - 0.64)	-
No	-	-	0.82 (0.79 - 0.85)	-
Prior Depression			n = 187,262	
Yes	-	-	9.04 (8.94 - 9.14)	-
No	-	-	1.08 (1.06 - 1.10)	-
Postpartum Insurance Status				n = 183,374
Insured	-	-	-	1.04 (1.03 - 1.04)
Uninsured	-	-	-	0.88 (0.88 - 0.88)

[1] Values in the table include prevalence ratio and 95% confidence interval, adjusting for state.

[2] Vermont is not included in the analysis stratified by race or ethnicity as the state did not release race or ethnicity data.

Table 3. Postpartum Contraceptive Use by Type Comparing the COVID-19 Pandemic to the Pre-Pandemic Period[1]

	LARC Usage[2]	Sterilization[3]	Mostly Effective Contraception[4]	Moderately Effective Contraception[5]	Least Effective Contraception[6]
Overall PR (n = 142,889)	1.03 (1.03 - 1.04)	0.96 (0.96 - 0.97)	1.01 (1.00 - 1.01)	1.00 (1.00 - 1.00)	0.96 (0.96 - 0.96)
Race[7] (n = 138,151)					
American Indian/Alaskan Native	1.40 (1.37 - 1.44)	1.01 (0.96 - 1.06)	1.28 (1.25 - 1.30)	1.06 (1.03 - 1.09)	0.78 (0.76 - 0.80)
Asian & Native Hawaiian	0.65 (0.64 - 0.66)	0.56 (0.54 - 0.57)	0.62 (0.61 - 0.63)	0.69 (0.68 - 0.70)	1.31 (1.30 - 1.32)
Black	1.09 (1.08 - 1.10)	0.86 (0.85 - 0.87)	0.99 (0.98 - 1.00)	1.15 (1.14 - 1.15)	0.96 (0.95 - 0.96)
Mixed Race	1.20 (1.18 - 1.22)	0.89 (0.87 - 0.91)	1.08 (1.07 - 1.09)	0.92 (0.90 - 0.93)	1.03 (1.02 - 1.04)
Other Race	1.26 (1.25 - 1.28)	0.94 (0.92 - 0.96)	1.14 (1.13 - 1.15)	1.01 (1.00 - 1.02)	0.81 (0.81 - 0.82)
White	1.04 (1.04 - 1.05)	0.98 (0.97 - 0.99)	1.02 (1.02 - 1.02)	1.00 (1.00 - 1.01)	0.96 (0.96 - 0.97)

[1] Values in the table include prevalence ratio and 95% confidence interval, adjusting for state.

[2] LARC stands for long-acting reversible contraception and includes implants and IUDs.

[3] Includes female and male sterilization (tubal ligation, vasectomy).

[4] According to the American College of Obstetrics and Gynecology, mostly effective contraception includes methods that result in less than 1 pregnancy in 100 women per year (implant, IUD, and male or female sterilization).

[5] According to the American College of Obstetrics and Gynecology, moderately effective contraception includes methods that result in 6 to 12 pregnancies in 100 women per year (3-month injection, pills, patch, and vaginal ring).

[6] According to the American College of Obstetrics and Gynecology, the least effective contraception includes methods that result in 18 or more pregnancies in 100 women per year (male condom, female condom, withdrawal, rhythm method, and abstinence).

[7] Vermont is not included in the analysis stratified by race as the state did not agree to release race variables.

Table 4. Topics Discussed at Postpartum Check-up Comparing the COVID-19 Pandemic to the Pre-Pandemic Period[1]

	Asked about Abuse at Postpartum Visit n = 162,110	Asked about Depression at Postpartum Visit n = 162,523
Overall PR	1.04 (1.04 - 1.04)	1.01 (1.01 - 1.02)
Race[2]	**n = 156,874**	**n = 157,273**
American Indian/Alaskan Native	1.27 (1.26 - 1.28)	1.01 (1.00 - 1.01)
Asian & Native Hawaiian	1.17 (1.16 - 1.17)	1.01 (1.01 - 1.02)
Black	1.34 (1.34 - 1.35)	1.02 (1.02 - 1.03)
Mixed Race	1.21 (1.21 - 1.22)	1.01 (1.00 - 1.01)
Other Race	1.38 (1.37 - 1.38)	1.01 (1.01 - 1.01)
White	1.04 (1.04 - 1.05)	1.01 (1.01 - 1.01)
Ethnicity[2]	**n = 156,995**	**n = 158,665**
Hispanic	1.34 (1.33 - 1.34)	1.03 (1.03 - 1.03)
Non-Hispanic	1.15 (1.14 - 1.15)	1.05 (1.04 - 1.05)
Postpartum Insurance Status	**n = 161,917**	**n = 162,329**
Insured	1.08 (1.07 - 1.09)	1.06 (1.06 - 1.06)
Uninsured	1.22 (1.22 - 1.22)	1.02 (1.02 - 1.02)

[1] Values in the table include prevalence ratio and 95% confidence interval, adjusting for state.

[2] Vermont is not included in the analysis stratified by race or ethnicity as the state did not release race or ethnicity data