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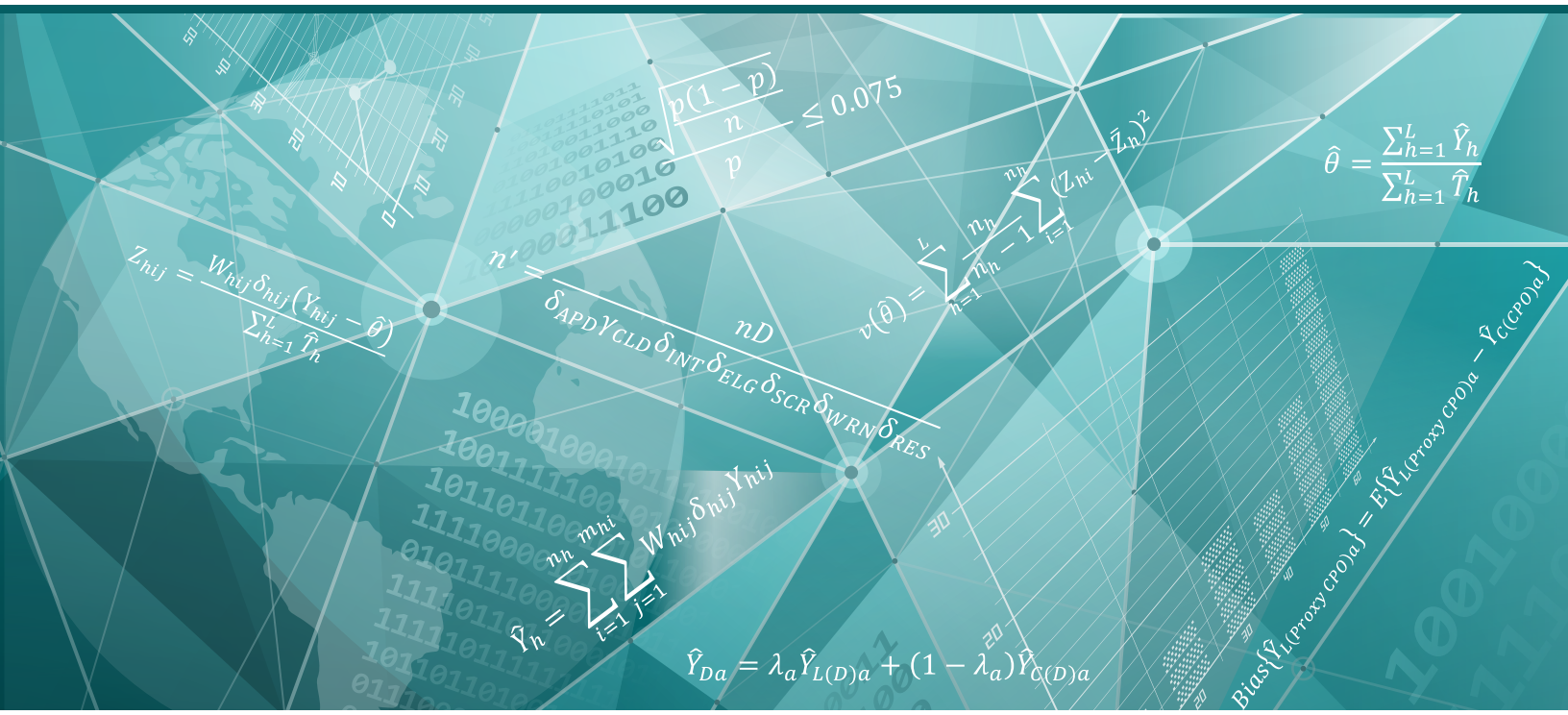

Updated Methodology to Estimate Overall and Unintended Pregnancy Rates in the United States

Data Evaluation and Methods Research

Centers for Disease Control and Prevention
National Center for Health Statistics

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Updated Methodology to Estimate Overall and Unintended Pregnancy Rates in the United States

Data Evaluation and Methods Research

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Center for Health Statistics

Hyattsville, Maryland
April 2023

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Updated Methodology to Estimate Overall and Unintended Pregnancy Rates in the United States

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Abstract

Background

Historically, the National Center for Health Statistics (NCHS) has published estimated pregnancy rates in the United States, with the most recent estimates published for 2010. Pregnancy rates are calculated from three components: live births, pregnancy losses (miscarriage or spontaneous abortion, ectopic pregnancy, and stillbirth), and induced abortions. Some of the data sources used to estimate these components have limitations with respect to factors such as data timeliness and completeness. Alternative ways of accounting for these limitations by using additional data sources and statistical methods for imputing missing data may improve the accuracy and timeliness of pregnancy rate estimates.

Methods

This report describes an updated methodology to estimate overall and unintended pregnancy rates for the United States during 2010–2019, and examines differences by demographic factors. Machine learning models were used to impute missing information on induced abortions, and data integration methods were used to combine estimates of abortions, live births, and pregnancy losses to produce estimates of the total numbers of pregnancies occurring during 2010–2019 and corresponding pregnancy rates, along with outcomes related to unintended pregnancy.

Results

An estimated 6,069,000 pregnancies in 2010 in females aged 15–44 occurred in 2010, declining by 9% to 5,507,000 in 2019. The overall pregnancy rate (estimated number of pregnancies per 1,000 females aged 15–44) was 97.3 in 2010, declining by 12% to 85.6 in 2019. The percentage of pregnancies that were unintended declined from 43.3% in 2010 to 41.6% in 2019.

Conclusions

More recent and timely estimates of overall and unintended pregnancy rates can help inform policies and programs to decrease the percentage of unintended pregnancies and are crucial for tracking reproductive health outcomes in the United States.

Keywords: reproductive health • fetal death • natality • National Survey of Family Growth • National Vital Statistics System

Introduction

Historically, the National Center for Health Statistics (NCHS) has published estimated pregnancy rates in the United States, relying on data from several sources: counts of live births from the National Vital Statistics System (NVSS)–Natality, estimates of pregnancy loss (miscarriage or spontaneous abortion, ectopic pregnancy, and stillbirth) from the National Survey of Family Growth (NSFG), and estimates of induced abortion from the Centers for Disease Control and Prevention's (CDC) Abortion Surveillance System, which are adjusted to national totals using data from the Guttmacher Institute (a nonprofit organization) (1). The most recent NCHS estimates of pregnancy rates for the United States are from 2010 (2,3).

More recent estimates of overall and unintended pregnancy rates can help inform policies and programs to decrease the percentage of unintended pregnancies and are crucial for tracking reproductive health outcomes in the United States. Decreasing unintended pregnancy is a national health priority in the United States (Healthy People 2030 Objective FP-01) (4). The percentage of unintended pregnancies decreased from 51% in 2008 to 45% in 2011 (5). While unintended pregnancy had historically been declining, the most recent estimate published by NCHS (43% in 2013) remains above the Healthy People 2030 target of 36.5% (4).

General Methodological Issues Related to Estimating Pregnancy Rates

This report describes an updated methodology to estimate overall and unintended pregnancy rates in the United States for 2010–2019, and examines differences by demographic factors. Pregnancy rates are calculated from three components: live births, pregnancy losses, and induced abortions. Figure 1 illustrates the three components of pregnancy rates and their respective data sources. The three components are outlined below along with corresponding methodological issues and data source quality concerns.

Live births

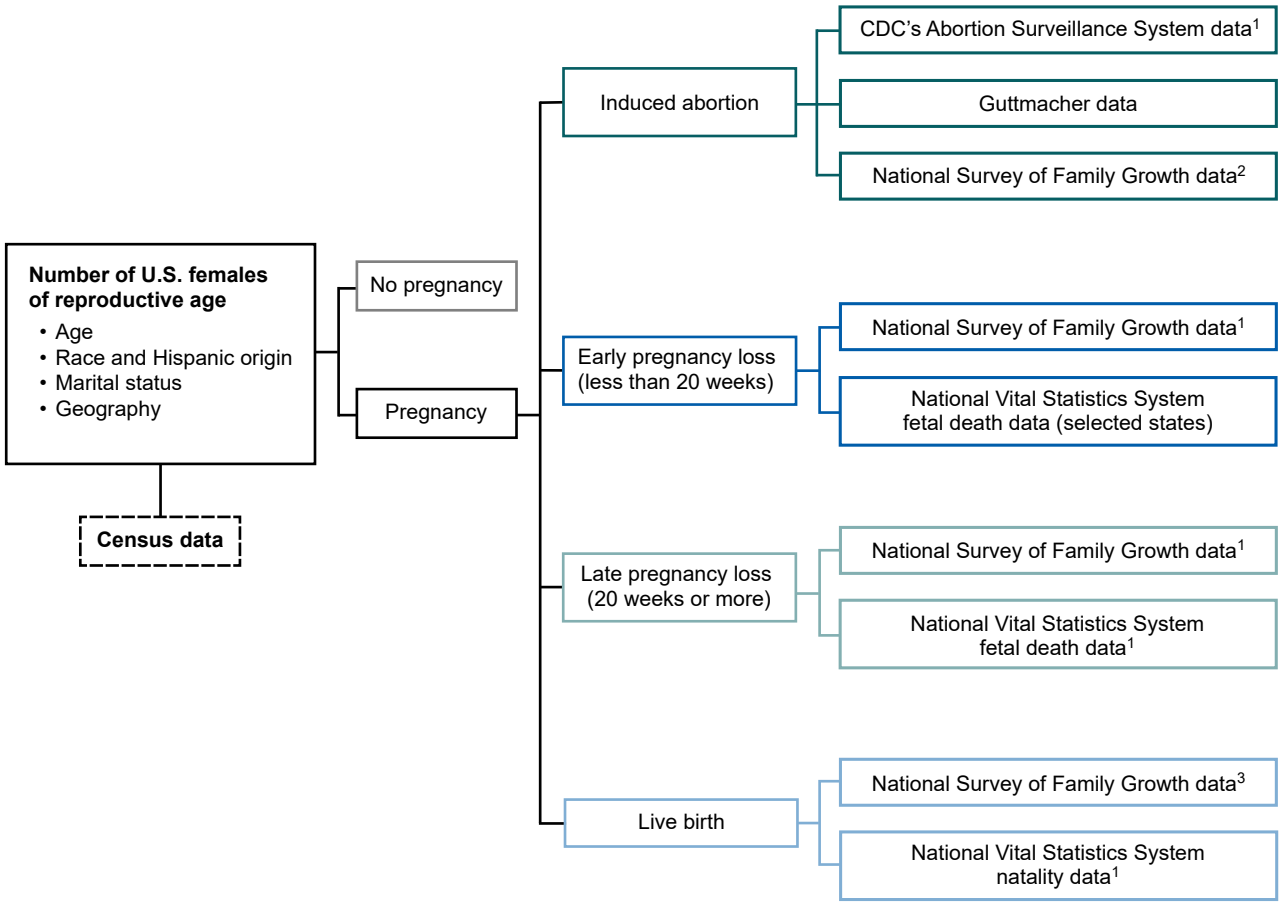
NVSS–Natality data include information from birth certificates registered in all 50 states, New York City, the District of Columbia (D.C.), and 5 U.S. territories. Over 99% of births occurring in the United States are registered, and birth certificate data are provided to NCHS through the Vital Statistics Cooperative Program (6,7). Data are available at the state (or equivalent reporting area or jurisdiction) level and are available by request from https://www.cdc.gov/nchs/nvss/nvss-restricted-data.htm or through CDC WONDER (8) by maternal characteristics collected on the birth certificate, including maternal age, race and Hispanic origin, marital status, and parity.

Data on live births are also captured in NSFG, and these estimates tend to be comparable to the numbers of live births from NVSS–Natality data (9,10). However, estimates of live births from NSFG do not include births to older women (either aged 45 and over or 50 and over, depending on the data year) and are subject to sampling error and variability.

Pregnancy loss

Historically, in the calculations of pregnancy rates, estimates of pregnancy loss (miscarriage or spontaneous abortion, ectopic pregnancy, and stillbirth) were based on pregnancy history data from NSFG. NSFG is a nationally representative

Figure 1. Data inputs and conceptual framework for pregnancy rate estimation



[1]Primary source used to estimate the number of pregnancies for each pregnancy outcome.
[2]Though data on induced abortion are available from the National Survey of Family Growth (NSFG), they were not used in the analysis in this report.
[3]Though data on live births are available from NSFG, they were not used to estimate the number of live births in the analysis in this report.
NOTES: NSFG data are not used to estimate the total number of live births or induced abortions, but NSFG includes data on these outcomes. NSFG data on live births are used to estimate the ratio of pregnancy losses to live births.
SOURCE: National Center for Health Statistics.

household survey of the U.S. household population aged 15–49 (aged 15–44 before 2015) that uses a complex, multistage probability design to select one participant per household (10). In 2022, NSFG began including an online survey mode but for 2019 and earlier years, which were used in calculations being described here, data collection was conducted completely in person. As part of the survey questionnaire, female respondents provide detailed information about their current or past pregnancies, including how each pregnancy ended. To calculate the pregnancy loss component in previous reports, ratios of fetal losses divided by fetal losses plus live births were calculated by age and race and Hispanic-origin subgroup, combining data from several NSFG file releases to ensure stable estimates (1). The values were then multiplied by the number of live births in each year (and subgroup) for years most closely corresponding to NSFG's data years to provide as reasonable an estimate as possible of fetal losses that occurred annually for use in the calculation of annual pregnancies in the United States.

Limitations of pregnancy loss data

Historically, NSFG data were used to estimate pregnancy loss as losses across all gestational ages are reported in the NSFG pregnancy history files, though the number of stillbirths reported to occur at gestational ages of 20 weeks or more is typically very small and may be difficult to estimate reliably for each year. However, fetal death data are also available from the NVSS–Fetal Death files (11–14), which represent all fetal deaths registered in the 50 states, New York City, and D.C. Vital statistics fetal death data are generally limited to losses occurring at gestational ages of 20 weeks or more, with the majority of states requiring the reporting of fetal deaths of 20 weeks of gestation or more (or 350 grams delivery weight), though some states report losses at all gestational ages (12–14).

Estimates from NSFG suggest that the risk of pregnancy loss increased from 1990 to 2011 (15). Consequently, relying on a single ratio of pregnancy loss-to-live births estimated over a large time period may not be sufficient to accurately capture the number of pregnancy losses occurring in the United States over time if substantial, differing trends over time are present. Additionally, the timing of pregnancy awareness may have potentially changed over time as well, given changes in the ability to detect pregnancies earlier and at home as well as the use of fertility treatments. These changes have consequences for the awareness of early pregnancy losses, although a study using NSFG data reported no significant changes in mean gestational age at the time of pregnancy awareness for pregnancies occurring from 1990–2012 (16). Pregnancy loss can potentially be estimated by integrating data from NSFG and NVSS–Fetal Death files, which may provide more accurate or complete information about pregnancy loss across the entire spectrum of gestational age and by maternal characteristics. Finally, while NSFG estimates are available at the national level, NVSS–Fetal Death data (available upon request from https://www.cdc.gov/nchs/nvss/nvss-restricted-data.htm) are available at the state (or equivalent reporting area) level as well as the national level.

Induced abortion

Previous publications of pregnancy rates were based on induced abortion data from two sources: CDC and the Guttmacher Institute. CDC's Abortion Surveillance System relies on the voluntary submission of aggregated data from the central health agencies of reporting areas (states and jurisdictions) to document the number and characteristics of females obtaining legal abortions in the United States (17). Because not all states submit abortion data to CDC, data from the Guttmacher Institute's Abortion Provider Census, a periodic survey of all known U.S. facilities providing abortion services (18), were previously used to benchmark the numbers provided through CDC's Abortion Surveillance System to a national total. Although estimates of induced abortion are also available in NSFG's pregnancy history data, these data have not been used to calculate pregnancy rates due to the potential underreporting of induced abortion in surveys that rely on interviews or self-report, like NSFG (10,19,20). For example, Desai et al. reported that likely only 40% of abortions were captured in NSFG from 2006–2015, and that 11% of pregnancies overall may be missed because pregnancies ending in abortion may not be reported (21). However, all data sources capturing abortions have known limitations.

Limitations of induced abortion data

Data from CDC's Abortion Surveillance System are limited in that not all states or reporting areas submit abortion data to the system. Out of the system's 52 reporting areas (the 50 states, D.C., and New York City) 48 consistently submitted abortion data to CDC (excluding California, Maryland, and New Hampshire in all years, and D.C. in 2016) from 2006 through 2019 (17). Additionally, data for Wyoming were suppressed for some years due to the small numbers reported (fewer than 20 abortions) (22). It is estimated that abortions performed in California, Maryland, and New Hampshire account for about 20% of all abortions performed in the United States (17,18,23). Additionally, numbers reported by D.C. and New Jersey were substantially lower than estimates published by the Guttmacher Institute, suggesting that the number of abortions may have been underreported in those reporting areas (17,18,23). While most reporting areas that submit abortion data to CDC have laws requiring medical providers to submit data for every abortion that is performed to a central health agency, in New Jersey and D.C., providers voluntarily submitted data during most of the study period (24,25). Enforcement of required reporting also varies by reporting areas, leading to potential underreporting in other areas. Finally, not all reporting areas provided numbers by various sociodemographic

characteristics in 2019 (such as race and Hispanic origin [reported by 30 reporting areas], marital status [42 areas], and parity [45 areas]). As a result, information on abortion by these demographic characteristics is incomplete in CDC's Abortion Surveillance System.

Data from the Guttmacher Institute's Abortion Provider Census are collected via a mail-based provider survey. The response rates to the 2014 and 2017 mail-based surveys were 38%–42% (18,26). While extensive efforts are undertaken to follow up with providers by phone, only an additional 17%–20% of facilities provide abortion data after follow-up, for a total response rate of about 60%. Data for the remaining providers and facilities are collected from health department data or were estimated using previously available data or key informants (about 17%–20% in each category), with a small percentage of remaining providers and facilities determined to be closed or no longer providing abortion services. A recent report describing these data suggest that it is possible that not all abortion providers are captured, particularly those with small caseloads, potentially undercounting the total number of abortions performed by as much as 5% (18). However, it is also possible that the total numbers of abortions are overestimated, as the extent to which low response rates and nonresponse bias might affect estimated numbers of abortions performed in the United States is unknown. Providers may over- or underreport the numbers of induced abortions performed, and there are no published studies documenting the validity of provider-based reports for abortions. Other studies of healthcare provider surveys have suggested that low response rates and potential bias are often of concern (27–30) and that providers may overestimate the number of procedures or services performed relative to chart audits or patient surveys (30–33). Additional limitations of the Guttmacher abortion data include the lack of information about sociodemographic characteristics of the females receiving services, including state of residence, and the lack of timely annual data.

Most of the discrepancies between CDC's Abortion Surveillance System data and Guttmacher Institute data are due to the lack of data for California, Maryland, and New Hampshire in CDC's Abortion Surveillance System (1,23). Therefore, it is possible that missing data from CDC's Abortion Surveillance System for these three states could be imputed, providing a more comprehensive picture of abortion data across the United States by demographic factors and better accounting for potential uncertainty in these estimates.

This report describes an updated methodological approach to estimate pregnancy rates and associated uncertainty. The goal of this updated methodology is to better account for some of the limitations of the various input data and prior estimates, integrate more data sources in new ways, and use sensitivity analyses to ascertain the impact of varying the underlying assumptions about data quality and completeness.

Methods

Data

Live births

Data on live births were from restricted-use NVSS–Natality data files for 2010–2019 to calculate numbers of births by state of residence, maternal age, race and Hispanic origin, and parity. While data on live births are also captured in NSFG's pregnancy history files for 2010–2019, estimates of live births from NSFG do not include births to older women (aged either 45 and over or 50 and over, depending on the data year) and are subject to sampling error and variability. Therefore, estimates of live births from NSFG are only used to estimate the ratio of pregnancy losses to live births and not as a second source of data on the total number of live births because complete data on live births is available from NVSS–Natality data.

Pregnancy loss

Data on fetal deaths were from the NVSS–Fetal Death data files for 2010–2019. The numbers of fetal deaths (occurring at 20 weeks of gestation or more) were calculated by state of residence, maternal age, race and Hispanic origin, and parity. Data on pregnancy losses across all gestational ages (including miscarriage or spontaneous abortion, ectopic pregnancy, and stillbirth) were obtained from pregnancy history data included in the NSFG pregnancy-based files for 2010–2019. Pregnancy losses in NSFG data were categorized as those occurring at 20 or more weeks of gestation (consistent with NVSS–Fetal Death data), or at less than 20 weeks of gestation. Gestational age detail (in weeks) is a restricted-use variable in NSFG data for 2017–2019 and is not included in the public-use files. Similar to live births, data on pregnancy losses in NSFG were used to estimate the ratio of losses to live births, and not as a second source of data on the total number of pregnancy losses due to the lack of coverage among older women and potential sampling variability.

Induced abortion

Data on induced abortions were from publicly available estimates from CDC's Abortion Surveillance System. Numbers of induced abortions reported to CDC's surveillance system by state of occurrence, age, race and Hispanic origin, and parity were obtained from published tables for 2010–2019 (17,22,23,34–39). Published tables on the counts by residence versus the counts by occurrence (40) were also used to develop a method to estimate counts by state of residence from the reported counts by state of occurrence.

Population counts

Counts of the female population aged 10–44 by state of residence, age, race and Hispanic origin, and marital status were obtained from census data. Vintage 2019 postcensal population estimates for 2011–2019 and decennial census

estimates for 2010 from the U.S. Census Bureau's Application Programming Interface (API) were used to obtain population estimates of females by age group, race and Hispanic origin, and state (41). Population estimates by marital status for females aged 15–44 were obtained from annual 1-year American Community Survey (ACS) data files, also available via API. Population estimates by parity are not available in ACS or postcensal population data and, consequently, pregnancy rates by parity are not provided.

Covariates

State-level covariates for imputation models for induced abortion were from several data sources, including ACS (single year estimates for 2010–2019), the Guttmacher Institute (2010–2019), Kaiser Family Foundation (2018), the National Conference on State Legislatures (2018), Pew Charitable Trust (2016), and Gallup polls (2016), as well as NVSS data (birth and linked birth-infant death data for 2010–2019). Covariates were selected based on potential associations with induced abortion and missingness of abortion data, and included:

- Sociodemographic factors
  - Age
  - Racial and ethnic distribution
  - Household size
  - Vacant housing units
  - Teen birth rates (ages 15–19)
  - Birth rates by marital status
  - Percentage of the population identifying as "very religious"
- Socioeconomic factors
  - Median household income
  - Poverty rates
  - Percentage receiving public assistance (such as from the Supplemental Nutrition Assistance Program [SNAP]; Supplemental Security Income [SSI]; Special Supplemental Nutrition Program for Women, Infants, and Children [WIC]; or Temporary Assistance for Needy Families) (42)
  - Employment status among people aged 16 and over
  - Educational attainment among people aged 25 and over
  - Income inequality as measured by the Gini index (43)
- State policy environment
  - Family and medical leave laws
  - Laws related to abortion
  - Laws related to insurance coverage for fertility treatment
  - Contraceptive coverage requirements
- Health-related factors
  - Health insurance coverage
  - Type of insurance
  - Infant mortality rates
  - Neonatal mortality rates
  - Fertility rates
  - Unintended pregnancy rates
  - Rates of interpersonal violence
  - Availability of abortion providers or clinics
  - Percentage of females using contraception
  - Percentage of females in need of contraceptive services.

For a list of covariates and related data sources, see Table I.

Statistical Analysis

Live births

The numbers of live births by state of residence, year, and demographic subgroup were tabulated using data from NVSS–Natality from 2010 through 2019. Standard errors were calculated using published formulas (44,45). Births were inversely weighted by plurality, so that the numbers represented pregnancies (for example, triplet births were weighted by one-third so that they counted as one pregnancy). Additionally, for estimates by parity, one was subtracted from the parity variable in the birth data file, corresponding to parity for abortions and pregnancy losses (for example, the first live born infant is equivalent to zero prior live born infants, as reported in the abortion and pregnancy loss data sources). Finally, births by marital status are not available from California after 2016, so estimates by marital status were calibrated to match aggregate total numbers of live births in previously published reports from 2017–2019 (6,46,47).

Pregnancy losses

Data on fetal deaths were from the NVSS–Fetal Death data files for 2010–2019. The annual numbers of fetal deaths (occurring at 20 weeks of gestation or more) were calculated by state of residence, maternal age, race and Hispanic origin, and parity. Marital status was only available from 2010–2014. For 2015–2019, the proportion of fetal deaths occurring to married and unmarried people was extrapolated from 2014, with the calibrated proportion of births to married people as described above as a predictor. The estimated proportions were then applied to the overall fetal death numbers for 2015–2019 to estimate fetal deaths by marital status. Standard errors were calculated using published formulas (13,48).

NSFG pregnancy history data from the 2011–2013, 2013–2015, 2015–2017, and 2017–2019 file releases were used to estimate the ratio of pregnancy losses to live births overall and by demographic subgroup for 2010–2019. Ratios were estimated for losses occurring before 20 weeks and 20 weeks or later, accounting for the complex survey design and sample weights. First, tests of trends in the ratio of losses to live births were done to determine if significant temporal trends were observed in the ratio. No significant trends over the time period were found, so a single estimated ratio of

losses to live births was used for 2010–2019. The ratios were estimated separately by demographic group, but due to the small numbers of pregnancies in females under age 15, a single ratio was estimated for individuals under age 20. The corresponding numbers of losses and standard errors were estimated by multiplying the survey-weighted ratios (and standard errors) by the numbers of live births from NVSS–Natality by state, year, and demographic group.

Estimates of the number of losses before 20 weeks of gestational age were derived solely from NSFG (and NVSS–Natality), while estimates of the number of losses occurring at 20 weeks of gestation or later were generated from both NSFG and NVSS–Fetal Death data. To get a single estimate of the number of losses occurring at 20 weeks of gestation or later, estimates from NSFG and NVSS–Fetal Death data had to be combined. First, the number of losses occurring at 20 weeks of gestation or later (and corresponding standard errors) were estimated using the survey-weighted ratios of late losses to live births from NSFG multiplied by the number of live births from NVSS–Natality as described earlier. These estimates were then combined with the number of fetal deaths from the NVSS–Fetal Death data, weighted by the inverse of the variance to account for the larger uncertainty associated with estimates from NSFG.

Imputation of missing abortion data

To account for missing data on the total number of abortions as well as by demographic characteristics, multiple imputation was performed for the 2010–2019 abortion data (49). Abortion ratios (number of abortions relative to number of live births) were imputed for the three areas that did not report any abortion data to CDC (California, Maryland, and New Hampshire) and for the states that had missing data on the number of abortions by demographic group during 2010–2019. The demographic groups included:

- Maternal age (in 49 reporting areas): under 15, 15–19, 20–24, 25–29, 30–34, 35–39, and 40 and over
- Race and Hispanic origin (in 30 reporting areas): Hispanic, non-Hispanic Black, non-Hispanic White, and non-Hispanic other race (including Asian, Native Hawaiian or Other Pacific Islander, multiple race, or other race). Because of differences in data collection for race and Hispanic-origin groups across reporting areas, data for specific race and Hispanic-origin subgroups beyond the three largest groups (non-Hispanic White, non-Hispanic Black, and Hispanic) are not available
- Marital status (in 42 reporting areas): married (including currently married or separated) or unmarried (including never married, widowed, or divorced)
- Parity (number of previous live births; in 45 reporting areas): zero, one, two, three, or four or more previous live births.

Additionally, the ratio of abortions by state of residence to occurrence was also imputed, as state of residence was only reported by 48 jurisdictions (50). Overall, across all 9,880 strata (52 reporting areas including people aged 10 and over and 19 demographic groups), 2,188 strata were missing (22%) and needed to be imputed.

Abortion ratios by state, year, and subgroup (age, race and Hispanic origin, marital status, and parity) were log-transformed for normality and missing values were imputed using multiple imputation by chained equations (MICE) in the R statistical computing environment (51). Because the abortion data were from published tables, a small number of cells were treated as missing if they were suppressed in the published tables due to small counts. Separate models were run to impute abortion ratios overall, and then by age, race and Hispanic origin, marital status, and parity. Each model produced 30 imputations, with 10 iterations to ensure adequate mixing and convergence.

State-level (or equivalent reporting area) covariates from several different sources were considered for inclusion in the imputation models. Because state regulatory requirements represent one factor (among many) that may impact whether people travel between states to obtain abortion services, spatial data analyses were conducted to identify clusters of states and spatial outliers with respect to state abortion laws in 2010 and 2019. Specifically, Getis-Ord Gi* (52) statistics were used to identify clusters of states with either more permissive or more restrictive laws. Getis-Ord Gi* analyses produce a series of *z* scores where low values (under -1.96) indicate cold spots and high values (over 1.96) indicate hot spots. These *z* scores, along with the number of neighboring states, were included as potential covariates in the imputation models as a larger number of neighboring states may be related to the geographic proximity of services in nearby states. Additionally, Anselin Local Moran's I (52) statistics were used to identify spatial outliers, or states with laws that are very different compared with the surrounding states (for example, states with a restrictive legal environment that are surrounded by states with permissive abortion laws, or vice versa). Anselin Local Moran's I analyses produce *z* scores along with an indication of the type of cluster or outlier: 1) not part of a cluster; 2) hot spot, or high values surrounded by high values; 3) cold spot, or low values surrounded by low values; 4) spatial outlier, or high values surrounded by low values; or 5) spatial outlier, or low values surrounded by high values. Including these variables in the imputation models can help account for the spatial dependence between states, where the values for a given state may depend, in part, on the values for the surrounding states.

As the over 500 potential covariates were taken from a variety of sources and only 520 units of observation (the 50 states, New York City, and D.C. over 10 years), LASSO (least absolute shrinkage and selection operator) (53) regression models were implemented for feature selection (to reduce the number of covariates included in the imputation models)

using the "glmnet" package (54) in R 4.0.4 with the equation:

$$Minimize \sum_{i=1}^{n}(y_i - \sum_{j=0}^{p} x_{ij}\beta_j)^2 + \lambda \sum_{j=0}^{p} |\beta_j| \quad [1]$$

Where y_i is the outcome for each of n reporting areas and years, x_{ij} is the j_{th} standardized predictor (from a total of p predictors) with corresponding coefficient β_j, and λ is a tuning parameter controlling the penalty associated with nonzero values of the regression coefficient, β_j.

A customized function was developed to use LASSO regression models in MICE procedures in R. This function used LASSO regression models to impute missing values, selecting the optimal value for lambda (the tuning parameter controlling the amount of shrinkage, or degree of penalization applied to the coefficients) by 10-fold cross-validation and minimizing the deviance (squared error). Models were run separately for overall log-transformed abortion ratios, and by age, race and Hispanic origin, marital status, and parity, allowing for the selection of different sets of covariates for each subgroup. By randomly selecting the data for the 10-fold cross-validation of the LASSO regression models for each of 30 multiple imputations, the best-performing model and corresponding covariates could differ for each of the 30 multiple imputations. For the first imputation of 30, LASSO reduced the number of covariates from over 500 to 42 for overall abortion ratios (Table II), to 27 for the ratio of abortion counts by residence to occurrence, to 13–93 for abortion ratios by age, to 11–34 for abortion ratios by race and Hispanic origin, to 23–34 for abortion ratios by marital status, and to 9–41 for abortion ratios by parity.

Multiply imputed abortion ratios (the number of abortions relative to the number of live births) were then converted to the number of abortions by state of occurrence and demographic group by multiplying the geometric mean abortion ratio (that is, the exponentiated mean of the log-transformed abortion ratio, equivalent to the median abortion ratio) by the corresponding number of live births. To convert estimated numbers by state of occurrence to state of residence, weights were estimated using published tables with the numbers of abortions occurring in each state versus the numbers reported by state of residence for 2010–2019 (40). Values for states that did not report the numbers of abortions by state of residence in all years (California, Florida, Maryland, and New Hampshire) were multiply imputed using the same processes described earlier, with the ratios first log-transformed for normality. The geometric means of these imputed residence-to-occurrence ratios were used as weights to generate counts of abortions by state of residence using the following formula:

$$\hat{Y}_{st} = \exp(\rho_{st}) \bullet \beta_{st} \bullet \exp(\omega_{st}) \quad [2]$$

where the estimated number of abortions by state of residence s in year t ($\hat{Y}_{st}$) is a function of the imputed geometric mean abortion ratio, $\exp(\rho_{st})$, the corresponding number of live births (β_{st}), and the geometric mean of the ratio of the count of abortions by residence to occurrence, $\exp(\omega_{st})$.

For each of the 30 imputations, estimates by subgroup were calibrated to the estimated total number of abortions for each state and year. For example, the sum of the estimated numbers for each age group was constrained to equal the total estimated number of abortions. The imputed values were then pooled using Rubin's rule (49) to estimate the numbers of abortions by residence, overall, and by demographic subgroup for 2010–2019, along with the corresponding standard errors.

Pregnancy intention

NSFG pregnancy history data from the 2011–2013, 2013–2015, 2015–2017, and 2017–2019 file releases were used to estimate the proportion of pregnancies ending in loss or live birth for 2010–2019 that were unintended at conception (defined as "too soon, mistimed" or "unwanted") (55,56). The proportions were estimated overall and by demographic subgroup, accounting for the complex survey design and sample weights, and trend tests were conducted to identify significant trends over time in the proportions of pregnancies ending in loss or live birth that were unintended. The estimated proportions by group and year were multiplied by the corresponding estimated numbers of live births and total pregnancy losses to obtain estimated numbers of unintended pregnancies ending in live birth or loss. Additionally, 95% of pregnancies ending in abortion were assumed to be unintended based on previous literature reporting that intended pregnancies account for less than 5% of all abortions (57–59).

Data integration models

To estimate pregnancy rates from live births, pregnancy losses, and induced abortions, parametric bootstrapping (60,61) was used where the estimated numbers and variance for each outcome were used to generate 1,000 random draws from a normal distribution, and then the median value and 2.5th and 97.5th percentiles were used to estimate total pregnancies and corresponding 95% confidence intervals (95% CIs). For pregnancy losses, the observed estimates from NSFG and NVSS–Fetal Death data for pregnancy losses at 20 weeks of gestational age or later were first combined by weighting the estimates by the inverse of the variance.

The number of unintended pregnancies by year and demographic group was estimated by multiplying the number of pregnancies ending in each outcome (live birth, pregnancy loss, and abortion) by the corresponding proportion that were unintended. Parametric bootstrapping was used as described to estimate the numbers of unintended pregnancies and 95% CIs. Overall pregnancy rates were calculated as the estimated total number of pregnancies per 1,000 females aged 15–44, and by demographic subgroup. Similarly, unintended pregnancy rates were calculated as the estimated number of unintended pregnancies per

1,000 females aged 15–44, and by demographic subgroup. All estimated numbers of pregnancies were rounded to the nearest 1,000 (or 100 in the case of groups with small numbers of pregnancies).

All differences in rates or numbers between 2010 and 2019 are statistically significant at the 0.05 level unless otherwise noted, based on pairwise *z*-tests (44). As the focus of this report was to describe updated methodology for estimating pregnancy rates and not to examine trends over time by group, detailed analyses of nonlinear trends and patterns were not performed, and differences between groups were not tested for statistical significance.

Sensitivity analyses

Because abortions may be underreported in CDC abortion surveillance data, in part due to incomplete reporting in certain jurisdictions, simulations were also implemented assuming that abortions were about 15% higher than reported. In 2017, CDC's abortion surveillance data included 612,719 abortions (23), while Guttmacher data (62) for the same reporting areas included in CDC abortion surveillance data (excluding California, Maryland, and New Hampshire) included 697,670 abortions, about 14% higher than in CDC abortion surveillance data. Therefore, assuming that abortions are about 15% higher than reported in CDC abortion surveillance data is consistent with the magnitude of observed differences between the two data sources.

Comparison with previously published estimates

Estimates of pregnancy rates for 2010 were compared with previously published estimates (2) overall and for selected demographic groups to describe the impact of the updated methodology. The percentage differences from the previous estimates were calculated overall and by age group and race and Hispanic origin.

Results

An estimated 6,069,000 pregnancies occurred in 2010, declining 9% to 5,507,000 in 2019 (Table A). Figure 2 shows trends in the number of pregnancies, live births, abortions, and pregnancy losses for 2010–2019. The overall pregnancy rate (the estimated number of pregnancies per 1,000 females aged 15–44) was 97.3 in 2010, declining by 12% to 85.6 in 2019 (Table A). The percentage of pregnancies ending in live birth increased from 64.8% in 2010 to 66.9% in 2019, while the percentage ending in abortion declined from 15.8% to 13.1%, and the percentage ending in loss increased from 19.4% in 2010 to 20.0% in 2019.

Patterns by Age

By age, estimated pregnancy rates declined by at least 50% for 2010–2019 for young people under age 20 (under age 15: 1.0 per 1,000 to 0.4, a decline of 60%; aged 15–19: 60.8 per 1,000 to 29.4, a decline of 52%) (Figure 3 and Table III). Pregnancy rates also declined 29% for women aged 20–24 (from 139.3 to 98.8) and 14% for women aged 25–29 (from 154.3 to 132.6). For women aged 30–34, pregnancy rates were essentially the same in 2019 (139.7) as in 2010 (139.1). For women aged 35 and over, pregnancy rates were higher in 2019 than in 2010. For women aged 35–39, pregnancy rates increased by 11% from 69.1 to 77.0. For women aged 40 and over, pregnancy rates increased 15%, from 21.5 to 24.7. In 2010, women aged 25–29 (154.3) had the highest estimated pregnancy rates followed by women aged 20–24 (139.3), but in 2019, the group with the highest estimated pregnancy rates was women aged 30–34 (139.7), followed by women aged 25–29 (132.6).

Patterns by Race and Hispanic Origin

Pregnancy rates declined by 21% for Hispanic females, from 108.6 in 2010 to 85.5 in 2019 (Figure 4 and Table III). Pregnancy rates declined by 10% for non-Hispanic Black females, from 122.5 to 109.8. Declines were smaller for non-Hispanic White females, with pregnancy rates decreasing 8%, from 90.1 to 82.6. For non-Hispanic females of other racial groups, pregnancy rates declined by 15%, from 80.4 to 68.7.

Patterns by Marital Status

Pregnancy rates for unmarried females declined by 19%, from 81.8 in 2010 to 66.4 in 2019, while rates for married females were relatively stable (from 118.4 to 115.7, respectively) (Figure 5 and Table III).

Patterns by Parity

Pregnancy rates were not available by parity due to the lack of population denominators by parity. However, trends in the number of pregnancies from 2010 to 2019 by parity group can be seen in Figure 6 and Table IV. The number of pregnancies declined by 14% for females with zero prior live births, from 2.38 million in 2010 to 2.05 million in 2019; this group also had the highest number of pregnancies throughout the time period. Declines from 2010 to 2019 were smaller for females with one prior live birth (8%), two prior live births (6%), and three prior live births (5%). The number of pregnancies increased by 3% for females with four or more prior live births. These differences in numbers were not tested for statistical significance.

Unintended Pregnancies

Rates of unintended pregnancies declined overall by 15%, from 42.1 per 1,000 females aged 15–44 in 2010 to 35.7 in 2019 (Table B). Rates of unintended pregnancy also declined for all age groups except for women aged 35–39 and 40 and over, for whom rates increased by 5% and 8%, respectively

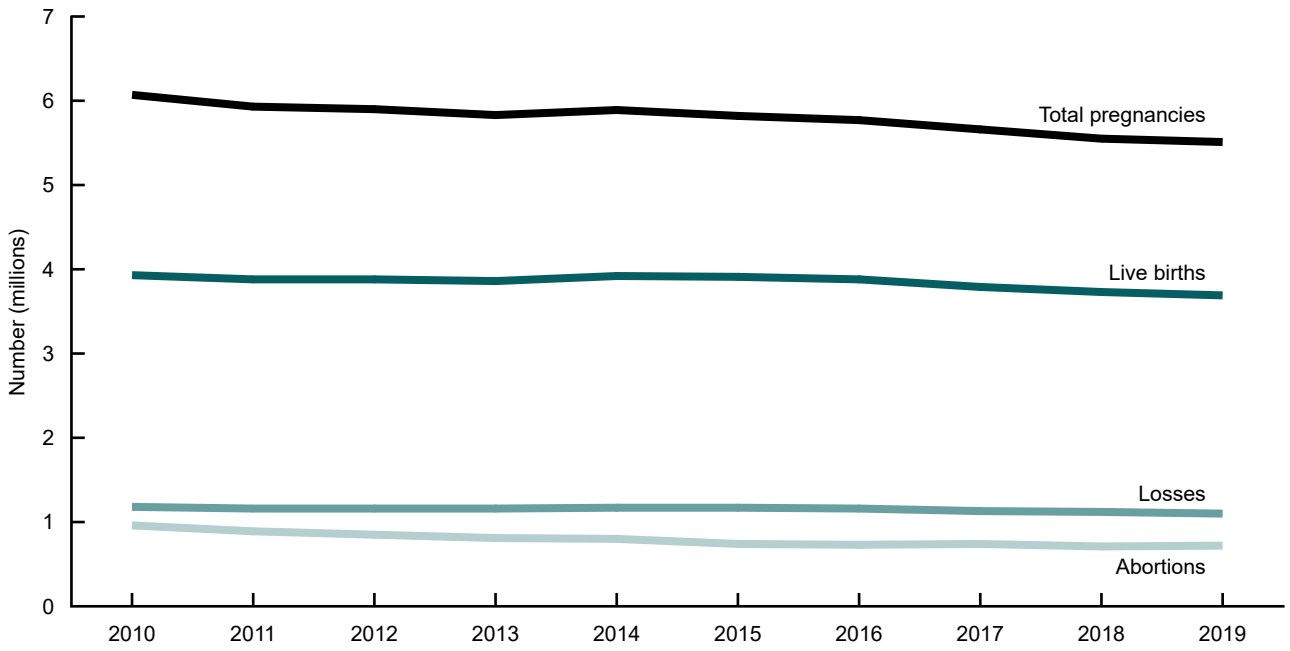
Table A. Total estimated number of pregnancies, pregnancy rates, and percentage of pregnancies, by outcome: United States, 2010–2019

Characteristic	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total estimated number of pregnancies[1]	6,069,000	5,934,000	5,899,000	5,828,000	5,888,000	5,824,000	5,773,000	5,660,000	5,555,000	5,507,000
Pregnancy rate[2] (95% confidence interval)	97.3 (90.7–103.9)	94.8 (88.7–100.7)	93.9 (88.3–99.7)	92.5 (87.2–97.8)	93.1 (88.0–98.1)	91.8 (87.3–96.3)	90.8 (86.4–95.2)	88.7 (83.8–93.8)	86.7 (82.7–90.8)	85.6 (81.5–89.6)
Pregnancy outcome						Percent				
Live birth	64.8	65.4	65.8	66.2	66.6	67.1	67.2	66.9	67.1	66.9
Induced abortion	15.8	15.0	14.4	13.9	13.5	12.8	12.7	13.0	12.9	13.1
Loss[3]	19.4	19.6	19.7	19.8	19.9	20.1	20.1	20.0	20.1	20.0

[1]Includes pregnancies in females of all ages.
[2]Per 1,000 females aged 15–44.
[3]Includes miscarriage or spontaneous abortion, ectopic pregnancy, and stillbirth or fetal death.

SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Figure 2. Trends in pregnancy outcomes in females aged 15–44: United States, 2010–2019



NOTE: Pregnancy losses include miscarriage or spontaneous abortion, ectopic pregnancy, and stillbirth or fetal death.
SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

(Figure 7 and Table C). From 2010 to 2019, unintended pregnancy rates declined by 14% for women aged 25–29, 31% for those aged 20–24, and 52% for teenagers aged 15–19. Unintended pregnancy rates and percentages for children and teens under age 15 are not reported, as pregnancies in this age group may disproportionately result from rape or abuse, so the construct of "intention" is not appropriate for this younger age group (63).

By race and Hispanic origin, unintended pregnancy rates declined from 2010 to 2019 by 23% for Hispanic females, 17% for non-Hispanic females of other races, 12% for non-Hispanic Black females, and 11% for non-Hispanic White females (Figure 8 and Table C). By marital status, unintended pregnancy rates declined from 2010 to 2019 by 20% for unmarried females and 5% for married females (Figure 9 and Table C).

The percentage of pregnancies that were unintended overall and by demographic group can be seen in Tables B and D, respectively, with women aged 25–29 being the only group to show a nonsignificant change in the percentage of pregnancies that were unintended from 2010 to 2019.

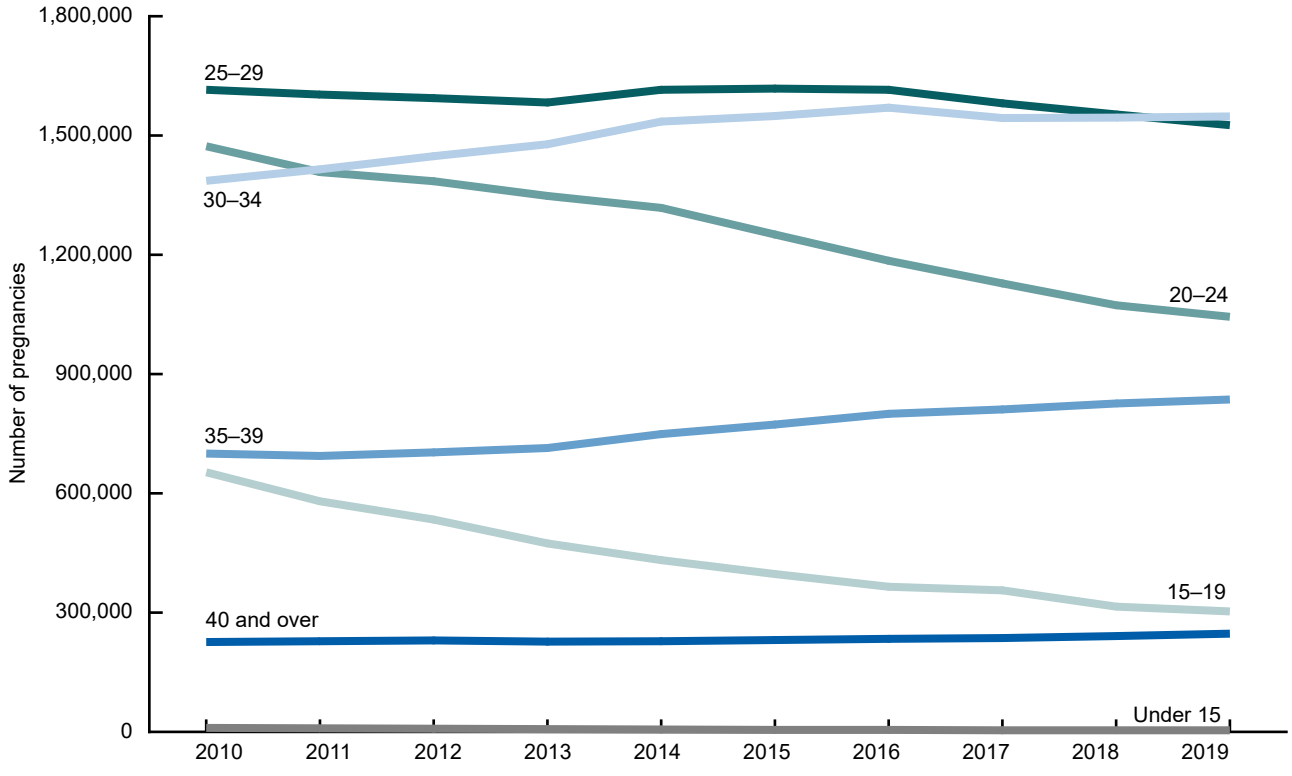
Comparisons With Previously Published Estimates

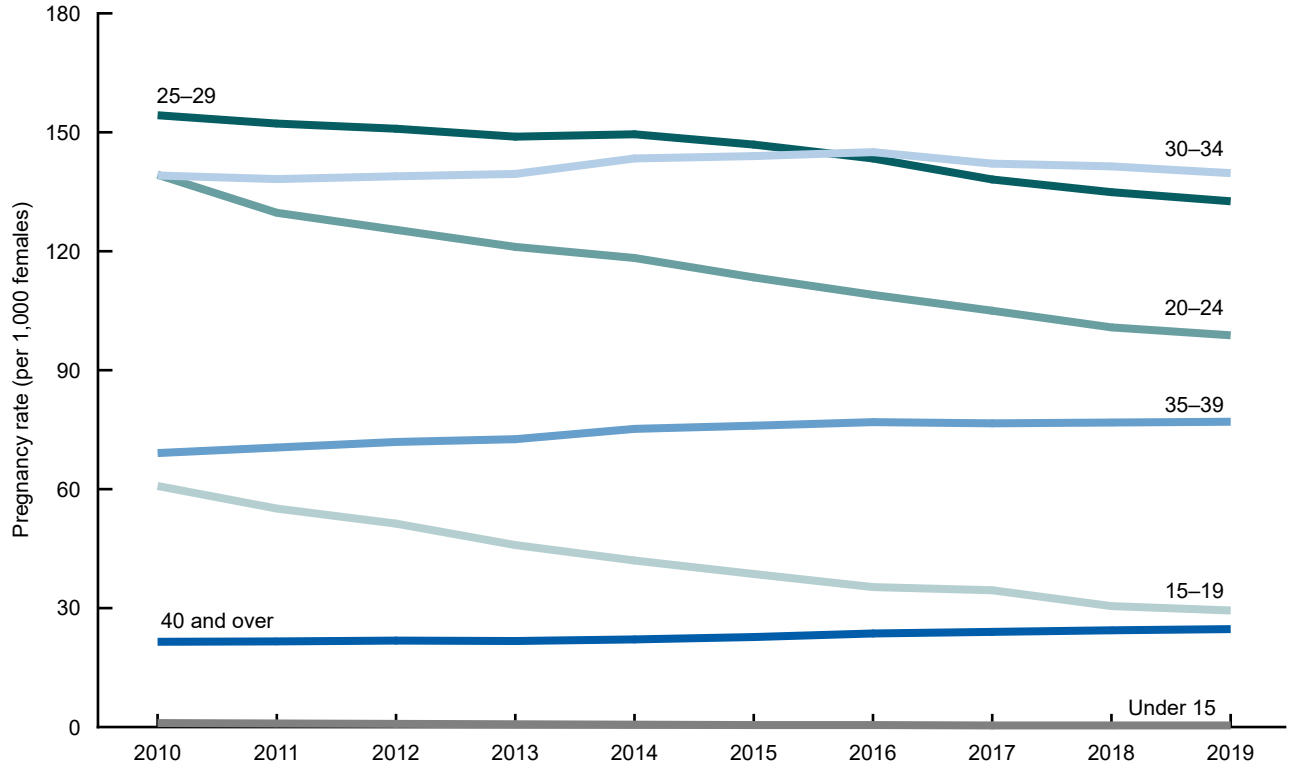
Estimates shown in this report are lower than the previously published estimates for 2010 using the older methodology (Table V) (2). For example, the previous methods resulted in an estimated 2010 pregnancy rate of 98.7, corresponding to 6.155 million pregnancies. The updated methodology presented in this report resulted in an estimated pregnancy rate of 97.3 (6.069 million pregnancies) in 2010, 1% lower than the previous estimate. By age and race and Hispanic origin, pregnancy rates estimated using the new methodology were within 1%–11% of the previous estimates. Nearly all of the available previous estimates of pregnancy rates for 2010 were within the 95% CIs of the estimates provided in this report, with two exceptions. The updated 2010 estimate for women aged 35–39 (69.1 pregnancies per 100,000 women; 95% CI: 63.5–74.6) was 10% lower than the previous estimate (76.5) and the previous estimate was not within the 95% CI shown here. Additionally, the updated 2010 estimate for non-Hispanic White females (90.1 pregnancies per 100,000 females; 95% CI: 86.1–94.1) was 7% higher than the previously published estimate (84.1) and the older estimate was outside the 95% CI shown here. Finally, the percentages of pregnancies by outcome were very similar using the previous methodology (65% live births, 18% abortions, and 17% pregnancy losses) compared with the updated methodology (65% live births, 16% abortions, and 19% pregnancy losses).

Discussion

This report describes an updated methodology for estimating pregnancy rates in the United States using several data sources from CDC and NCHS. By imputing missing data from

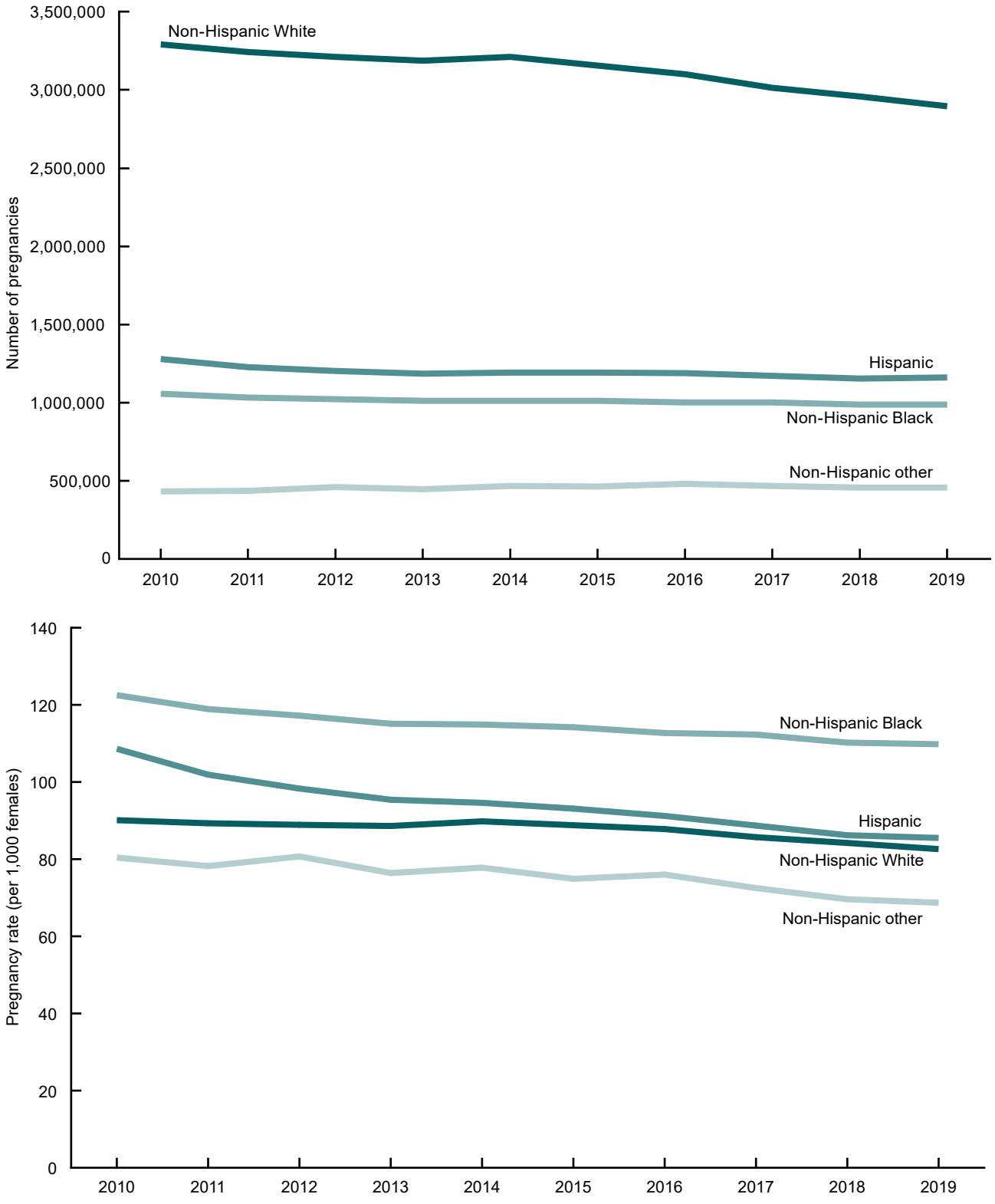
Figure 3. Trends in the number of pregnancies and pregnancy rate, by age: United States, 2010–2019





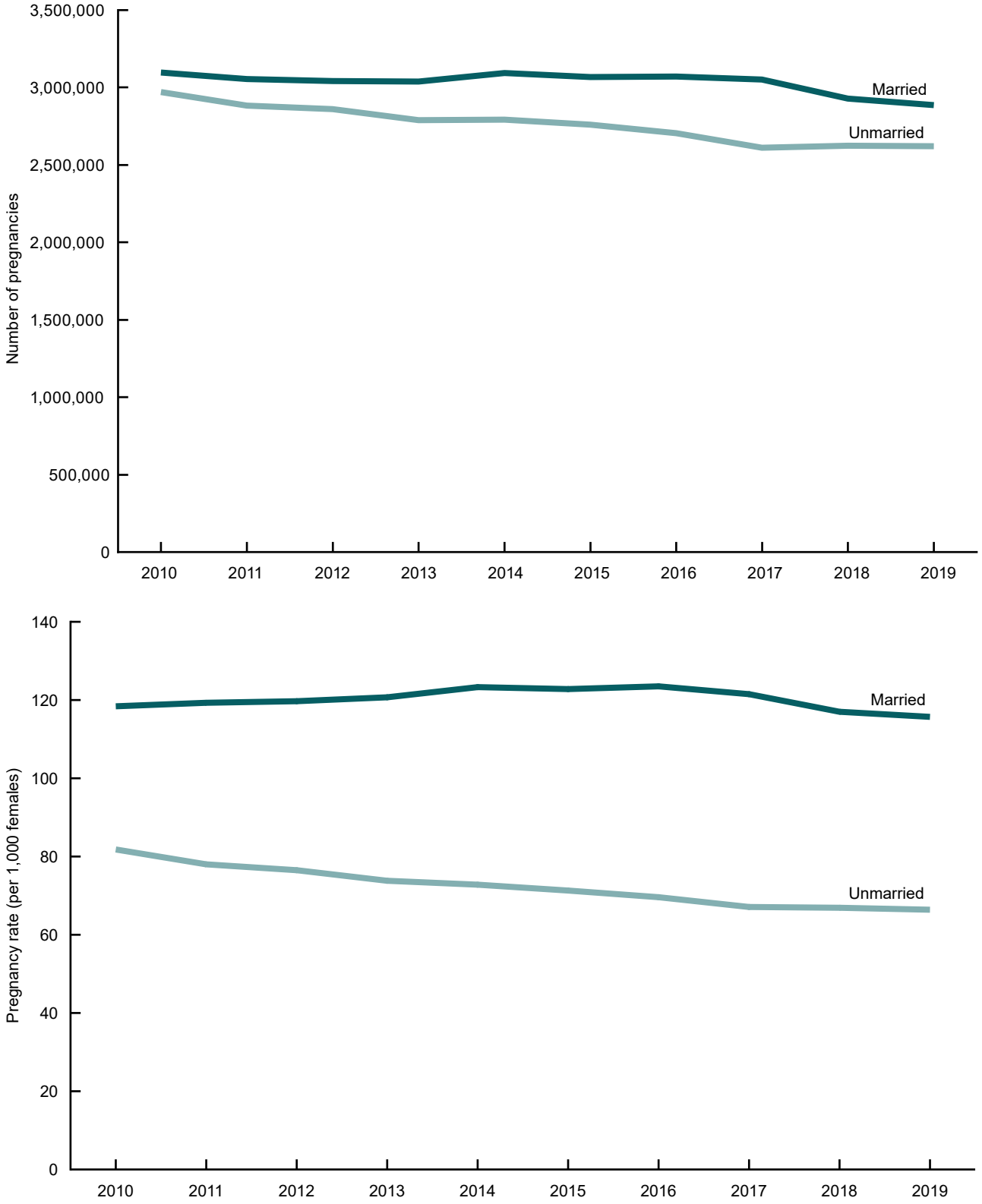
SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Figure 4. Trends in the number of pregnancies and pregnancy rate, by race and Hispanic origin: United States, 2010–2019



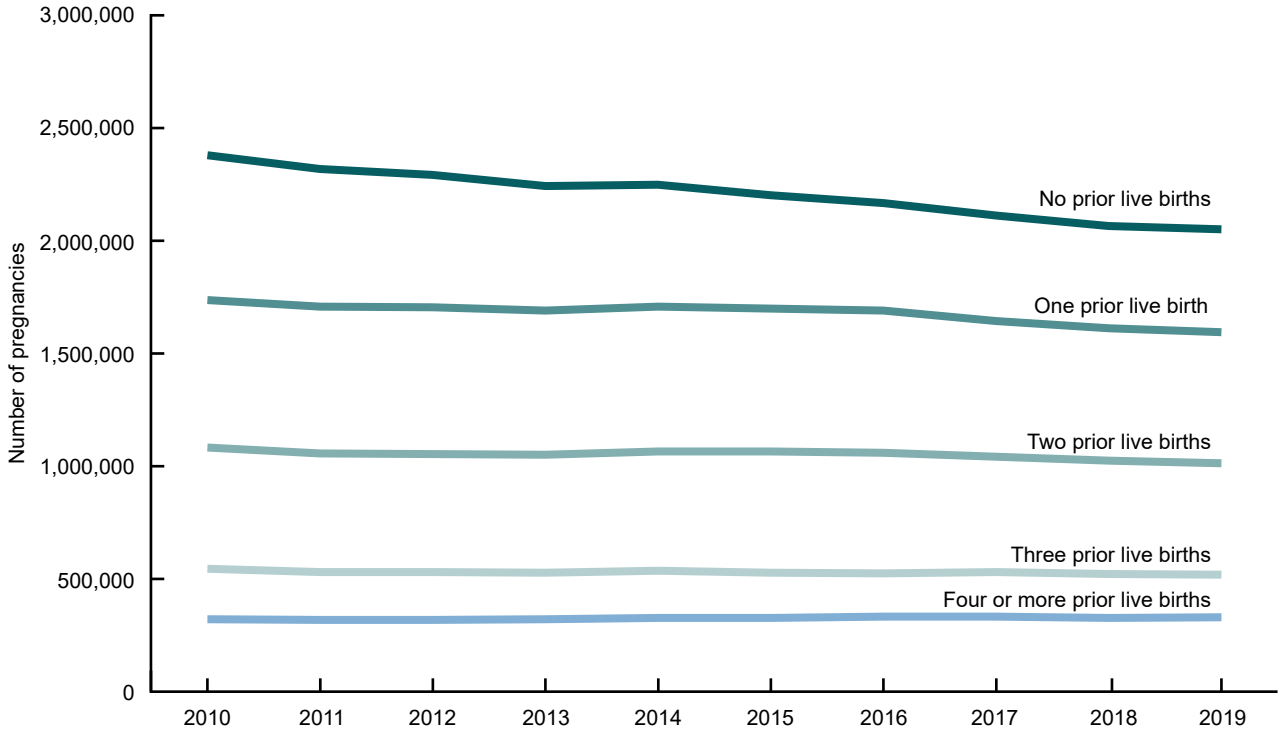
NOTE: The non-Hispanic other race group includes people identifying as Asian, Native Hawaiian or Other Pacific Islander, multiple race, or other races.
SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Figure 5. Trends in the number of pregnancies and pregnancy rate, by marital status: United States, 2010–2019



SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Figure 6. Trends in the number of pregnancies, by parity: United States, 2010–2019



SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

CDC's Abortion Surveillance System, more timely estimates of pregnancy rates and unintended pregnancies can be made available as these data are published annually. Historically, pregnancy rate estimates for the United States have relied on abortion data from periodic abortion provider surveys, which were only conducted every few years and published 2 or 3 years after data collection. By integrating data from multiple data systems, including NSFG and NVSS (birth and fetal death data), this report shows continued declines in pregnancy rates in the United States through 2019 and for most demographic groups. Unintended pregnancy rates also declined for most groups, though the percentage of unintended pregnancies was relatively steady for 2010–2019 at 41%–43% and remained above the Healthy People 2030 target of 36.5% (4).

Larger percentage declines in unintended pregnancy rates were seen among younger age groups, and those patterns were mirrored for pregnancy rates overall, declining by 52% for teenagers aged 15–19. Additionally, unintended pregnancy rates declined the most among Hispanic females (23%), with unintended pregnancy rates converging from 59% higher than those among non-Hispanic White females in 2010 to 38% higher in 2019. The unintended pregnancy rates among non-Hispanic Black females also declined from 2010 to 2019 (by 12%), but remained more than twice as high in 2019 (63.2 per 1,000 females) as rates for non-Hispanic White females (28.2 per 1,000 females).

Estimates shown in this report (97.3 pregnancies per 100,000 females, representing about 6.069 million pregnancies) are 1% lower than previously published estimates for 2010 (98.7, representing 6.155 million pregnancies) (2). Estimates may differ for several reasons, as changes were made in calculating each pregnancy outcome (live births, abortions, and pregnancy losses). In this updated methodology, the number of live births was adjusted for multiple births, so that each pregnancy was only counted once (instead of multiple births each being counted separately, as was the case previously), resulting in a lower number of pregnancies ending in live birth (3.929 million compared with 3.999 million using the previous methodology). Pregnancy losses were estimated using the ratio of losses to live births and incorporated data on fetal deaths from NVSS, while the previous methodology used losses as a proportion of the sum of live births and losses and did not use fetal death data. This modification resulted in a higher number of pregnancy losses estimated with the updated methodology (1.177 million in 2010 compared with 1.053 million using the previous methodology). The overall estimated number of abortions in 2010 was also lower using this updated methodology (958,200) compared with the previous methodology (1.103 million) that relied on different methods and data sources for abortions. By age and race and Hispanic origin, pregnancy rates estimated using the new methodology were generally within 1%–11% of the previously published estimates and the previous estimates were nearly all within the 95% CIs of the

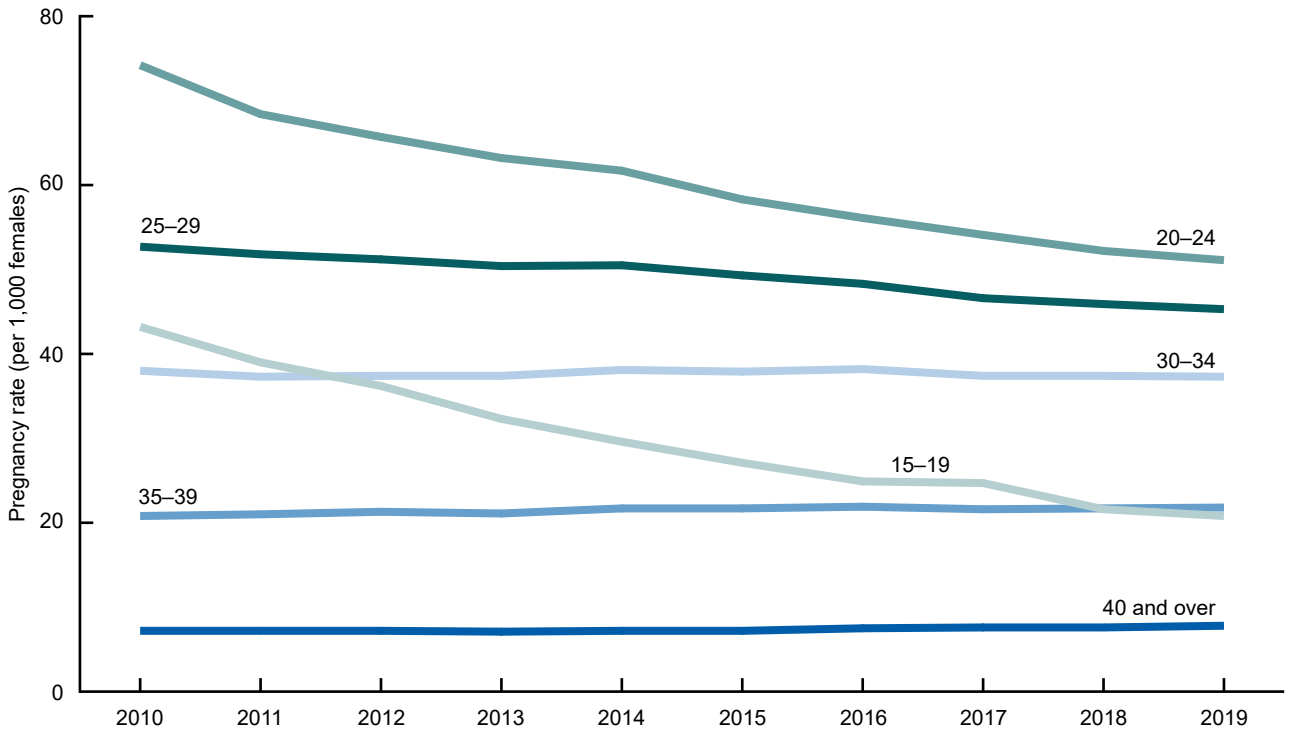
Table B. Total estimated number, percentage, and rate of unintended pregnancies: United States, 2010–2019

Characteristic	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Number of unintended pregnancies	2,626,000	2,544,000	2,510,000	2,461,000	2,471,000	2,417,000	2,394,000	2,359,000	2,311,000	2,293,000
Percentage of unintended pregnancies	43.3	42.9	42.6	42.2	42.0	41.5	41.5	41.7	41.6	41.6
Rate[1] of unintended pregnancies (95% confidence interval)	42.1 (35.4–48.8)	40.6(34.8–46.7)	40.0 (34.4–45.6)	39.0 (33.7–44.3)	39.1 (34.0–44.1)	38.1 (33.6–42.6)	37.6 (33.2–41.9)	37.0 (31.8–42.1)	36.1 (31.9–40.2)	35.7 (31.6–39.7)

[1]Per 1,000 females aged 15–44.

SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Figure 7. Trends in the unintended pregnancy rate, by age: United States, 2010–2019



SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

estimates in this report except for two demographic groups (non-Hispanic White females and women aged 35–39). The larger discrepancies for these two groups could be driven by the factors noted earlier related to different data sources and methods for estimating pregnancy components, which may impact various groups differently. Additionally, by age, larger percentage differences were seen for age groups with the smallest pregnancy rates, where there is likely more variability or uncertainty due to the smaller numbers. Although the estimates shown in this report are similar to previous estimates for 2010, they should not be compared with previous estimates to describe longer-term trends due to the differences in methodology.

This analysis has several limitations. First, this analysis does not capture abortions obtained by U.S. residents traveling to other countries. Second, pregnancy rate estimates may understate the risk of pregnancy in the youngest age group given that the denominators represent the total population of females aged 10–14 years, many of whom may not be at risk of pregnancy. Third, the number of abortions estimated by imputing missing data from CDC's Abortion Surveillance System is about 15% lower than the numbers published by other data sources for 2011–2017 (18,23,26,62). It is possible that abortions are underestimated, which would lead to pregnancy rate estimates that are too low. Sensitivity analyses assuming that abortions are 15% higher than reported estimates resulted in pregnancy rates that were 2% higher, on average, for 2010–2019 but were also within the 95% CIs of the original estimates (Table VI). Estimated unintended pregnancy rates shown here are also consistent with estimates published in other studies, including a recent analysis examining country-specific estimates of unintended pregnancy for 2015–2019 (64). The estimated rate from that study was about 35 unintended pregnancies per 1,000 females (64) compared with estimated rates in this report of 35.7–38.1 unintended pregnancies over that same time period. An older study reported unintended pregnancy rates of 45 per 1,000 females in 2011 (5), which is somewhat higher than the rates shown in this report for 2010–2011 (42.1 and 40.6, respectively).

Earlier studies have noted that using a binary measure of pregnancy intention provides a very crude assessment of the complex feelings and attitudes toward pregnancy (64–68), but unintended pregnancy as defined by this binary measure has documented associations with factors affecting maternal and child well-being, such as prenatal care, breastfeeding, and longer-term effects throughout childhood (69–71). The binary measure is commonly used in tracking progress toward national health objectives related to decreasing the proportion of pregnancies that are unintended (4). Estimates shown here related to pregnancy intention are also limited in that state-level variability was not accounted for, and data from other sources suggest that there is geographic variation in the percentage of pregnancies or live births that are unintended (59,72).

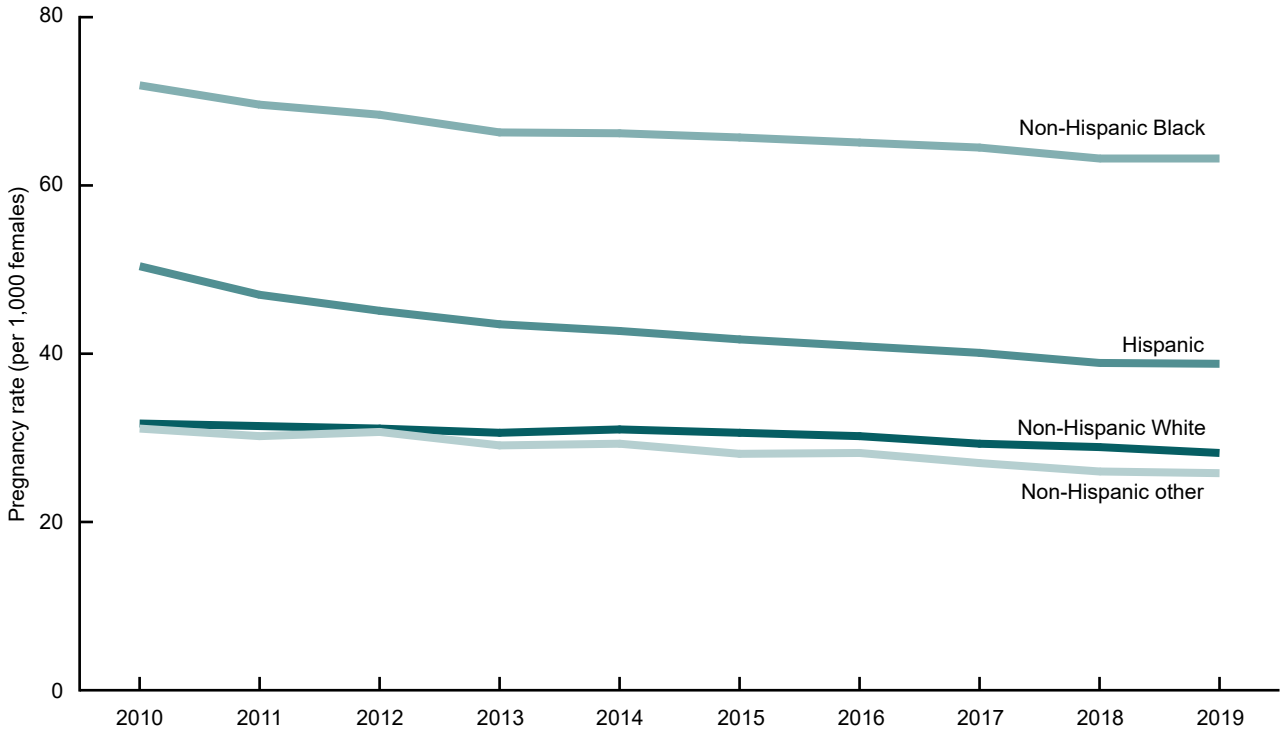
Table C. Estimated unintended pregnancy rate, by selected characteristics: United States, 2010–2019

Characteristic	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Age	Rate (95% confidence interval)									
15–19	43.2 (36.8–49.6)	39.0 (33.4–44.6)	36.2 (31.1–41.2)	32.3 (27.9–36.9)	29.6 (25.4–33.7)	27.1 (23.4–30.9)	24.9 (21.6–28.3)	24.7 (10.7–38.2)	21.6 (18.7–24.5)	20.8 (17.9–23.7)
20–24	74.2 (56.3–92.8)	68.4 (53.6–82.8)	65.7 (52.0–79.2)	63.2 (50.7–76.0)	61.7 (49.4–73.8)	58.3 (48.6–68.1)	56.1 (46.7–65.6)	54.1 (44.9–63.4)	52.2 (43.5–60.6)	51.1 (42.5–59.6)
25–29	52.7 (43.6–62.1)	51.8 (42.4–61.3)	51.2 (42.3–60.4)	50.4 (41.4–59.2)	50.5 (41.7–59.4)	49.3 (40.9–57.7)	48.3 (40.2–56.5)	46.6 (38.9–54.3)	45.9 (38.3–53.5)	45.3 (37.7–53.1)
30–34	38.0 (29.2–47.0)	37.3 (28.4–46.1)	37.4 (28.7–46)	37.4 (28.9–46.1)	38.1 (29.4–46.9)	37.9 (29.3–46.6)	38.2 (29.5–46.9)	37.4 (29.0–46.1)	37.4 (28.7–46.0)	37.3 (28.7–46.0)
35–39	20.8 (15.1–26.6)	21.0 (15.3–26.8)	21.3 (15.4–27)	21.1 (15.5–26.6)	21.7 (16.1–27.3)	21.7 (16.1–27.4)	21.9 (16.3–27.5)	21.6 (16.2–27.3)	21.7 (16.2–27.2)	21.8 (16.3–27.4)
40 and over	7.2 (4.1–10.3)	7.2 (4.1–10.2)	7.2 (4.2–10.3)	7.1 (4.0–10.1)	7.2 (3.9–10.3)	7.2 (4.0–10.4)	7.5 (4.2–10.8)	7.6 (4.3–11.0)	7.6 (4.3–11.0)	7.8 (4.3–11.2)
Race and Hispanic origin										
Hispanic	50.4 (38.7–61.8)	47.0 (36.6–57.0)	45.1 (35.6–54.8)	43.5 (34.5–52.3)	42.7 (34.5–51.0)	41.7 (34.1–49.4)	40.9 (33.4–48.4)	40.1 (32.4–47.6)	38.9 (31.8–46.2)	38.8 (31.6–46.3)
Non-Hispanic Black	71.9 (58.0–85.9)	69.6 (56.5–82.5)	68.4 (56.0–80.6)	66.3 (54.9–77.7)	66.2 (54.9–77.5)	65.7 (54.4–77.3)	65.1 (54.7–75.8)	64.5 (54.3–74.7)	63.2 (53.4–73.3)	63.2 (53.0–73.3)
Non-Hispanic White	31.7 (27.8–35.7)	31.4 (27.6–35.4)	31.1 (27.3–35.0)	30.6 (27.0–34.4)	31.0 (27.3–34.7)	30.6 (27.0–34.2)	30.2 (26.6–33.7)	29.3 (25.9–32.7)	28.9 (25.4–32.2)	28.2 (24.9–31.6)
Non-Hispanic other	31.1 (23.1–39.0)	30.2 (22.8–37.4)	30.7 (23.2–38.2)	29.1 (22.0–36.1)	29.3 (22.1–36.5)	28.1(21.7–34.4)	28.2 (21.9–34.5)	27.0 (20.8–33.1)	26.0 (20.2–31.7)	25.8 (19.9–31.6)
Marital status										
Married	26.6 (22.1–31.3)	26.7 (22.1–31.3)	26.6 (22.1–31.2)	26.6 (22.1–31.0)	27.0 (22.5–31.4)	26.7 (22.3–31.1)	26.8 (22.3–31.0)	26.3 (21.4–31.1)	25.5 (20.4–30.6)	25.4 (19.3–31.3)
Unmarried	53.3 (41.3–65.6)	50.5 (39.4–61.6)	49.3 (38.5–60.0)	47.2 (37.6–56.7)	46.3 (37.3–55.4)	45.3 (36.8–53.7)	44.2 (36.1–52.1)	41.9 (33.5–50.2)	43.1 (20.5–65.8)	42.7 (24.5–61.4)

NOTES: Rate is unintended pregnancies per 1,000 females. Parity is not included because there are no corresponding denominators to estimate unintended pregnancy rates. Population denominators for the 40 and over age group include women aged 40–44. The non-Hispanic other race group includes people identifying as Asian, Native Hawaiian or Other Pacific Islander, multiple race, or other races.

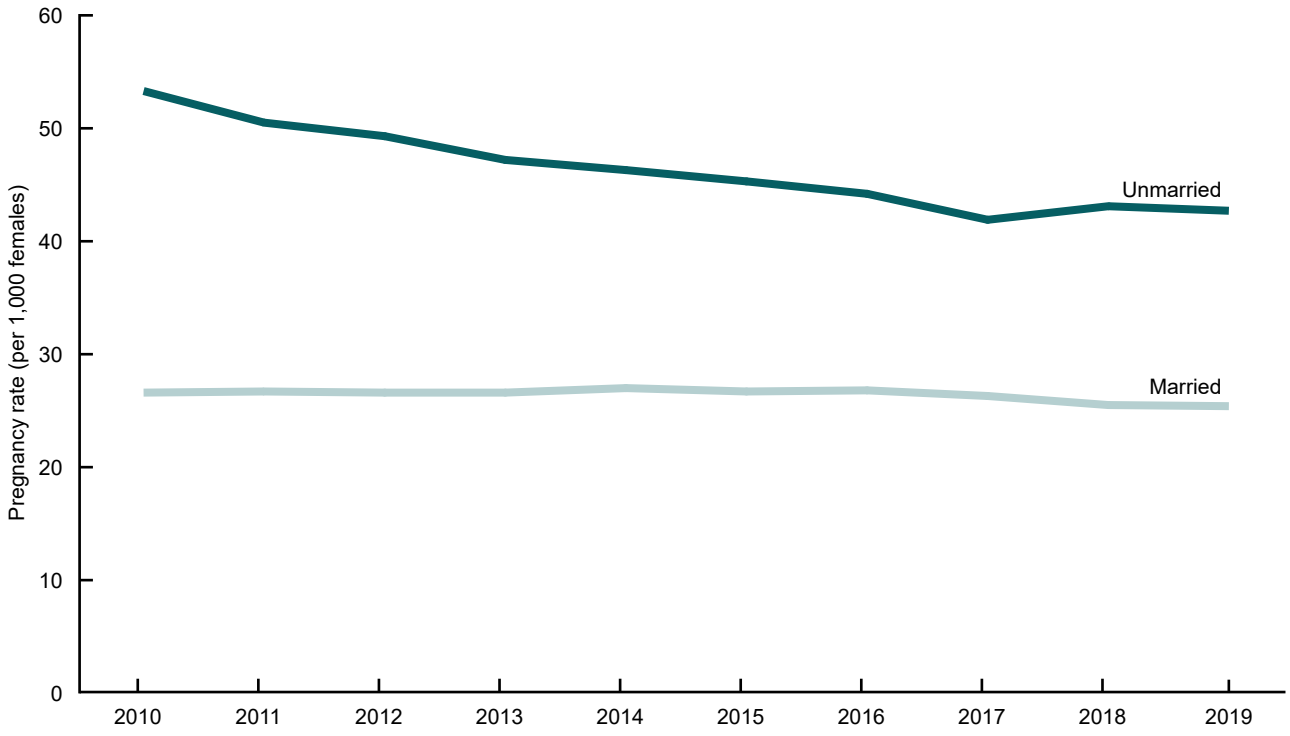
SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Figure 8. Trends in the unintended pregnancy rate, by race and Hispanic origin: United States, 2010–2019



SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Figure 9. Trends in the unintended pregnancy rate, by marital status: United States, 2010–2019



SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Table D. Estimated percentage of unintended pregnancies, by selected characteristics: United States, 2010–2019

Characteristic	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Age										
15–19	71.0	70.7	70.6	70.5	70.4	70.2	70.5	71.5	70.7	70.8
20–24	53.2	52.7	52.4	52.2	52.2	51.4	51.5	51.5	51.7	51.8
25–29	34.1	34.0	33.9	33.9	33.8	33.6	33.7	33.8	34.0	34.2
30–34	27.3	27.0	26.9	26.8	26.6	26.4	26.3	26.3	26.5	26.7
35–39	30.2	29.8	29.6	29.0	28.9	28.6	28.5	28.3	28.3	28.3
40 and over	33.5	33.2	33.3	32.7	32.5	31.9	31.8	31.5	31.2	31.6
Race and Hispanic origin										
Hispanic	46.4	46.1	45.9	45.6	45.2	44.8	44.9	45.2	45.2	45.3
Non-Hispanic Black	58.7	58.5	58.3	57.6	57.6	57.6	57.7	57.4	57.4	57.5
Non-Hispanic White	35.2	35.2	35.0	34.6	34.5	34.4	34.4	34.2	34.3	34.2
Non-Hispanic other[1]	38.7	38.6	38.1	38.1	37.7	37.5	37.1	37.2	37.3	37.6
Marital status										
Married	22.5	22.3	22.2	22.0	21.9	21.8	21.7	21.7	21.8	21.9
Unmarried	65.2	64.7	64.5	63.9	63.6	63.5	63.6	62.5	64.4	64.3
Parity										
No prior live births	48.1	47.6	47.7	47.2	47.1	47.2	46.9	47.3	47.1	47.6
One prior live birth	40.1	39.8	39.7	39.0	38.6	38.4	38.1	38.2	38.4	38.4
Two prior live births	45.9	45.9	45.6	45.1	44.8	44.5	44.2	44.2	44.3	44.4
Three prior live births	51.1	50.5	49.8	49.6	48.8	47.7	47.4	48.2	48.1	48.6
Four or more prior live births	50.0	49.6	49.2	48.7	48.2	48.0	47.9	47.7	47.8	48.0

[1]The non-Hispanic other race group includes people identifying as Asian, Native Hawaiian or Other Pacific Islander, multiple race, or other races.

NOTE: Unintended pregnancies were defined as "too soon, mistimed" or "unwanted."

SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Additionally, many factors affecting pregnancy rates (such as state variation in abortion and contraceptive access, birth rates, and socioeconomic factors) have changed in recent years (73,74). These changes may not be reflected in the various data sources used in the imputation models, which are often only available periodically; some covariates were only available for a single year during the study period. Future updates to this analysis will be challenging given all of the changes that occurred in 2020 and later (74) affecting various aspects of reproductive health, along with potential but unknown changes in data quality and reporting since 2020. Changes in data availability by demographic factors, such as marital status or how race and Hispanic origin is reported, will limit future analyses and the ability to examine trends over time. For example, marital status is no longer available in NVSS–Fetal Death data, and changes in race and Hispanic-origin reporting were introduced for 2010–2019 as jurisdictions in NVSS adopted the 1997 Office of Management and Budget standards for reporting race and Hispanic origin (75). Data are only provided for the three largest race and ethnicity groups given the need to harmonize this variable across various data systems, leading to a gap in information about several subpopulations including those within the non-Hispanic other race category as well as Hispanic-origin subgroups. Finally, further methodological work may provide additional insights about how pregnancy rates vary by geographic factors such as state or urban–rural residence.

The methodology described in this report allows for the publication of more timely estimates of overall and unintended pregnancy rates to inform policies and programs to decrease the percentage of unintended pregnancy. Importantly, due to differences in timeliness of availability for some of the data sources used to estimate pregnancy rates, further evaluation will be needed to determine if production of preliminary estimates using interim or previously imputed data, for example, may be feasible. This includes pregnancy loss data from NSFG, which is currently produced every other year. In addition, more substantial evaluation of potential recent changes in abortion reporting and corresponding data quality (73) may be needed before future updates of the data presented in this report. However, the goal is to produce more regular and timely updates to these rates in the future. The availability of timelier estimates of pregnancy rates and unintended pregnancies will be crucial for tracking reproductive health outcomes in the United States, as is consistent with U.S. health objectives.

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Appendix. Supporting Tables

Table I. Data sources for covariates in abortion imputation models

Data source	Related publications	Types of covariates and years	Number of covariates
National Vital Statistics System (NVSS)			
Birth data	Births: Final Data for 2019 (Reference 47 in this report)	Births and birth rates by demographic group (2010–2019)	238
Period-linked birth-infant death data	Infant Mortality in the United States, 2019: Data From the Period Linked Birth/Infant Death File	Infant mortality rates by demographic group (2010–2019)	38
Other sources			
NCHS urban–rural classification	2013 NCHS Urban–Rural Classification Scheme for Counties	Percentage and number of counties in each urban–rural group and population estimate for each urban–rural group (2013)	18
National Intimate Partner and Sexual Violence Survey	The National Intimate Partner and Sexual Violence Survey (available from: https://www.cdc.gov/violenceprevention/datasources/nisvs/index.html)	Prevalence of interpersonal violence (2010–2012)	20
Census American Community Survey annual estimates	American Community Survey (available from: https://www.census.gov/programs-surveys/acs)	Demographic factors, economic indicators, employment, income inequality, female poverty rates, age distribution, female unemployment, education levels, family size, uninsurance rates, fertility rates, household size, female-headed households, percentage of the population receiving public assistance, and private insurance coverage (2010–2019)	276
Gallup and Pew Research Center survey data	Mississippi Maintains Hold as Most Religious U.S. State (available from: https://news.gallup.com/poll/160415/mississippi-maintains-hold-religious-state.aspx?g_source=link_NEWSV9&g_medium=&g_campaign=item_&g_content=Mississippi%2520Maintains%2520Hold%2520as%2520Most%2520Religious%2520U.S.%2520State) Wyoming, North Dakota and Mississippi Most Conservative (available from: https://news.gallup.com/poll/203204/wyoming-north-dakota-mississippi-conservative.aspx?g_source=link_NEWSV9&g_medium=TOPIC&g_campaign=item_&g_content=Wyoming%2c%2520North%2520Dakota%2520and%2520Mississippi%2520Most%2520Conservative) How Religious Is Your State? (available from: https://www.pewresearch.org/fact-tank/2016/02/29/how-religious-is-your-state/?state=alabama)	Religiosity and political climate (2013, 2016)	7
Guttmacher Institute	Pregnancies, Births and Abortions in the United States, 1973–2017: National and State Trends by Age (available from: https://www.guttmacher.org/report/pregnancies-births-abortions-in-united-states-1973-2017; Reference 62 in this report)	Abortion rates, changes over time, number of providers, number of clinics providing abortion services, and unintended pregnancy rates (2010–2017)	113

See footnotes at end of table.

Table I. Data sources for covariates in abortion imputation models—Con.

Data source	Related publication	Types of covariates and years	Number of covariates
Other sources—Con.			
Kaiser Family Foundation	Status of State Action on the Medicaid Expansion Decision (available from: https://www.kff.org/health-reform/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D) State Requirements for Insurance Coverage of Contraceptives (available from: https://www.kff.org/other/state-indicator/state-requirements-for-insurance-coverage-of-contraceptives)	State laws related to health insurance and insurance coverage for various contraceptive services (such as coverage of over-the-counter methods and prohibitions on cost-sharing) (2018)	25
National Conference of State Legislatures	State Family and Medical Leave Laws (available from: https://www.ncsl.org/labor-and-employment/state-family-and-medical-leave-laws)	State laws related to family planning and medical leave (2018)	3
Spatial analysis of Guttmacher data on abortion laws	Hostile and Supportive Abortion Laws in 2000, 2010, and 2019 (available from: https://www.guttmacher.org/article/2019/08/state-abortion-policy-landscape-hostile-supportive)	State laws related to abortion access and whether states were part of clusters of states with either highly restrictive or highly supportive abortion laws (2010, 2019)	7

SOURCE: National Center for Health Statistics.

Table II. Covariates selected in Least Absolute Shrinkage and Selection Operator regression model imputing abortion ratios: United States, 2010–2019

Variable	Coefficient
Year	-0.050
Percentage of population aged 20–24	-0.076
Percentage of population aged 20–24, Hispanic	-0.006
Percentage of population aged 25–29, non-Hispanic White	-0.004
Percentage of population aged 35–39, Hispanic	0.002
Percentage of households with married residents	0.007
Percentage of population over age 25 with high school diploma, Hispanic	0.005
Percentage of population over age 25 with some college, Hispanic	0.006
Poverty rate for females under age 18	-0.786
Poverty rate overall, non-Hispanic White	-0.028
Median earnings, male	3.34E-06
Percentage of men over age 25 with less than high school education	-0.006
Percentage of men over age 25 with less than high school education, non-Hispanic Black	-0.001
Percentage with total income below poverty threshold, non-Hispanic White	-0.004
Percentage of female-headed households	-0.013
Percentage of population that is Asian or Pacific Islander	-0.006
Percentage of households that are crowded (more than 1.51 people per room)	-0.001
Percentage of the population over age 25 with less than 9th grade education	1.44E-08
Percentage of occupied housing units	-0.008
Percentage of population receiving public assistance	-0.030
Percentage of housing units that are vacant	0.001
Percent change in abortions from 2014–2017	-0.001
Number of federally funded abortions	0.001
Number of female contraceptive clients served at publicly funded centers, 2016	-6.55E-07
Number of females who likely need public support for contraceptive services and supplies in 2016, non-Hispanic Black	9.84E-07
Percentage of pregnancies ending in birth, 2014	-0.047
Public costs per capita among females aged 15–44 for unintended pregnancies (in dollars), 2010	0.001
Pregnancies that were “wanted-then-or-sooner” (rate per 1,000 females aged 15–44) in 2014	-0.011
Percentage of population very religious	-0.008
Percentage of population nonreligious	0.002
Paid family and medical leave laws (0 = no, 1 = yes)	-0.401
Unpaid family and medical leave laws (0 = no, 1 = yes)	-0.054
Number of infant deaths, non-Hispanic other race	-0.000
Infant mortality rate, non-Hispanic Black	-0.016
Infant deaths among mothers aged 30–34	-0.006
Infant mortality rate among first-born infants	-0.011
Percentage of births where mother self-paid, non-Hispanic Black	0.010
Percentage of births where mother self-paid, unmarried	0.005
Count of large central metro counties in state	0.528
Population estimate in medium or small metro areas	-0.382
Population estimate in micropolitan areas	1.561
Spatial outlier, restrictive abortion laws surrounded by states with less restrictive laws	0.067

NOTES: For categorical variables with multiple levels, including the spatial outlier type, the Least Absolute Shrinkage and Selection Operator (LASSO) regression model could select any number of levels associated with this variable. For example, spatial outliers were categorized as: 1) not part of a cluster; 2) hot spot, or high values surrounded by high values; 3) cold spot, or low values surrounded by low values; 4) spatial outlier, or high values surrounded by low values; and 5) spatial outlier, or low values surrounded by high values. Typically, all of these levels are included as indicator variables, with the first category omitted as the reference category. In cases where only one level of the variable was selected in the LASSO regression, the reference group for that variable would consist of all the other levels of the variable (all the levels that were omitted from the model).

SOURCE: National Center for Health Statistics.

Table III. Pregnancy rate, by selected characteristics: United States, 2010–2019

Characteristic	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Age group										
Under 15	1.0	0.9	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.4
15–19	60.8	55.1	51.3	45.9	42.0	38.6	35.3	34.5	30.5	29.4
20–24	139.3	129.7	125.4	121.1	118.3	113.4	109.0	105.0	100.8	98.8
25–29	154.3	152.2	150.9	148.9	149.5	146.9	143.4	138.1	134.9	132.6
30–34	139.1	138.2	138.9	139.5	143.4	144.0	145.0	142.1	141.4	139.7
35–39	69.1	70.5	71.9	72.6	75.2	76.0	76.9	76.6	76.8	77.0
40 and over	21.5	21.6	21.8	21.7	22.1	22.7	23.6	24.0	24.4	24.7
Race and Hispanic origin										
Hispanic	108.6	101.9	98.3	95.4	94.6	93.1	91.2	88.7	86.2	85.5
Non-Hispanic Black	122.5	118.9	117.2	115.1	114.9	114.2	112.7	112.3	110.2	109.8
Non-Hispanic White	90.1	89.3	88.9	88.6	89.8	88.8	87.8	85.7	84.2	82.6
Non-Hispanic other[1]	80.4	78.2	80.7	76.4	77.8	74.9	76.0	72.5	69.6	68.7
Marital status										
Married	118.4	119.3	119.7	120.7	123.3	122.8	123.5	121.5	117.0	115.7
Unmarried	81.8	78.0	76.5	73.8	72.8	71.3	69.6	67.1	66.9	66.4

[1]The non-Hispanic other race group includes people identifying as Asian, Native Hawaiian or Other Pacific Islander, multiple race, or other races.

NOTE: Rate is per 1,000 females.

SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Table IV. Number of pregnancies, by selected characteristics and year: United States, 2010–2019

Characteristic	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Age group										
Under 15	10,000	9,000	8,000	7,000	6,000	5,000	5,000	4,000	4,000	4,000
15–19	653,000	580,000	534,000	474,000	432,000	397,000	365,000	356,000	315,000	303,000
20–24	1,473,000	1,408,000	1,385,000	1,348,000	1,318,000	1,251,000	1,185,000	1,128,000	1,073,000	1,044,000
25–29	1,615,000	1,603,000	1,594,000	1,583,000	1,615,000	1,618,000	1,615,000	1,581,000	1,553,000	1,526,000
30–34	1,386,000	1,415,000	1,448,000	1,478,000	1,535,000	1,549,000	1,570,000	1,544,000	1,545,000	1,548,000
35–39	700,000	694,000	703,000	714,000	749,000	773,000	800,000	811,000	826,000	836,000
40 and over	226,000	228,000	230,000	227,000	228,000	231,000	234,000	236,000	241,000	247,000
Race and Hispanic origin										
Hispanic	1,280,000	1,227,000	1,203,000	1,185,000	1,194,000	1,193,000	1,188,000	1,173,000	1,156,000	1,160,000
Non-Hispanic Black	1,059,000	1,033,000	1,024,000	1,011,000	1,014,000	1,012,000	1,003,000	1,003,000	988,000	989,000
Non-Hispanic White	3,292,000	3,241,000	3,211,000	3,186,000	3,210,000	3,157,000	3,101,000	3,014,000	2,957,000	2,896,000
Non-Hispanic other[1]	434,000	436,000	462,000	449,000	468,000	463,000	481,000	469,000	457,000	459,000
Marital status										
Married	3,096,000	3,055,000	3,040,000	3,038,000	3,094,000	3,066,000	3,070,000	3,050,000	2,927,000	2,887,000
Unmarried	2,969,000	2,884,000	2,860,000	2,790,000	2,793,000	2,760,000	2,703,000	2,612,000	2,624,000	2,619,000
Parity										
Zero prior live births	2,381,000	2,318,000	2,292,000	2,244,000	2,248,000	2,204,000	2,169,000	2,113,000	2,067,000	2,052,000
One prior live birth	1,736,000	1,709,000	1,704,000	1,690,000	1,709,000	1,700,000	1,690,000	1,644,000	1,611,000	1,595,000
Two prior live births	1,082,000	1,057,000	1,053,000	1,050,000	1,067,000	1,065,000	1,060,000	1,042,000	1,024,000	1,013,000
Three prior live births	546,000	532,000	530,000	529,000	535,000	527,000	526,000	530,000	523,000	518,000
Four or more prior live births	321,000	317,000	318,000	321,000	326,000	328,000	333,000	332,000	328,000	331,000

[1]The non-Hispanic other race group includes people identifying as Asian, Native Hawaiian or Other Pacific Islander, multiple race, or other races.

SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Table V. Comparisons of pregnancy rate estimates with previously published estimates, overall and by selected characteristics: United States, 2010

Characteristic	Estimates using current methodology (95% confidence interval)	Previously published estimates	Percentage difference
Overall totals	97.3 (90.7–103.9)	98.7	-1
Age group			
Under 15	1.0 (0.8–1.1)	1.1	-9
15–19	60.8 (54.5–67.4)	58.9	3
20–24	139.3 (120.3–157.9)	144.6	-4
25–29	154.3 (145.0–163.6)	157.1	-2
30–34	139.1 (130.2–148.3)	136.5	2
35–39	69.1 (63.5–74.6)	76.5	-10
40 and over	21.5 (18.5–24.6)	19.4	11
Race and Hispanic origin			
Hispanic	108.6 (96.7–120.7)	118.4	-8
Non-Hispanic Black	122.5 (108.7–136.4)	135.1	-9
Non-Hispanic White	90.1 (86.1–94.1)	84.1	7
Non-Hispanic other[1]	80.4 (72.5–88.2)	…	…

… Category not applicable.
[1]The non-Hispanic other race group includes people identifying as Asian, Native Hawaiian or Other Pacific Islander, multiple race, or other races.

NOTES: Rate is per 1,000 females. Estimates for non-Hispanic, other race females were not previously published for 2010.

SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

Table VI. Total number of pregnancies and pregnancy rate estimates from main and sensitivity analyses: United States, 2010–2019

Year	Original estimates		Sensitivity analysis	
	Number (95% confidence interval)	Rate (95% confidence interval)	Number (95% confidence interval)	Rate (95% confidence interval)
2010	6,069,000 (5,655,000–6,483,000)	97.3 (90.7–103.9)	6,200,000 (5,791,000–6,627,000)	99.4 (92.8–106.2)
2011	5,934,000 (5,554,000–6,303,000)	94.8 (88.7–100.7)	6,063,000 (5,687,000–6,438,000)	96.9 (90.9–102.9)
2012	5,899,000 (5,548,000–6,264,000)	93.9 (88.3–99.7)	6,019,000 (5,669,000–6,379,000)	95.8 (90.3–101.6)
2013	5,828,000 (5,494,000–6,166,000)	92.5 (87.2–97.8)	5,942,000 (5,611,000–6,282,000)	94.3 (89.0–99.7)
2014	5,888,000 (5,563,000–6,204,000)	93.1 (88.0–98.1)	6,000,000 (5,677,000–6,324,000)	94.9 (89.8–100.0)
2015	5,824,000 (5,534,000–6,108,000)	91.8 (87.3–96.3)	5,933,000 (5,643,000–6,216,000)	93.6 (89.0–98.0)
2016	5,773,000 (5,493,000–6,057,000)	90.8 (86.4–95.2)	5,878,000 (5,601,000–6,153,000)	92.4 (88.1–96.8)
2017	5,660,000 (5,346,000–5,985,000)	88.7 (83.8–93.8)	5,765,000 (5,439,000–6,096,000)	90.4 (85.2–95.5)
2018	5,555,000 (5,298,000–5,815,000)	86.7 (82.7–90.8)	5,659,000 (5,400,000–5,920,000)	88.3 (84.3–92.4)
2019	5,507,000 (5,242,000–5,764,000)	85.6 (81.5–89.6)	5,609,000 (5,346,000–5,867,000)	87.2 (83.1–91.2)

NOTES: Rate is per 1,000 females. Analysis assumes that the number of abortions in each year was 15% higher than reported.

SOURCES: National Center for Health Statistics, National Vital Statistics System and National Survey of Family Growth, and Centers for Disease Control and Prevention's Abortion Surveillance System, 2010–2019.

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