

Contraceptive Failure in the United States: Estimates from the 2006–2010 National Survey of Family Growth

CONTEXT: Contraceptive failure rates measure a woman's probability of becoming pregnant while using a contraceptive. Information about these rates enables couples to make informed contraceptive choices. Failure rates were last estimated for 2002, and social and economic changes that have occurred since then necessitate a reestimation.

METHODS: To estimate failure rates for the most commonly used reversible methods in the United States, data from the 2006–2010 National Survey of Family Growth were used; some 15,728 contraceptive use intervals, contributed by 6,683 women, were analyzed. Data from the Guttmacher Institute's 2008 Abortion Patient Survey were used to adjust for abortion underreporting. Kaplan-Meier methods were used to estimate the associated single-decrement probability of failure by duration of use. Failure rates were compared with those from 1995 and 2002.

RESULTS: Long-acting reversible contraceptives (the IUD and the implant) had the lowest failure rates of all methods (1%), while condoms and withdrawal carried the highest probabilities of failure (13% and 20%, respectively). However, the failure rate for the condom had declined significantly since 1995 (from 18%), as had the failure rate for all hormonal methods combined (from 8% to 6%). The failure rate for all reversible methods combined declined from 12% in 2002 to 10% in 2006–2010.

CONCLUSIONS: These broad-based declines in failure rates reverse a long-term pattern of minimal change. Future research should explore what lies behind these trends, as well as possibilities for further improvements.

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In 2011, just under half (45%) of all pregnancies in the United States were unintended; that is, the woman became pregnant when she either did not want a child or had wanted to delay having a child.¹ Although high, this proportion is significantly lower than the 2008 estimate of 51%.² A substantial proportion of unintended pregnancies occur despite women's and their partners' use of contraceptives. In 2001, some 48% of women experiencing an unintended pregnancy had been using a method in the month of conception.³

Estimates of contraceptive failure are a measure of a woman's probability of becoming pregnant during method use within a given period.* Failure rates are usually presented for the first 12 months of use so that methods can be compared across an equivalent period. It is important, however, to distinguish between typical use and perfect use of a contraceptive method, and the failure rates associated with each.⁴ Typical use refers to the way a method is actually used by women and their partners, including inconsistent or incorrect use, and even outright nonuse among individuals who report using. Typical-use failure rates are generally measured using population-based survey data. In contrast, perfect use of a method refers to women's and their partners' following the exact directions for use; perfect-use failure rates are estimated during clinical trials.

Information about contraceptive failure rates, for both typical and perfect use, enables women and their partners to make informed contraceptive choices and allows health care providers to recommend methods appropriate for their clients' needs. Estimates of contraceptive failure are also used by population scientists modeling outcomes that depend on these estimates and evaluating characteristics associated with unintended pregnancy.^{5–9} The most recent estimates of typical-use failure rates for the United States are for 2002. Changes in provision of contraceptive information and services, and in demographic, social and economic conditions, since 2002 may be associated with method effectiveness. Thus, up-to-date estimates of these widely used rates are needed.

In this article, we examine contraceptive use as reported by women in the 2006–2010 National Survey of Family Growth (NSFG), and provide updated typical-use failure rates for the most commonly used methods in the United States, as well as estimates of contraceptive failure among demographic subgroups. In addition, we compare the new estimates with those from 1995 and 2002.

*The probability of failure is the proportion of method use episodes that result in contraceptive failure. We continue the tradition of referring to these probabilities as rates, although they do not represent rates in a population of women. Hereafter, we refer to these proportions as "probabilities of failure."

BACKGROUND

In the 2006–2010 NSFG, virtually all women of reproductive age who had ever had sexual intercourse reported having used a contraceptive method at some point.¹⁰ The most common methods women or their partners had ever used were the male condom (93%), the pill (82%), withdrawal (60%) and the injectable (23%). Among current contraceptive users, the most commonly reported methods were the pill (28%) and female sterilization (27%).^{*11}

Typical-use failure rates during the first 12 months of method use have been calculated periodically for several decades and have changed over time. In the 1970s, the failure rate for the condom was 7%.¹² For 1970–1973, the pill had the lowest failure rate among reversible methods examined (2%); the rate for the IUD was 3%.¹²

However, the failure rate for the pill had increased to 6% by 1982 and to 8% by 1988.^{13,14} The failure rate for the condom doubled in 1982, to 14%,¹⁵ and then remained fairly steady in 1988 and 1995, at 15%.^{13,16} Some part of the increase between the 1970s and the 1980s is due to the later estimates' adjustment for abortion underreporting;¹⁵ all rates estimated for subsequent time points were similarly adjusted.

Estimates for 1995 suggested that as a group, longer-acting methods (the IUD, injectable† and implant) had the lowest failure rate (about 3%). The failure rate for the pill remained at 8%.¹⁶

Results from 2002 show that the injectable—the only long-acting method for which an estimate could be computed—had the lowest failure rate of all reversible methods (7%), but this rate was higher than those estimated for long-acting methods in the previous studies.¹⁷ The failure rate for the pill in 2002 was 9%, which is similar to the rate in 1995.¹⁶ However, between 1995 and 2002, the failure rate for the condom increased further, to 17%, bringing it almost on par with the rate for withdrawal (18%).

METHODS

Data

The NSFG is a nationally representative probability survey of the U.S. noninstitutionalized population aged 15–44, conducted by the National Center for Health Statistics.^{18–20} The 2006–2010 survey sampled 12,279 women and includes a respondent file with information on a woman's demographic characteristics and union status history, as well as a detailed month-by-month calendar of contraceptive use

for the year of interview and for the three calendar years prior to the interview. A separate pregnancy interval file contains one record for each of the respondent's reported pregnancies and includes information on the wantedness of the pregnancy and the respondent's contraceptive use at the time of conception.

Interviews were conducted from June 2006 through June 2010.¹⁸ Thus, the contraceptive calendar data cover method use from January 2003 to June 2010. The contraceptive calendar indicated months when the woman was pregnant. After calculating the dates of these pregnancies, we matched the data from the contraceptive calendar with the information about the circumstances of the conception from the pregnancy interval files. We then constructed a new data file in which observations were uninterrupted intervals of contraceptive use during the period covered by the contraceptive use calendar.

Intervals reflected varying durations of use and included information on the demographic characteristics of the user and on how the interval ended (e.g., in a pregnancy, a switch to another method or to nonuse, or censoring at the time of interview). Women who switched methods within the observation window contributed more than one interval to the analysis. Intervals of contraceptive use constituted our unit of analysis; more information on the contraceptive use interval file can be found in the appendix.

Because we were interested in first-year failure rates, we observed each method use interval for up to one year. Likewise, if a method had already been used for one year or longer at the beginning of the calendar, that interval was not included. All women who had ever used contraceptives at the time of the interview, and who had not been sterilized for noncontraceptive reasons‡ before the calendar began, were included in the analysis. Contraceptive use during reported pregnancy was ignored, and intervals of nonuse and of contraceptive sterilization were not included. We assumed that a contraceptive failure had occurred if a respondent continued to use contraceptives after conception or if her report of contraceptive use ended in the month of conception and, when asked, she said she had not stopped use before becoming pregnant.

A total of 6,683 women were included in the analysis. Together they contributed 15,728 contraceptive use intervals (mean, three intervals per woman). Overall, 5% of intervals ended in contraceptive failure during the first year of use. Only 1% of women reported more than one contraceptive failure during the observation period.

Correcting for Abortion Underreporting

Failure rate estimates from survey data can be too low or biased if pregnancies ending in abortion occurred during contraceptive use but were not reported.^{13,21,22} Only 47% of the 6.5 million abortions that occurred during the five years preceding the 2002 NSFG were reported.²³ The current estimate indicates an even lower proportion of the almost 6.2 million abortions that occurred in 2006–2010: 38%.^{18,24} Because about half of pregnancies terminated by

*Respondents could report up to four methods currently in use. When multiple methods were reported, we ranked them by effectiveness and considered the most effective method the current one (see the appendix for further details).

†At the time the estimates were published, injectables were considered "longer-acting," but they are not now generally considered to be a long-acting reversible method.

‡Noncontraceptive sterilization refers to the surgical procedures hysterectomy and ovariectomy. We distinguish them from contraceptive sterilization procedures—vasectomy and tubal ligation.

induced abortions in 2008 occurred during use of contraceptives, estimates of failure relying on NSFG data alone are likely to be low because of abortion underreporting.²⁵ In addition, because self-reports of abortions vary by women's demographic characteristics,^{13,15,16,22,23,26–28} underreporting can contribute to misleading differentials in the risk of failure among subgroups.

Estimates may be biased in the reverse direction if women overreport contraceptive use to put the blame for an unintended pregnancy on contraceptive failure.^{27,29,30} However, the extent of such overreporting is unknown.^{25,29}

The demographic and socioeconomic characteristics of U.S. women who had abortions in a given year were obtained from the Guttmacher Institute's Abortion Patient Survey (APS), a nationally representative survey of abortion patients that includes information on contraceptive use at the time of pregnancy.³¹ Because the NSFG does not accurately represent the number of abortions or the characteristics of women obtaining abortions,²³ we used the 2008 APS (which included 9,493 women) to adjust for abortion underreporting. The identification of a contraceptive failure in the APS was designed to be similar to the approach used in the NSFG (i.e., determining that a contraceptive method was being used at the time the respondent conceived). However, contraceptive use is not recorded in a calendar in the APS. Instead, women are asked about the last method they used before becoming pregnant and whether they stopped using contraceptives before becoming pregnant. The latter question is similar to one in the NSFG that asks women who stopped using their method in the month of conception whether they stopped before getting pregnant.

To adjust for abortion underreporting in the NSFG, we removed abortions following contraceptive failure in the NSFG data and replaced them with counts of contraceptive failures followed by abortion from the APS.* We distributed these abortions among population subgroups, by duration of method use, in the NSFG data according to their distributions in the APS data. This correction was done at the subgroup level because it is not possible to allocate abortions from the APS to individual women's contraceptive use intervals in the NSFG. Thus, for example, to estimate the probability of failure among pill users, we divided the number of failures, adjusted for abortion underreporting, by months of pill use, both according to monthly duration of use. The denominators were not adjusted because we assumed that reports of the duration of contraceptive use in the NSFG are reasonably correct. The probability of failure could be overestimated to the extent that women who experienced a failure reported an abortion as a miscarriage; with the addition of the APS abortions, the failure would be counted twice in the numerator, while the exposure would be counted only once in the denominator. However, there is little evidence that this type of misreporting is common.^{22,23,28}

To distribute the corrected numbers of abortions following contraceptive failure among population subgroups, we weighted the APS abortions by age and race, so that

the totals matched the abortions from the Guttmacher Institute's Abortion Provider Census for the period covered by the NSFG contraceptive calendar.^{†24,32}

Because the failure rates estimated from the 1995 and 2002 NSFG were based on the same methodology used here to correct for abortion underreporting,¹⁷ we could compare estimates across time. The analysis of the 1995 NSFG used the 1994 APS, and the analysis of the 2002 NSFG used the 2000–2001 APS, to make the corrections; for all years, abortions were weighted to represent national numbers of abortions for the period covered by the NSFG's contraceptive and pregnancy calendar histories.

Analysis

We estimated the probability of failure for the five most commonly used reversible methods in the United States: the injectable; the pill; the male condom; withdrawal; and long-acting reversible contraceptive (LARC) methods, which comprise the IUD and the implant. There was not enough reported use of other nonpermanent methods to allow separate estimates of contraceptive failure, even after all spermicidal and barrier methods other than the male condom were combined into a single group.‡ To calculate stable estimates for the probability of failure over the course of a year, we required a minimum of 50 intervals at every duration during the 12 months of use. Methods that did not meet this criterion were grouped in an "other" category. Although separate estimates are not presented for this residual group, its use intervals were included in estimating rates for reversible methods combined. Our analysis included 15,728 intervals of contraceptive use—893 for the injectable, 3,307 for the pill, 6,819 for the male condom, 1,808 for withdrawal, 560 for LARC methods and 2,341 for other methods.

The risk of method failure may be associated with the duration of method use and with demographic characteristics of the user.^{16,22,26,27} We therefore estimated failure rates by duration of use and, when we had a sufficient number of observations, by parity, age, race and ethnicity, union status and poverty status.

Parity at conception was coded into three categories: no previous births, one previous birth, and two or more previous births.

Age was measured at the start of each contraceptive use interval and was classified as 15–17, 18–19, 20–24, 25–29 or 30–44. For comparison with previous estimates, we also estimated failure rates for a combined 15–19 age-group.

*In rare instances, the counts were higher in the NSFG than in the APS.

†Weighting factors were calculated for each combination of seven age-groups (younger than 15, 15–19, 20–24, 25–29, 30–34, 35–39 and 40 or older) and four race and ethnicity groups (black, white, other and Hispanic).

‡Other nonpermanent methods used by women include other barrier methods, the patch, the ring, Lunelle (a one-month injectable now unavailable in the United States), fertility awareness methods and spermicides.

TABLE 1. Number of intervals of use of various contraceptive methods, and probability of failure within the first three, six and 12 months of use, by method, National Survey of Family Growth, United States, 2006–2010

Method	No. of intervals	Three months	Six months	12 months
All†	15,728	3.3 (0.20)	6.5 (0.32)	10.3 (0.49)
All hormonal and IUDs	4,760	2.0 (0.24)	3.9 (0.37)	6.0 (0.52)
Injectable	893	1.8 (0.53)	2.8 (0.76)	4.0 (1.06)
Pill	3,307	2.2 (0.31)	4.7 (0.49)	7.2 (0.68)
Male condom	6,819	4.0 (0.38)	7.8 (0.66)	12.6 (1.11)
Withdrawal	1,808	5.8 (0.85)	11.9 (1.39)	19.9 (2.03)
Long-acting reversible††	560	0.4 (0.31)	0.6 (0.39)	1.4 (0.68)

‡Includes methods for which number of intervals was too small for separate analysis. These methods represented 13% of all intervals. §“All hormonal” consists of the injectable, the pill and the implant. ††IUD and implant; the IUD represents 3% of all intervals and 90% of all intervals of use of long-acting reversible methods. Notes: Number of intervals is unweighted; probabilities of failure are weighted and corrected for abortion underreporting. Numbers in parentheses are standard errors, which were calculated using the Peto method.

We used four categories for race and ethnicity: Hispanic, black, white and other. We combined use intervals for whites and others in a trend analysis to match categories used in the earlier published estimates; for 1995 and 2002, failure rates had been obtained for the two groups combined because of insufficient observations in the other race category.¹⁷

Poverty status was measured as the ratio of the woman's household income in the year prior to the interview to the federal poverty standard for her family size. Women whose household income was less than 100% of the poverty standard were considered poor; those at 100–199%, near-poor; and those at 200% or more, relatively well-off.

There were four union status groups: married, cohabiting, formerly married and never-married. This measure was time-varying; thus, a contraceptive use interval was divided into separate segments of use if a woman's union status changed during the interval. For example, if a woman began using the pill within the observation period and her union status changed from cohabiting to married in her fifth month of use, she had a cohabiting segment ending at the completion of four months and a married segment commencing at the fifth month of use. Analyses that include union status included 670 more segments than other analyses. Also, to enable comparison with previous estimates, we estimated failure rates for users not currently in union (i.e., formerly married and never-married women).

Since respondents contributed multiple contraceptive use intervals to our analytic sample, our results could have

*For example, if a woman started using the pill in October 2004, but her calendar period of observation began in January 2005, her pill use is first observed in the fourth month. We ignore her use in October–December because other women who also started in October could have experienced a failure but would not be observed in the calendar. Thus, including the months of use prior to the calendar period would contribute exposure to the risk of failure but no failures.

†Not all IUDs are hormonal, but it was not possible to separate hormonal IUD use from nonhormonal.

been biased by clustered observations. We conducted a sensitivity test, restricting the analysis to the first observation per woman and comparing the results with estimates obtained from the full sample. Findings were within one percentage point of each other. Because restricting our analysis to one episode for each woman would have greatly reduced our sample size, we conducted the analysis on the full sample.

Statistical Methods

To compute failure rates for each method, all methods combined, and by women's demographic characteristics, we analyzed the contraceptive use intervals using Kaplan-Meier methods to estimate the associated single-decrement probability of failure by duration of use. Women who were already using a method at the beginning of the calendar observation period entered the life table at the duration of use as of the start of the calendar. * If a woman discontinued use of a method for a reason other than failure, we considered that reason a competing risk; we estimated the probability of failure in the absence of competing risks using the formula developed by Trussell and Menken.¹² (Competing risks are ascertained using other data collected in the survey. They include changing methods, stopping to get pregnant, having a noncontraceptive sterilizing operation, ceasing sexual activity and stopping for reasons that are not discerned from the data.) Observations for women who were still using a method at the time of interview were censored two months prior to the interview, because some such women may have been pregnant without knowing it. The resulting life table provided failure probabilities for each month of use, which were cumulated to estimate the probability of failure up to a given duration of use. We present failure rates at three, six and 12 months of use for data corrected for abortion underreporting.

We then compared method-specific estimates for 2006–2010 with those for 1995 and 2002,¹⁷ and examined the 2006–2010 failure rates by demographic groups, for all reversible methods combined and for specific methods that had sufficient data—the pill (3,224 intervals), the condom (6,593), withdrawal (1,738) and the injectable (862). For some subgroup categories, the number of intervals for analysis fell below our criterion of at least 50 intervals at each duration of use; we do not show these results. Because several hormonal methods (the injectable, implant and IUD†) had too few intervals to permit separate subgroup analyses, we examined the failure rates among population subgroups for a category combining all hormonal methods, including the pill, and the IUD. Finally, we compared the 2006–2010 subgroup rates with those published for 1995 and 2002.¹⁷

We used a method devised by Peto et al. to calculate standard errors for the estimated probabilities,³³ because it is more conservative than the commonly used Greenwood method.³⁴ The Peto standard errors are designed to reflect increased uncertainty caused by

TABLE 2. Probability of failure within the first 12 months of contraceptive use, by survey year, and absolute difference in probability of failure between years, by method

Method	1995		2002		2006–2010		Difference in probability of failure		
	No. of intervals	12-month probability of failure	No. of intervals	12-month probability of failure	No. of intervals	12-month probability of failure	1995 vs. 2002	2002 vs. 2006–2010	1995 vs. 2006–2010
All†	6,839	14.9 (0.71)	9,033	12.4 (0.64)	15,728	10.3 (0.49)	-2.5**	-2.1**	-4.6***
All hormonal and IUD§	2,539	8.1 (0.80)	3,393	7.9 (0.69)	4,760	6.0 (0.52)	-0.2	-1.9*	-2.1*
Injectable	209	5.4 (3.44)	715	6.7 (1.52)	893	4.0 (1.06)	1.3	-2.7	-1.4
Pill	2,127	8.8 (0.90)	2,541	8.7 (0.83)	3,307	7.2 (0.68)	-0.1	-1.5	-1.6
Male condom	2,909	17.8 (1.23)	3,845	17.4 (1.46)	6,819	12.6 (1.11)	-0.4	-4.8**	-5.2**
Withdrawal	438	28.4 (3.54)	848	18.4 (2.67)	1,808	19.9 (2.03)	-10.0*	1.5	-8.5*

*p<.05. **p<.01. ***p<.001. †Includes methods for which number of intervals was too small for separate analysis. §“All hormonal” consists of the injectable, the pill and the implant. Notes: Data are from the 1995, 2002 and 2006–2010 cycles of the NSFG. Number of intervals is unweighted; probabilities of failure are weighted and corrected for abortion underreporting. Numbers in parentheses are standard errors, which were calculated using the Peto method.

censoring at durations when no failures are observed. Although there are very few such instances in our data, we chose the Peto method given the increased uncertainty caused by the combination of two data sources (the NSFG and the APS). The Peto standard errors were used to calculate z-scores to identify statistically significant differences in estimates. We did dependent sample z-tests for the estimates computed for the 2006–2010 data, and an independent sample z-test to analyze time trends. All estimates were weighted using the women’s population weights in the NSFG.

RESULTS

Overall Contraceptive Failure

•**By duration and method.** Overall, 32% of annual failures occur in the first three months of use, and 63% occur in the first six months (Table 1). LARC is the only method category that departs from this pattern; here, failures were distributed more or less evenly throughout the year. Users of withdrawal had the highest probability of contraceptive failure; 20% of use episodes ended in a pregnancy within one year. The male condom had the next highest probability of failure (13%); the pill and the injectable had failure rates of 7% and 4%, respectively. The 12-month probability of failure for LARC methods was 1%. This estimate should be interpreted with caution, however, given the high associated standard error.* Our correction for abortion underreporting resulted in an increase of 1–3 percentage points in the rates for all methods, the pill, the male condom and the injectable. It led to a decrease of 0.2–2 percentage points in the rates for withdrawal and LARC methods.

•**Trends.** For any method use, the probability of failure dropped from 14.9% in 1995 to 12.4% in 2002, and to 10.3% in 2006–2010 (Table 2). Probabilities of failure for individual methods showed little change from the first time period to the second, except for a decrease in the failure rate for withdrawal, from 28% to 18%. However, for several methods, estimates for 2006–2010 were much lower than earlier ones. For example, while the probability of failure for the male condom was relatively unchanged between 1995 (18%) and 2002 (17%), it dropped about

five percentage points in 2006–2010, to 13%. While the failure rates for the pill and the injectable did not change over time, the rate for the combined hormonal contraceptive and IUD category declined from 8% to 6% between 1995 and 2006–2010.

Subgroup Analyses

•**Parity.** The probability of failure within 12 months of initiating use of any method increased from 5% among users with no children to 14% among those with one child and 15% among those with two or more children (Table 3). † Failure rates among users of the pill, condoms and withdrawal, and for those in the combined hormonal methods and IUD group, mirrored this pattern.

•**Age.** There were no statistically significant differences across age-groups of users in the failure rates for all reversible methods combined, condoms or withdrawal. Among pill users, the failure rate was significantly higher for women aged 25–29 than for those aged 30–44 (10% vs. 4%); a similar difference by age-group was found among those in the combined hormonal and IUD group (8% vs. 3%).

•**Race/ethnicity.** Black women had significantly higher probabilities of method failure than white women for all methods combined (15% vs. 8%) and for condom use (21% vs. 9%); similar differences were found among Hispanic women and white women—14% vs. 8% for all methods combined and 19% vs. 9% for condoms. These results may be confounded by higher poverty among blacks and Hispanics. Pill failure rates also differed between blacks and whites (13% vs. 6%), but there were no differences by race or ethnicity for withdrawal. We found significant differences in condom failure rates between “other” races (7%) and blacks (21%) and Hispanics (19%).

*We examined the difference in failure rates between methods to identify relative effectiveness (not shown). LARC methods and the injectable were the most effective (there was no difference between the two), followed by the pill, then the condom and then withdrawal.

†Differentials between categories of these measures at three- and six-month durations for all subgroups were consistent with those shown for 12 months of use (not shown).

TABLE 3. Probability of failure within the first 12 months of use among users of all nonpermanent methods combined and of selected nonpermanent methods, by women's demographic characteristics

Characteristic	All§		Pill		Male condom		Withdrawal		All hormonal and IUD††	
	No. of intervals	12-month probability of failure	No. of intervals	12-month probability of failure	No. of intervals	12-month probability of failure	No. of intervals	12-month probability of failure	No. of intervals	12-month probability of failure
Parity at conception										
0 (ref)	7,534	5.2 (0.56)	1,722	3.2 (0.64)	3,745	7.7 (1.48)	767	8.4 (2.54)	2,048	2.9 (0.56)
1	3,676	13.6 (1.14)***	717	11.5 (1.93)**	1,497	17.8 (2.57)*	444	20.5 (4.42)	1,144	9.0 (1.37)**
≥2	4,518	14.6 (0.92)***	868	11.6 (1.61)***	1,577	16.4 (1.97)*	597	27.7 (3.35)**	1,568	8.2 (1.02)***
Age at start of method use										
15–19	4,378	11.4 (1.01)	1,031	7.8 (1.22)	2,103	16.0 (2.54)	377	##	1,399	6.4 (0.98)
15–17	2,419	10.8 (1.32)	552	6.6 (1.50)	1,243	16.4 (3.29)	186	##	746	5.5 (1.22)
18–19	1,959	12.1 (1.55)	479	9.2 (2.02)	860	15.7 (4.01)	191	##	653	7.5 (1.60)
20–24 (ref)	4,113	11.2 (1.00)	953	6.7 (1.34)	1,673	14.6 (2.34)	432	21.0 (3.94)	1,376	6.3 (1.07)
25–29	3,343	10.7 (0.99)	700	10.4 (1.73)‡	1,395	12.0 (2.10)	365	19.8 (4.03)	1,063	8.2 (1.27)‡
30–44	3,894	8.3 (0.88)	623	4.1 (1.14)	1,648	8.4 (1.86)	634	17.7 (3.41)	922	3.3 (0.83)
Race/ethnicity										
Black	3,781	15.3 (1.31)***	602	13.1 (2.50)*	1,950	20.7 (2.66)**‡	347	21.9 (5.69)	1,025	9.2 (1.50)
Hispanic	3,298	13.8 (1.20)**	634	9.5 (1.87)	1,324	19.3 (2.78)*,‡	405	18.3 (3.94)	1,017	7.2 (1.31)
White (ref)	7,686	8.3 (0.61)	1,907	6.1 (0.81)	3,113	8.7 (1.42)	921	21.4 (2.91)	2,491	5.3 (0.66)
Other	963	9.8 (1.88)	164	4.0 (2.17)	432	7.1 (3.08)	135	##	227	3.9 (1.79)
Union status at conception										
Married	3,522	8.5 (0.78)**	741	7.4 (1.33)	1,144	5.6 (1.38)***	522	19.3 (3.06)	1,117	5.6 (0.94)
Cohabiting (ref)	2,323	14.9 (1.34)	477	10.6 (2.04)	788	23.9 (3.36)	321	15.9 (4.47)	823	8.3 (1.45)
Never-married	8,740	9.6 (0.74)	1,892	6.2 (0.90)	4,375	12.8 (1.76)*,†	801	23.2 (4.12)	2,503	5.3 (0.73)
Formerly married	1,143	13.9 (2.35)†	197	6.2 (2.50)	512	##	164	##	317	8.5 (2.31)
Not currently in union	9,883	10.1 (0.71)*	2,089	6.1 (0.85)	4,887	14.3 (1.74)	965	22.5 (3.75)	2,820	5.6 (0.70)
% of federal poverty level at interview										
0–99	4,504	17.3 (1.21)‡	798	13.2 (1.85)‡	2,035	23.8 (2.89)‡	492	31.6 (5.29)‡	1,382	9.9 (1.27)‡
100–199 (ref)	3,805	13.4 (1.12)	759	8.6 (1.61)	1,620	15.2 (2.42)	443	26.3 (4.25)	1,158	6.9 (1.17)
≥200	7,419	6.3 (0.55)***	1,750	4.7 (0.75)	3,164	6.9 (1.21)*	873	12.1 (2.36)*	2,220	4.1 (0.62)

*p<.05. **p<.01. ***p<.001. †Significantly different from rate in first row at p<.05. ‡Significantly different from rate in last row at p<.05. §Includes methods for which number of intervals was too small for separate analysis. ††“All hormonal” consists of the injectable, the pill and the implant. ##Did not meet the minimum of 50 intervals at every duration required to ensure estimate stability. Notes: Data are from the 2006–2010 cycle of the NSFG. Number of intervals is unweighted; probabilities of failure are weighted and corrected for abortion underreporting. Numbers in parentheses are standard errors, which were calculated using the Peto method. ref=reference group.

•**Union status.** The overall probability of failure was higher for cohabiting women (15%) than for those who were married (9%) or not currently in a union (10%), and was higher among formerly married women (14%) than among those who were married (9%). The only other significant differences by union status were for condom use: Cohabiting women had a higher failure rate than both married women (24% vs. 6%) and never-married women (24% vs. 13%), and never-married were more likely than married women to experience failure (13% vs. 6%).

•**Poverty status.** Women with incomes that were 0–99% of the poverty threshold had significantly higher failure rates than those whose incomes were at least 200% above poverty for all categories of methods examined: 17% vs. 6% for all methods, 13% vs. 5% for the pill, 24% vs. 7% for condoms, 32% vs. 12% for withdrawal, and 10% vs. 4% for use of all hormonal contraceptives or an IUD. Also, women with incomes that were at least 200% above the poverty threshold had lower failure rates than those with incomes that were 100–199% of the poverty standard for use of all methods (6% vs. 13%), condoms (7% vs. 15%) and withdrawal (12% vs. 26%).

•**Trends.** Between 1995 and 2006–2010, the overall failure rate declined significantly across most demographic subgroups we examined (Table 4). In contrast, there were fewer differences between 1995 and 2002 and between 2002 and 2006–2010.

The 2006–2010 estimates for all age-groups are lower than estimates from 1995. For example, the failure rate for women aged 20–24 fell from 17% in 1995 to 11% in 2006–2010. Rates during this time also declined nine percentage points for black users and four percentage points for whites and women of other races. The failure rate among method users without prior births fell nine percentage points, while the rates among those with one prior birth and those with two or more were unchanged. Large and significant declines were observed across this period for users in all categories of poverty status (4–8 percentage points), and among cohabiting, formerly married and never-married women (6–14 percentage points).

DISCUSSION

Millions of couples conceive while trying to avoid doing so. In 2011, the U.S. Department of Health and Human Services, in its Healthy People 2020 initiative, set a goal of

TABLE 4. Probability of failure within the first 12 months of use of all reversible methods combined, and absolute difference in probability of failure, by survey year, according to women's demographic characteristics

Characteristic	Probability of failure			Difference in probability of failure		
	1995	2002	2006–2010	1995 vs. 2002	2002 vs. 2006–2010	1995 vs. 2006–2010
Age at start of method use						
<20	15.6 (1.47)	13.1 (1.37)	11.4 (1.01)	-2.5	-1.7	-4.2*
20–24	17.1 (1.44)	14.3 (1.29)	11.2 (1.00)	-2.8	-3.1	-5.9***
25–29	14.6 (1.46)	14.9 (1.50)	10.7 (0.99)	0.3	-4.2*	-3.9*
≥30	11.9 (1.25)	8.2 (1.01)	8.3 (0.88)	-3.7*	0.1	-3.6*
Race/ethnicity						
Black	23.9 (1.73)	21.3 (1.88)	15.3 (1.31)	-2.6	-6.0**	-8.6***
Hispanic	18.4 (2.02)	15.0 (1.52)	13.8 (1.20)	-3.4	-1.2	-4.6
White/other‡	12.6 (0.83)	10.1 (0.76)	8.4 (0.58)	-2.5*	-1.7	-4.2***
Parity at conception						
0	14.3 (1.08)	6.2 (0.76)	5.2 (0.56)	-8.1***	-1.0	-9.1***
1	15.9 (1.38)	18.0 (1.49)	13.6 (1.14)	2.1	-4.4*	-2.3
≥2	14.8 (1.24)	16.3 (1.17)	14.6 (0.92)	1.5	-1.7	-0.2
% of federal poverty level at interview						
<100	25.5 (2.05)	19.8 (1.75)	17.3 (1.21)	-5.7*	-2.5	-8.2***
100–199	17.3 (1.62)	17.7 (1.60)	13.4 (1.12)	0.4	-4.3*	-3.9*
≥200	11.6 (0.81)	8.4 (0.71)	6.3 (0.55)	-3.2**	-2.1*	-5.3***
Union status at conception						
Married	10.4 (0.91)	9.5 (0.94)	8.5 (0.78)	-0.9	-1.0	-1.9
Cohabiting	28.7 (2.98)	21.7 (1.86)	14.9 (1.34)	-7.0*	-6.8**	-13.8***
Formerly married	23.1 (3.16)	12.2 (2.43)	13.9 (2.35)	-10.9**	1.7	-9.2*
Never-married	15.4 (1.13)	11.5 (1.04)	9.6 (0.74)	-3.9*	-1.9	-5.8***

*p<.05. **p<.01. ***p<.001. ‡The white and other race categories were combined in this analysis to match the categories across waves. Notes: Data are from the 1995, 2002 and 2006–2010 cycles of the NSFG. Probabilities of failure are weighted and corrected for abortion underreporting. Numbers in parentheses are standard errors, which were calculated using the Peto method.

reducing contraceptive failure during the first year of use from 12.4%, the failure rate measured for 2002, to 9.9% by 2020.³⁵ Contraceptive failure rates showed no noticeable improvements from the 1980s to the early 1990s,^{13,16,26,27} but the overall failure rate fell between 1995 and 2002, owing exclusively to a decline in the failure rate for withdrawal (from 28% to 18%). We found that contraceptive failure rates for almost all of the most commonly used reversible methods in the United States decreased substantially between 2002 and 2006–2010, while the rate for withdrawal has remained virtually unchanged. Typical-use failure rates in 2006–2010 for the group comprising all hormonal methods and IUDs (6%) and for the condom (13%) were lower than ever measured previously in the United States. In fact, the overall failure rate of 10.3% falls just above the Healthy People target.

Since 1995, failure rates associated with coitus-dependent methods—the condom and withdrawal—have shown improvement. While the rate for withdrawal dropped significantly from 1995 to 2002 and then stayed steady, the rate for the condom declined between 2002 and 2006–2010. Although this is welcome news, both methods still carry the highest probabilities of failure.

Declines in the failure rate for all nonpermanent methods combined occurred in almost every demographic subgroup. This broad-based decline, while promising, is surprising, partly because it reverses a long-term pattern of minimal change, and partly because there are no obvious reasons to

account for it. We explored explanations related to the comparability of data across the periods covered by the NSFG and APS, and they did not account for the observed changes.

These declines in failure rates may reflect shifts in the demographic composition of the users of specific methods; an increase in the strength of individuals' motivation to avoid unintended pregnancy; and changes in method mix, particularly increased use of more effective methods, such as IUDs and implants. Examining reasons for the decline is, however, outside the scope of this analysis. Further research is needed to understand what drives these trends and to ascertain possibilities for further improvements.

There are limitations to the data. Because we use retrospective data, there is a possibility of recall error, particularly regarding contraceptive use around the time of pregnancy. In addition, the length of the interview (an average of 80 minutes) may lead to fatigue for both the interviewer and the respondent, and this may lead to further errors. Another limitation is sparse data for fertility awareness methods; although the rates for these methods have been measured in the past, the lack of sufficient data for 2006–2010 means we cannot examine trends over time.

Despite these limitations, this study makes a significant contribution by highlighting the decline in contraceptive failure rates. It may also help explain the decline in unintended pregnancy: Like failure rates, the unintended pregnancy rate for the United States remained unchanged between 1995 and 2002;³ however, it declined 18% from 2008 to 2010.¹

Continued efforts to provide women and men with full access to available methods, and with public education to help ensure those methods are used effectively, may lead to even further declines in contraceptive failure rates and unintended pregnancy.

APPENDIX

Interval Data

A contraceptive interval is defined as an uninterrupted period of use of a particular contraceptive method. Our analysis includes all intervals observed in the period covered by the NSFG contraceptive calendar. Most intervals observed during the calendar period began after January of the year three years prior to interview, and were observed from the beginning of use. Some were left-truncated, meaning use began before the start of the observation window and was observed in progress. Similarly, some intervals are right-censored by the date of interview, when observation ends.

In the NSFG interview, the contraceptive history was obtained after the pregnancy history was recorded in the calendar. In this way, pregnancies served to help women recall periods of contraceptive use. If the woman reported having stopped method use in the same month as the conception, we examined the response to the question “Before you became pregnant, had you stopped using all methods of birth control?” If the answer was “no,” we recorded a failure.

If method use continued for 1–4 months following a conception, a failure was assigned to the interval of use; if it continued beyond four months after the conception, we checked additional information from the survey to determine if the woman had stopped use earlier. In 119 intervals, women reported using the method for more than four months after conception; however, in 19 of these, when the woman was asked what method she had been using, she said she had not been using any method. Thus, 100 of these intervals were considered to have ended in contraceptive failure.

For each interval, we calculated exposure to the risk of pregnancy during contraceptive use. The calendar section of the survey records the months in which contraceptives were used, but not duration of use. For example, a woman’s calendar may indicate pill use in March, April and May. We assume that on average, use begins and ends in the middle of the month (i.e., some women start early in the month, some start later). If a new method is recorded in the next month (June, in the example), we assume that the method switch occurred in the middle of that month and that the previous method was used until then. In the above example, this means that exposure for the pill would be three months: one-half of March, all of April, all of May and one-half of June.

On the other hand, if an interval of use is followed by nonuse, total exposure is calculated as total number of months of use minus one. In the example above, if nonuse was recorded for June, we count the woman as having used the pill for one-half of March, all of April and one-half of May, or a total of two months. On the basis of previous

research,³⁶ exposure for intervals in which use begins and ends in the same month is assigned to be one-third of a month.

If a woman began using a method before the start of the calendar in January 2003, we include only the months observed in 2003 in her exposure calculation. For example, if she began use three months prior to January and continued use for the first four months of 2003, she enters the life tables at duration four (not zero). She would receive a full month of exposure in January, even though that is her first month of use in the calendar, because her use is observed for the entire month.

Some women who were using a method at interview may not have been exposed to the risk of pregnancy because they were already pregnant but did not realize it. We therefore censored intervals among current users two months prior to interview; for example, a woman who was using a method when interviewed in June was observed only through April because we cannot be sure she did not have a contraceptive failure in May. We examined the distribution of currently pregnant women by week of pregnancy, and found that the proportion who were in their seventh week was similar to, or even higher than, the proportion who were at higher order weeks of pregnancy. It would be expected to be higher, because some women lose the pregnancy or end it; at least we can say with a good degree of certainty that women who were more than six weeks pregnant at the time of interview would report the pregnancy.

For intervals censored two months before the interview, we added one-half of a month to the total exposure calculated. Without the additional half-month, we would have only one-half of a month of exposure in the denominator of our failure rate calculations for the final month of exposure, but a full month’s worth of events in the numerator, because there is no way to know which failures occurred in the first half of the final month and which in the second half. If we did not add one-half of a month to the final interval observed prior to interview, we would overestimate failure rates by excluding one-half of a month of exposure yet including all failures that occurred in the month.

NSFG respondents could report more than one method in each month of their calendar histories of contraceptive use, and numerous respondents did, either because they used multiple methods simultaneously or because they alternated between methods. Whenever one of the multiple methods was a highly effective or hormonal one, we assigned the more effective method to the interval, using the effectiveness ranking reported in Trussell.³⁷ For cases of multiple method use among the remaining methods, we assigned the most effective of the methods used to the interval if the respondent indicated that the methods had been used simultaneously. If the respondent indicated that she had alternated use of the methods, we coded use as “sequential use of methods less effective than the pill”; we classified such intervals as “other.”

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