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Prevalence and correlates of very rapid repeat pregnancy, Pregnancy Risk Assessment Monitoring System, United States, 2009-2020

Amanda Luff[1,2], **Michelle Menegay**[3], **Maria F. Gallo**[1]

[1]Division of Epidemiology, College of Public Health, Ohio State University, Columbus, Ohio, U.S.

[2]Advocate Aurora Research Institute, Aurora Health Care, Advocate Health, Milwaukee, WI, U.S.

[3]Ohio Colleges of Medicine Government Resource Center, Ohio State University Wexner Medical Center, Columbus, Ohio, U.S.

Abstract

Background: Most rapid repeat pregnancies, defined as those occurring within 18 months of a previous birth, are unintended. These pregnancies are associated with later initiation of prenatal care and are more common among people with lower socioeconomic status and among racially and ethnically minoritized populations.

Objectives: To assess prevalence and correlates pregnancies occurring in the immediate period after a live birth in the U.S., using the Pregnancy Risk Assessment Monitoring System (PRAMS).

Methods: We assessed data from the 2009-2020 PRAMS, a population-based survey of perinatal maternal characteristics of mothers of liveborn infants in U.S. locations. We assessed pregnancies reported during the immediate postpartum period (approximately 2-6 months post-delivery), and term this “very rapid repeat pregnancy” (VRRP). We assessed the adjusted prevalence of VRRP from 2009-2020. From 2016-2020, we calculated adjusted prevalence ratios (aPRs) with 95% confidence intervals (CIs) for maternal characteristics.

Results: The adjusted prevalence of VRRP ranged from 0.38% (95% CI: 0.29, 0.48) in 2009 to 0.76% (95% CI: 0.61, 0.91) in 2020. Demographic characteristics associated with VRRP included younger age, lower educational attainment, and being unmarried. Black mothers had a higher prevalence or VRRP compared to white mothers. Mothers who attended a healthcare visit in the 12 months preconception had lower prevalence of VRRP as did mothers who attended a postpartum check-up, compared to their counterparts without these visits. Among those receiving prenatal care, mothers whose prenatal healthcare provider asked about postpartum contraception birth had a lower prevalence of VRRP, compared to those not asked about postpartum contraception.

Corresponding author: Amanda Luff, Division of Epidemiology, The Ohio State University, Columbus, OH, luff.13@buckeyemail.osu.edu.

Ethics Statement: Data used in these analyses were acquired through a data use agreement with CDC PRAMS. PRAMS is overseen by the CDC Institutional Review Board (IRB). The data were provided to investigators in a de-identified format, and the OSU IRB deemed the present analysis to not be human subjects research. The authors report no conflicts of interest.

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Conclusions: VRRP appeared to increase over time in 2009-2020. Mothers who are younger, Black, have lower educational attainment, or who did not attend healthcare visits before or after pregnancy had higher prevalence of VRRP and may comprise a population who would benefit from additional family planning resources.

Keywords

Fertility; Postpartum Period; Pregnancy; Surveys and Questionnaires; PRAMS

Background

In the U.S., 64.5% of women ages 40-49 have given birth to more than one child, with women giving birth to an average of 1.7 children in their lifetimes.[1,2] Rapid repeat pregnancies (RRPs), or pregnancies occurring within 18 months of a previous birth, account for 29-39% of second or higher-order births, with 5-9% of repeat pregnancies occurring within six months. [3,4] RRP is associated with later initiation of prenatal care in the subsequent pregnancy,[3] and is more common among people who are unmarried, have lower educational attainment, and who are not white.[5] Although some research indicates that RRP is associated with a higher risk of adverse birth outcomes, such as low birthweight, neonatal intensive care unit admissions, and infant mortality, the causal relationship is unclear.[3,6–8] Nearly 73% of RRPs are unintended,[9] suggesting that for many people RRP is a negative health outcome unto itself, independent of potential negative health outcomes.

RRPs are often unintended for a variety of reasons, including that ovulation has been documented to occur as early as 27 days postpartum,[10] and some may misestimate their return to fertility. Postpartum contraception is typically discussed at the 6-week postpartum visit, by which time many women may have returned to fertility, especially those who are not exclusively breastfeeding.[11] Additionally, many women face challenges in attending these postpartum visits, citing reasons such changes to personal schedules or lifestyles due to their newborn, lack of childcare, and work or school obligations.[12] Unintended RRPs are more likely among those with lower educational attainment.[13] Contraceptive counseling in the prenatal and immediate postpartum period is associated with decreased risk of RRP.[14,15]

The Pregnancy Risk Assessment Monitoring System (PRAMS) is a surveillance project conducted by the Centers for Disease Control and Prevention in conjunction with state and jurisdiction health departments and participating sites represent 81% of U.S. live births.[16] PRAMS surveys mothers two to six months after delivery of a liveborn infant using mail and telephone surveys.[16] Using PRAMS data, we sought to assess temporal trends and correlates of very rapid repeat pregnancy (VRRP), which we define as pregnancies reported by mothers in the immediate postpartum period, approximately 2-6 month following live birth.

Methods

The PRAMS sampling pool includes mothers who reside in a participating site (states or other geographic areas) who gave birth to a liveborn infant within the survey year. Sites identify eligible mothers from birth certificates filed with their vital statistics office,

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excluding adoptive parents and gestational carriers, two to six months after the delivery of a liveborn infant. An important point for this analysis is that, although PRAMS initiates contact with respondents in the 2-6 month postpartum period, survey responses submitted after 6 months may still be accepted and included in the sample, allowing some participants to have time-to-response greater than 6 months. Although PRAMS does not collect information on the gender identity of the parent, we use the term “mother” for consistency with the birth record. Sites included in the PRAMS change annually: some sites choose not to participate, and some are excluded from the dataset for not meeting the minimum response rate for inclusion (response rate threshold for PRAMS inclusion: 2009-2011: 65%; 2012-2014: 60%; 2015-2017: 55%; and 2018-2020: 50%).[16] PRAMS uses stratified sampling, which allows states to tailor their sampling methods to oversample subpopulations of public health interest, such as those living in higher risk areas or participating in benefits programs.[16] PRAMS uses a mixed mode of data collection: mothers are first contacted by mail and then nonresponders are contacted by telephone. We analyzed 2009-2020 data from PRAMS, which included three phases (6, 7, and 8). The CDC supports survey versions in English and Spanish, and New York City additionally supports a Mandarin version of the survey.[16] For all analyses, we applied PRAMS survey weights, which include sampling weights to account for different sampling rates in different strata and adjustments for nonresponse and noncoverage.[16]

Correlates of interest

The measure used for temporal trend analysis was the year of index birth, which is identified by the PRAMS survey year, which PRAMS measures using the date of the index birth rather than the date of survey completion. We assessed the following demographic characteristics: race and ethnicity, educational attainment, marital status, age, and breast feeding status. Race and ethnicity were classified as “white, non-Hispanic,” “Black, non-Hispanic,” “Hispanic,” and “another non-Hispanic race.” Although more detailed racial and ethnic data were collected by PRAMS, we were unable to report on other classifications due to the rarity of the VRRP and small sampling strata. Race is included in this analysis to assess the impact of racism on health inequity. We classified educational attainment as less than high school, high school diploma or equivalent, or greater than high school. We assessed marital status as either married or unmarried at the time of the index birth. We collapsed age into categories of less than 20, 20-29, 30-39, or greater than 40 years. Finally, we assessed the current and past breast feeding of the index infant.

We also evaluated factors related to healthcare, including insurance status before, during, and after pregnancy. Pre-pregnancy healthcare interactions of interest were whether the respondent attended any healthcare visit in the 12 months before pregnancy and whether they reported speaking with a healthcare provider about their desire to have or not have children or about using contraception to prevent pregnancy. We assessed the trimester in which the respondent first sought prenatal care for their newborn infant, and whether they reported speaking with a healthcare provider during pregnancy about plans to use contraception after giving birth. We also assessed whether the respondent reported attending a postpartum healthcare visit.

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Maternal race, ethnicity, age, education, and initiation of prenatal care were collected from the index infant's birth record; all remaining measures were reported on the PRAMS questionnaire.

Identification of very rapid repeat pregnancy

We identified VRRP using two core questions in the PRAMS questionnaire. Respondents were first asked, "Are you or your husband or partner doing anything now to keep from getting pregnant?" Those who chose "no" were asked, "What are your reasons or your husband's or partner's reasons for not doing anything to keep from getting pregnant?" Response options included: I want to get pregnant, I am pregnant now, I had my tubes tied or blocked, I don't want to use birth control, I am worried about side effects from birth control, I am not having sex, My husband or partner doesn't want to use anything, and I have problems paying for birth control. We classified respondents who selected "I am pregnant now" as having VRRP.

Statistical Analysis

We assessed demographic and healthcare variables by VRRP and presented these results as both numbers and weighted percentages. We report time-to-response as medians and interquartile ranges (IQR) for those with and without VRRP.[17] We used log-binomial regression to calculate unadjusted and adjusted prevalence ratios (PR and aPR, respectively) and 95% CIs to assess the association between respondent characteristics and VRRP. Several survey items of interest were collected in only Phase 8 of PRAMS; therefore, we restricted our analysis of demographic and healthcare correlates to responses from 2016-2020.

To assess temporal trends of VRRP, we estimated adjusted prevalence by performing log-binomial regression, adjusting for maternal age, race/ethnicity, education and PRAMS site, to calculate predictive margins of VRRP by year. We plotted predictive margins with 95% confidence intervals (CIs) on a connected line graph.[18] As a sensitivity analysis, we repeated these analyses restricting to the 11 states that contributed data all 12 years to assess bias due to differing sampling populations at each time point.

Adjusted regressions include maternal race/ethnicity, maternal education, maternal age, PRAMS site, and year as covariates.

Missing Data

Of 468,001 survey responses, 5,575 were missing a response to the question used to assess VRRP (weighted 1.1%). Missingness for covariates of interest ranged from 0-11.9% of the complete dataset. We used multiple imputation by chained equations to generate 50 imputed datasets.[19,20] Imputation accounted for survey sampling weights and included PRAMS site, year, and time-to-response as auxiliary variables for prediction of missing values.

Ethics Approval

Data used in these analyses were acquired through a data use agreement with CDC PRAMS. PRAMS is overseen by the CDC Institutional Review Board (IRB). The data were provided to investigators in a de-identified format, and The Ohio State University Institutional Review

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Board determined this research did not meet the federal definition of human subjects research requiring review.

Results

Our analytic sample consisted of 468,001 responses collected between 2009 and 2020 from 46 sites (44 states, New York City, and Washington D.C.). Of these, 44 sites had data during Phase 8 (2016-2020) and 11 sites had data for all 12 years (Figure 1). The median time-to-response was 153 days (5.0 months; interquartile range (IQR) 125-185 days) for those with VRRP, 113 days (3.7 months; IQR 96-113 days) for those without VRRP, and 176 days (5.8 months; IQR 155-203 days) for those missing VRRP data.

Overall, 0.6% of 1,361 mothers had VRRP (n=1,361) in 2016-2020 (Table 1). Among all mothers, the largest proportion of mothers were 20-29 years of age (47.3%), followed by 30-39 years (44.9%); however, among mothers with VRRP, the age distribution skewed younger, with 67.2% of mothers being ages 20-29. Overall, 57.1% of mothers were non-Hispanic white, 15.1% were non-Hispanic Black, 17.7% were Hispanic, and 9.2% were another race. Most mothers were married and had education above the high school level. Most had supplied breastmilk for their current newborn and over half were still providing breastmilk at the time of the survey response.

The majority of mothers had insurance before, during, and after pregnancy (Table 1). In the 12 months before pregnancy, over half of all mothers attended a healthcare visit, during which 44.1% spoke to a healthcare provider about their desire to have or not have children, and 41.6% spoke to a healthcare provider about using contraception to prevent pregnancy. Prenatal care was initiated in the first trimester by 85.0% of mothers, and the majority of these mothers spoke with a healthcare provider about contraception plans after giving birth, and this was similar for mothers with and without VRRP. In the postpartum period and 88.3% of all mothers attended a postpartum healthcare visit, but only 78.5% of those with VRRP.

Following multiple imputation, the weighted unadjusted prevalence of VRRP in 2009-2020 was 0.53% (95% CI 0.49, 0.56). The adjusted prevalence of VRRP among all sites ranged from 0.38% (95% CI: 0.29, 0.48) in 2009 to 0.76% (95% CI: 0.61, 0.91) in 2020 (Figure 2). Among the 11 states with data for all years, the prevalence ranged from 0.30% (95% CI: 0.19, 0.41) in 2009 to 0.67% (95% CI: 0.45, 0.89) in 2020 (see eTable 1 for annual adjusted prevalence estimates).

Age was inversely related to prevalence of VRRP prevalence, with mothers younger than 20 years of age having the highest prevalence of VRRP (Table 2). Mothers who were non-Hispanic Black or were non-Hispanic and another race had a higher prevalence of VRRP compared to white mothers. Lower educational attainment was associated with a higher prevalence of VRRP, with those with less than a high school diploma having a prevalence nearly three times that of mothers with education beyond the high school level. Unmarried mothers had a 50% higher prevalence of VRRP than married respondents. Ever providing breastmilk for the current infant was not associated with lower VRRP but

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continuing to provide breastmilk until the survey response period was associated with a decreased prevalence of VRRP.

Having health insurance before, during, or after pregnancy was not associated with VRRP; however, attending a healthcare visit in the 12 months before pregnancy and attending a postpartum healthcare visit were both associated with a lower prevalence of VRRP, compared to those not attending these visits (Table 2). Having a healthcare worker ask about pregnancy desires and contraception before pregnancy was not associated with VRRP, but having a healthcare worker discuss postpartum contraceptive options during pregnancy was associated with a lower prevalence of VRRP.

Comment

Principal findings

The overall weighted prevalence of VRRP 0.53%. Our findings during the observation period of 2009-2020 suggest a modest increase in VRRP prevalence over the past decade in the U.S. Additionally, demographic factors such as younger age, Black race, lower educational attainment, and unmarried status were all associated with an increased prevalence of VRRP. We also found an association between VRRP and healthcare behaviors, namely, not having a visit in the 12 months before pregnancy, not having a postpartum visit, and not being asked about postpartum contraception by a healthcare provider during pregnancy.

Strengths of the study

A primary strength of this study is that it benefits from the large, representative nature of PRAMS, covering twelve years and 46 sites. PRAMS is population-representative of mothers who had live births in participating sites. This robust sample allows us to assess VRRP across a long time period and among a demographically and geographically diverse population.

Limitations of the data

These analyses only included current pregnancies that were recognized at the time of participant responses to the PRAMS survey; therefore, this is likely an underestimate of VRRP, because it excludes pregnancies that were ended by spontaneous or induced abortion before survey completion, as well as pregnancies that were not yet recognized. People are less likely to recognize early signs of pregnancy during the postpartum period before the resumption of regular menstruation.[21] Also, mothers experiencing VRRP could have been less likely to complete the PRAMS questionnaire due to added stress of a likely unintended pregnancy. Additionally, our analysis cannot account for the timing of VRRP, only that it occurred between the birth of the index infant and the response to the PRAMS questionnaire. We based the VRRP measure on respondents selecting current pregnancy as a response option for a survey question about contraception. Because respondents were not asked directly about current pregnancy, some respondents with a recognized pregnancy might have overlooked this response option.

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Time-to-response, measured as days between childbirth and the date of survey completion, may have influenced measurement of VRRP, because later respondents have more time in which they can conceive and experience a positive pregnancy test. PRAMS respondents who are Hispanic, non-white, or have lower educational attainment are more likely to respond to telephone surveys compared to mailed surveys and therefore tend to complete the survey later.[16] This may have inflated the association between VRRP and characteristics associated with later response, such as race, ethnicity, and educational attainment.

Finally, the changes in PRAMS methodology and included states from year to year may have impacted prevalence from year to year. Because vital statistics from birth records are available for responders and nonresponders, PRAMS is able to apply weights to account for nonresponse and noncoverage among the sampled population. This limits the impact of changes in response rate across years. We assessed for bias that may have resulted from different states contributing data to our analytic sample from year to year by conducting a sensitivity analysis in which we restricted the assessment of annual prevalence to states which contributed data for all years. We observed that, although the overall prevalence was lower among these 11 states, similar temporal patterns were present.

Interpretation

The observed prevalence in the restricted analysis was lower than the analysis including all states, but followed a similar trend, indicating that observed patterns are likely not due to differing sampling populations at each time point. This increase in VRRP over time has not been previously documented and could be due to a combination of factors, including improved early pregnancy detection, which leads to a greater proportion of pregnancies being recognized during this early period. Unintended pregnancies, which account for most VRRPs, are typically recognized at a later gestational age and might not have been captured by these analyses.[22,23] Additionally, systematic changes in PRAMS administration, such as changes to the response rate threshold for inclusion in the dataset, may have influenced these estimates; however, PRAMS sampling weights include corrections for nonresponse to ensure data are representative at the state level.

The demographic associations we found are consistent with previous research, which has found that RRPs are disproportionately experienced by Black mothers and by mothers with lower educational attainment.[13] Previous research has found that non-Hispanic Black mothers had higher prevalence of interpregnancy intervals less than 18 months compared to both Hispanic and non-Hispanic white mothers. This is consistent with our findings that non-Hispanic Black, but not Hispanic mothers, had higher prevalence of VRRP compared to white mothers.[5] Additionally, prevalence was inversely related to education, with more educated mothers having a lower prevalence of interpregnancy intervals of 6 months or less.[5]

We observed association with various healthcare behaviors throughout the perinatal period. Behaviors such as visiting a healthcare provider in the 12 months before pregnancy and attending a postpartum visit are likely related to characteristics associated with a lower risk of VRRP, such as educational attainment and socioeconomic status, and we cannot discount that the relationship we observed with these healthcare interactions is due to

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residual confounding. Although we cannot draw causal conclusions based on these findings, this does highlight that these patients comprise a population at higher prevalence of VRRP who may benefit from additional family planning resources to help them achieve their reproductive goals.

The lower prevalence of VRRP among mothers producing breastmilk at the time of survey responses could be attributable to two different factors. First, exclusive breast feeding induces lactational amenorrhea in the immediate postpartum period, which provides some protection against pregnancy; in other words, mothers who are still breastfeeding at the time of survey responses are at a lower risk of pregnancy.[24] The other explanation is that mothers experiencing VRRP may be more likely to stop providing breast milk. Although there is no evidence suggesting breastfeeding cessation due to pregnancy, pregnant mothers may experience changes in psychosocial factors that support continued breastfeeding.[25]

It is difficult to compare our measures of VRRP prevalence with the literature due to the lack of uniform definitions used for rapid repeat pregnancy and short interpregnancy intervals. The prevalence of closely spaced births has been described in two ways: the proportion of all repeat pregnancies that occurred within 12-24 months of a previous birth (i.e. using pregnancies as the denominator),[3–5,9] and the proportion of postpartum mothers who experience pregnancy within 12-24 months following delivery (i.e. using mothers as the denominator).[26–28] Our estimates use postpartum mothers as a denominator, which is a larger population than that of repeat pregnancies; therefore, these estimates are not directly comparable with the former method. Estimates using mothers as the denominator are more comparable; however, as expected that our estimates fall below those that have been published (18-36%)[26–28] due to the short survey administration period of 2-6 months following delivery. As noted earlier, 5-9% of repeat pregnancies occur within 6 months of a previous pregnancy[4]; however, this measure uses repeat pregnancies as the denominator resulting in a higher estimate than if measured using mothers as the denominator. We did not identify reports with estimates using mothers as the denominator that investigated this immediately postpartum period. Additionally, the incidence of pregnancy and the likelihood that a pregnancy is intended increase following six months post-delivery.[26] This sample may not be directly comparable to others in that this research was limited to pregnancies immediately following a previous live birth, whereas other samples may have included repeat pregnancies following miscarriage or stillbirth. People who have experienced pregnancy loss may be more likely to intentionally conceive shortly after a previous pregnancy, which may lead to a higher VRRP prevalence among other samples.

Conclusion

Interventions to reduce the prevalence of VRRPs should focus on addressing the underlying social determinants of health, such as racism and lack of access to education. Mothers not attending healthcare visits in the preconception and postpartum periods may comprise a population at higher prevalence of VRRP who would benefit from additional family planning resources to help them achieve their reproductive goals. This is consistent with previous literature indicating that comprehensive contraceptive counseling during the prenatal and immediate postpartum periods is associated with a decreased risk of

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RRP.[26,29,30] Finally, more research is needed to better understand the causal relationship between VRRPs and adverse birth outcomes and to develop effective interventions to reduce the prevalence of VRRPs and improve maternal and child health outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Synopsis

Study question:

What are the prevalence and correlates of pregnancies occurring in the immediate period after a live birth?

What's already known:

Pregnancies occurring quickly after a previous birth are often unintended and more commonly impact mothers of lower socioeconomic status and racially and ethnically minoritized populations.

What this study adds:

Limited evidence on pregnancies occurring within 6 months postpartum exists. We evaluate maternal characteristics associated with pregnancies reported in the immediate postpartum period, approximately 2-6 months following a live birth, terming this "very rapid repeat pregnancy" (VRRP). VRRP was more common among mothers who were younger, Black, had lower educational attainment, were unmarried, did not attend a healthcare visit within 12 months preconception, were not asked about postpartum contraception by their provider, and did not attend a postpartum visit.

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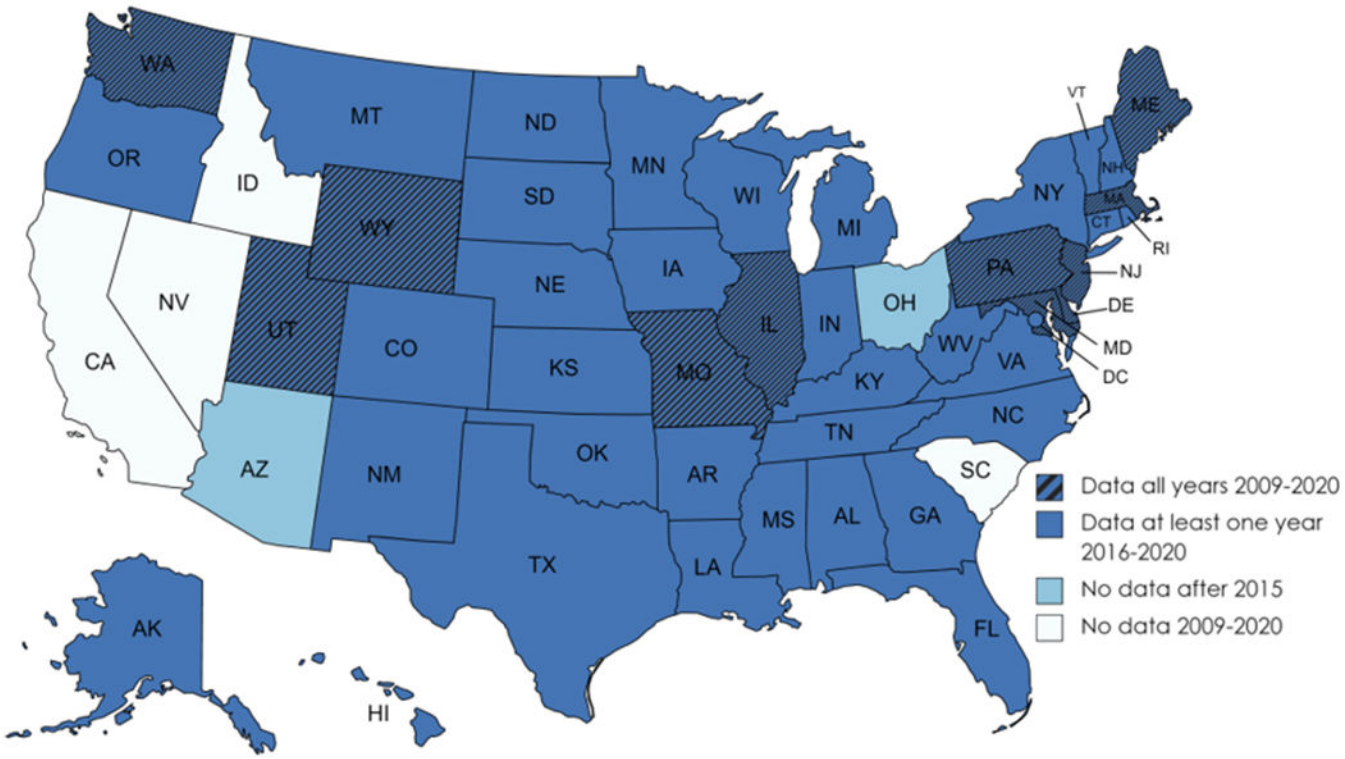


FIGURE 1:
PRAMS sites by time intervals of interest with contributing data

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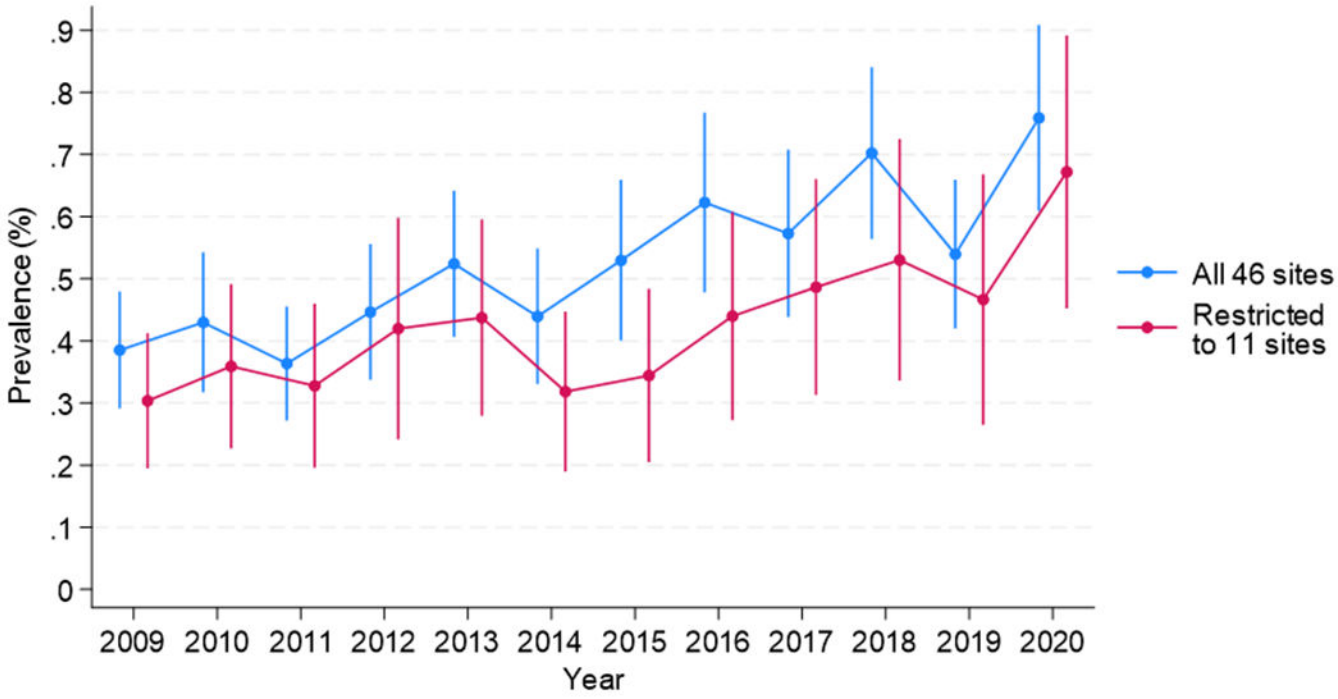


FIGURE 2: Adjusted prevalence of very rapid repeat pregnancy, 2009-2020

Adjusting for maternal race/ethnicity, maternal age, maternal educational attainment, and PRAMS site.

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TABLE 1:

Distribution of demographic and healthcare correlates by very rapid repeat pregnancy (VRRP) status, 2016-2020

	No VRRP		VRRP		Unreported		Full Sample	
	N	Weighted % (95% CI)	N	Weighted % (95% CI)	N	Weighted % (95% CI)	N	Weighted % (95% CI)
	197,872	98.1(98.0, 98.2)	1,361	0.6 (0.5, 0.6)	2,954	1.4 (1.3, 1.9)	202,187	100
Age in years								
<20	8,786	4.2 (4.1, 4.4)	153	10.3 (7.7, 13.7)	258	8.5 (7.0, 10.3)	9,197	4.3 (4.2, 4.5)
20-29	92,282	47.1 (46.7, 47.4)	915	67.2 (62.7, 71.5)	1,663	58.1 (55.1, 61.1)	94,860	47.3 (47.0, 47.7)
30-39	89,727	45.3 (44.9, 45.6)	279	21.1 (17.6, 25.0)	946	30.1 (27.5, 32.8)	90,952	44.9 (44.6, 45.3)
≥40	7,069	3.5 (3.3, 3.6)	14	1.4 (0.6, 3.2)	87	3.3 (2.3, 4.6)	7,170	3.4 (3.3, 3.6)
Missing	8	0.0 (0.0, 0.0)	0	0.0	0	0.0	8	0.0 (0.0, 0.0)
Race/Ethnicity								
White, non-Hispanic	92,903	57.6 (57.3, 57.9)	438	42.5 (38.0, 47.2)	602	28.7 (26.0, 31.5)	93,943	57.1 (56.8, 57.4)
Black, non-Hispanic	35,247	14.8 (14.6, 15)	399	26.1 (22.2, 30.4)	1,162	35.5 (32.6, 38.4)	36,808	15.1 (14.9, 15.4)
Hispanic	32,292	17.6 (17.4, 17.9)	220	19.2 (15.5, 23.4)	538	23.2 (20.6, 26.1)	33,050	17.7 (17.5, 18.0)
Other, non-Hispanic	32,279	9.2 (9.0, 9.3)	275	11.2 (8.9, 14.1)	610	12.0 (10.4, 13.8)	33,164	9.2 (9.0, 9.4)
Missing	5,151	0.8 (0.8, 0.9)	29	1.0 (0.3, 2.8)	42	0.7 (0.4, 1.2)	5,222	0.8 (0.8, 0.9)
Education Level completed								
Less than high school	23,912	11.7 (11.5, 11.9)	326	23.2 (19.3, 27.5)	685	21.4 (19.0, 24.0)	24,923	11.9 (11.7, 12.1)
High school	47,458	24.5 (24.2, 24.8)	526	39.6 (35.1, 44.3)	1,054	35.8 (32.9, 38.8)	49,036	24.8 (24.4, 25.1)
More than high school	124,732	63.0 (62.6, 63.3)	496	36.6 (32.3, 41.1)	1,155	40.9 (37.9, 43.9)	126,383	62.5 (62.2, 62.9)
Missing	1,770	0.8 (0.7, 0.9)	15	0.6 (0.2, 1.7)	60	1.9 (1.2, 3.1)	1,845	0.8 (0.8, 0.9)
Marital Status								
Unmarried	78,784	38.0 (37.7, 38.3)	882	62.7 (58.0, 67.1)	1,965	63.2 (60.2, 66.0)	81,631	38.5 (38.2, 38.8)
Married	118,929	62.0 (61.6, 62.3)	478	37.3 (32.9, 42.0)	986	36.7 (33.8, 39.7)	120,393	61.5 (61.1, 61.8)
Missing	159	0.0 (0.0, 0.1)	1	0.0 (0.0, 0.0)	3	0.2 (0.0, 1.0)	163	0.0 (0.0, 0.1)
Ever breast fed or pumped milk for this newborn								
No	22,970	12.0 (11.7, 12.2)	236	15.0 (12.2, 18.4)	191	6.3 (4.8, 8.1)	23,397	11.9 (11.7, 12.1)
Yes	170,102	86.3 (86.1, 86.5)	989	78.7 (74.8, 82.1)	816	27.5 (24.9, 30.2)	171,907	85.4 (85.2, 85.7)
Missing	4,800	1.7 (1.7, 1.8)	136	6.3 (4.4, 8.9)	1,947	66.3 (63.3, 69.1)	6,883	2.7 (2.5, 2.8)
Currently breast feeding or pumping milk								

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	No VRRP		VRRP		Unreported		Full Sample	
	N	Weighted % (95% CI)	N	Weighted % (95% CI)	N	Weighted % (95% CI)	N	Weighted % (95% CI)
No	89,169	45.1 (44.7, 45.4)	1,043	79.1 (74.9, 82.7)	658	21.6 (19.2, 24.2)	90,870	45.0 (44.6, 45.3)
Yes	103,588	53.0 (52.7, 53.4)	183	14.7 (11.6, 18.4)	334	11.7 (9.9, 13.8)	104,105	52.3(51.9, 52.6)
Missing	5,115	1.9 (1.8, 2.0)	135	6.2 (4.3, 8.9)	1,962	66.7 (63.7, 69.5)	7,212	2.8 (2.7, 2.9)
In the 12 months before pregnancy								
Had Health Insurance								
No	24,661	13.8 (13.5, 14.0)	203	16.7 (13.3, 20.7)	373	13.1 (11.2, 15.4)	25,237	13.8 (13.5, 14.0)
Yes	173,094	86.2 (85.9, 86.4)	1,157	83.3 (79.2, 86.7)	2,558	86.2 (83.9, 88.2)	176,809	86.2 (85.9, 86.4)
Missing	117	0.1 (0.1, 0.1)	1	0.0 (0.0, 0.1)	23	0.7 (0.4, 1.1)	141	0.1 (0.1, 0.1)
Attended Any Healthcare Visit								
No	64,184	32.1 (31.8, 32.4)	689	50.3 (45.6, 54.9)	1,630	54.7 (51.6, 57.8)	66,503	32.5 (32.2, 32.8)
Yes	131,254	66.6 (66.2, 66.9)	656	48.8 (44.1, 53.5)	1,273	43.4 (40.4, 46.5)	133,183	66.1 (65.8, 66.5)
Missing	2,434	1.3 (1.2, 1.4)	16	0.9 (0.4, 2.1)	51	1.9 (1.3, 2.7)	2,501	1.3 (1.3, 1.4)
If attended healthcare visit: **Spoke to a healthcare worker about desire to have or not have children**								
No	70,810	53.0 (52.6, 53.4)	390	57.8 (51.2, 64.1)	774	59.1 (54.4, 63.7)	71,974	53.1 (52.7, 53.5)
Yes	59,143	44.2 (43.8, 44.6)	264	39.5 (33.3, 46.0)	481	33.8 (29.6, 38.3)	59,888	44.1 (43.6, 44.5)
Missing	3,735	2.8 (2.7, 3.0)	18	2.7 (1.4, 5.4)	69	7.1 (4.6, 10.8)	3,822	2.9 (2.7, 3.0)
If attended healthcare visit: **Spoke to a healthcare worker about using birth control to prevent pregnancy**								
No	73,669	55.7 (55.2, 56.1)	294	45.4 (39.0, 51.9)	524	41.4 (36.9, 46.1)	74,487	55.5 (55.1, 55.9)
Yes	56,103	41.5 (41.0, 41.9)	359	51.8 (45.3, 58.3)	734	51.8 (47.1, 56.5)	57,196	41.6 (41.2, 42.0)
Missing	3,916	2.9 (2.7, 3.0)	19	2.8 (1.4, 5.5)	66	6.8 (4.3, 10.5)	4,001	2.9 (2.8, 3.1)
During pregnancy								
Had Health Insurance								
No	4,483	2.6 (2.5, 2.8)	29	2.1 (1.2, 3.8)	57	2.4 (1.5, 3.7)	4,569	2.6 (2.5, 2.7)
Yes	187,071	94.3 (94.1, 94.4)	1,246	88.9 (85.0, 91.9)	2,551	87.0 (84.8, 88.9)	190,868	94.1 (94.0, 94.3)
Missing	6,318	3.1 (3.0, 3.2)	86	9.0 (6.2, 12.9)	346	10.6 (8.9, 12.6)	6,750	3.2 (3.1, 3.4)
Prenatal Care Initiation								
First Trimester	167,560	85.3 (85.0, 85.5)	1,079	81.0 (77.1, 84.3)	1,991	69.1 (66.3, 71.8)	170,630	85.0 (84.8, 85.3)
Second or Third Trimester	24,110	11.8 (11.6, 12.0)	211	14.5 (11.5, 18.2)	464	15.5 (13.4, 17.8)	24,785	11.9 (11.6, 12.1)

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	No VRRP		VRRP		Unreported		Full Sample	
	N	Weighted % (95% CI)	N	Weighted % (95% CI)	N	Weighted % (95% CI)	N	Weighted % (95% CI)
No Prenatal Care	1,778	0.8 (0.8, 0.9)	23	1.1 (0.6, 2.0)	38	0.8 (0.5, 1.3)	1,839	0.8 (0.8, 0.9)
Missing	4,424	2.1 (2.0, 2.2)	48	3.4 (2.2, 5.4)	461	14.6 (12.7, 16.7)	4,933	2.3 (2.2, 2.4)
If attended prenatal care visit: **Health care worker asked about birth control plans after giving birth**								
No	31,834	17.1 (16.8, 17.3)	217	17.8 (14.4, 21.9)	241	9.9 (8.2, 12.0)	32,292	17.0 (16.7, 17.2)
Yes	160,780	81.2 (80.9, 81.5)	1,089	80.1 (76.0, 83.7)	2,078	70.0 (67.1, 72.7)	163,947	81.0 (80.8, 81.3)
Missing	3,480	1.7 (1.6, 1.8)	32	2.0 (1.2, 3.5)	597	20.1 (17.8, 22.6)	4,109	2.0 (1.9, 2.1)
Postpartum								
Had Health Insurance								
No	18,361	10.6 (10.4, 10.8)	127	10.7 (7.9, 14.4)	345	14.0 (11.8, 16.5)	18,833	10.7 (10.4, 10.9)
Yes	179,256	89.2 (89.0, 89.5)	1,228	88.6 (84.8, 91.6)	2,573	84.9 (82.3, 87.2)	183,057	89.2 (89.0, 89.4)
Missing	255	0.1 (0.1, 0.2)	6	0.6 (0.1, 2.7)	36	1.1 (0.7, 1.8)	297	0.2 (0.1, 0.2)
Attended Postpartum Check-Up								
No	20,751	9.9 (9.7, 10.1)	317	21.1 (17.4, 25.3)	130	5.1 (3.6, 7.2)	21,198	9.9 (9.7, 10.1)
Yes	175,660	89.4 (89.2, 89.6)	1,033	78.5 (74.3, 82.2)	439	14.6 (12.7, 16.7)	177,132	88.3 (88.1, 88.6)
Missing	1,461	0.7 (0.6, 0.7)	11	0.4 (0.2, 1.1)	2,385	80.3 (77.6, 82.7)	3,857	1.8 (1.7, 1.9)

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TABLE 2:

Prevalence ratios for correlates of very rapid repeat pregnancy, 2016-2020

	Unadjusted Prevalence Ratio[b] (95% CI)	Adjusted[a] Prevalence Ratio (95% CI)
Age in years		
<20	1.00 (Reference)	1.00 (Reference)
20-29	0.58 (0.42, 0.80)	0.86 (0.62, 1.21)
30-39	0.19 (0.13, 0.27)	0.36 (0.25, 0.52)
≥40	0.16 (0.06, 0.40)	0.28 (0.11, 0.70)
Race/Ethnicity		
White, non-Hispanic	1.00 (Reference)	1.00 (Reference)
Black, non-Hispanic	2.44 (1.93, 3.09)	2.05 (1.58, 2.66)
Hispanic	1.51 (1.15, 1.98)	1.04 (0.77, 1.40)
Another non-Hispanic race	1.65 (1.25, 2.17)	1.59 (1.19, 2.13)
Education Level		
Less than high school	3.42 (2.67, 4.39)	2.65 (2.01, 3.50)
High school	2.78 (2.26, 3.43)	2.05 (1.65, 2.56)
More than high school	1.00 (Reference)	1.00 (Reference)
Marital Status		
Unmarried	2.75 (2.26, 3.35)	1.50 (1.17, 1.93)
Married	1.00 (Reference)	1.00 (Reference)
Ever breast fed or pumped milk for newborn		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.72 (0.56, 0.94)	1.06 (0.80, 1.40)
Currently breast feeding or pumping milk		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.15 (0.12, 0.20)	0.21 (0.16, 0.28)
In the 12 months before pregnancy		
Had Health Insurance		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.82 (0.63, 1.07)	1.12 (0.85, 1.47)
Attended Any Healthcare Visit		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.46 (0.38, 0.56)	0.69 (0.56, 0.84)
If attended healthcare visit: **Spoke to a healthcare worker about desire to have or not have children**		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.81 (0.62, 1.07)	1.03 (0.79, 1.36)
If attended healthcare visit: **Spoke to a healthcare worker about using birth control to prevent pregnancy**		
No	1.00 (Reference)	1.00 (Reference)

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	Unadjusted Prevalence Ratio[b] (95% CI)	Adjusted[a] Prevalence Ratio (95% CI)
Yes	1.53 (1.17, 2.00)	1.14 (0.87, 1.50)
During pregnancy		
Had Health Insurance		
No	1.00 (Reference)	1.00 (Reference)
Yes	1.26 (0.69, 2.31)	1.52 (0.81, 2.86)
Prenatal Care Initiation		
First Trimester	1.00 (Reference)	1.00 (Reference)
Second or Third Trimester	1.31 (1.00, 1.72)	0.88 (0.66, 1.17)
No Prenatal Care	1.40 (0.73, 2.69)	0.85 (0.44, 1.66)
If attended prenatal care visit: **Health care worker asked about birth control plans after giving birth**		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.97 (0.75, 1.25)	0.70 (0.54, 0.92)
Postpartum		
Had Health Insurance		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.96 (0.68, 1.35)	1.34 (0.93, 1.93)
Attended Postpartum Check-Up		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.41 (0.32, 0.52)	0.58 (0.45, 0.74)

[a] Adjusted models include the following covariates: maternal race/ethnicity, maternal age, maternal educational attainment, and PRAMS site

[b] Estimated using log-binomial regression of 50 multiply imputed datasets using chained equations