

Contraceptive Failure in the First Two Years of Use: Differences Across Socioeconomic Subgroups

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Context: While differences in levels of contraceptive use across socioeconomic subgroups of women have narrowed greatly over time, large disparities remain in rates of unintended pregnancy. One reason is variations in the effectiveness with which women and their partners use contraceptive methods.

Methods: Data on contraceptive use and accidental pregnancy from the 1988 and 1995 National Surveys of Family Growth were corrected for abortion underreporting and pooled for analysis. Use-failure rates were estimated for reversible methods during the first year, second year and first two years of use, for subgroups of women of various characteristics.

Results: The average failure rate for all reversible methods, adjusted for abortion underreporting, declines from 13% to 8% from the first year of method use to the second year. First-year failure rates are highest among women using spermicides, withdrawal and periodic abstinence (on average, 23–28% in the first year), and lowest for women relying on long-acting methods and oral contraceptives (4–8%). On average, they exceed 10% for all users except women aged 30–44, married women and women in the highest poverty-status category. The chance of accidental pregnancy does not differ significantly between method users younger than 18 and those aged 18–19.

Conclusion: Both user and method characteristics determine whether contraceptive users will be able to avoid unintended pregnancy. Family planning providers should help clients to identify methods that they are most likely to use successfully, and counsel them on how to be consistent users and to avoid behaviors that contribute to method failure.

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The level of unintended pregnancy in a population reflects contraceptive prevalence, the methods used and the effectiveness of use. In the United States, where contraceptive prevalence is moderately high and the most commonly used methods offer high potential effectiveness, persistently high levels of unintended pregnancy and abortion are indicative of low use-effectiveness.¹ Since most subgroup differentials in the level of contraceptive use are small,² variations in rates of unintended pregnancy are attributable mainly to differences in contraceptive method choice and use-effectiveness.

In the United States, 49% of pregnancies ending in 1994 were unintended, and 54% of unintended pregnancies were resolved by abortion.³ At 1994 rates, the average American woman will have 1.42 unintended pregnancies before she turns 45.⁴ Almost all U.S. women use contraceptives

or rely on their partner's method use during at least some of their reproductive years, often for fairly long periods. In 1995, 93% of the 42 million women aged 15–44 who were at risk for unintended pregnancy* were using a method; 61% of users relied on a reversible contraceptive.⁵ Women who use contraceptives will have fewer lifetime pregnancies than women who use no contraceptives,⁶ but because reversible contraceptives are rarely used perfectly, some degree of failure—sometimes a substantial degree—occurs with all reversible methods, over and beyond their clinical failure rates.⁷ Failure rates tend to decline with longer duration of use for all reversible methods, probably in part because less-effective users are filtered out, and in part because use improves with practice.⁸

Use-effectiveness of reversible contraceptives varies considerably across subgroups in the United States, as in other countries. Unmarried women, poor women, members of minority racial or ethnic groups, and younger women often experience elevated contraceptive failure rates.⁹ These patterns are generally reflected in elevated levels of unintended pregnancy in these subgroups.¹⁰

One limitation of most studies that have examined contraceptive failure rates by women's characteristics is that their samples are not large enough to detect differentials across small subgroups. Consequently, many analyses have used only two or three broadly defined categories for certain variables (e.g., age and poverty level), a practice that may conceal important differences.¹¹ Sample size limitations have also typically precluded the examination of socioeconomic differentials in failure rates over periods longer than 12 months, although rates for longer durations are of considerable research and policy interest.

In this article, we examine, in greater detail than in the past, socioeconomic and duration-related differentials in failure rates of reversible contraceptives in the United States. We estimate the probabilities of failure during typical use of each method (use-failure rates), rather than the probabilities of failure during perfect use (clinical failure rates).¹² We obtained the large sample size that this analysis requires by pooling data from two successive rounds of the National Survey of Family Growth (NSFG), carried out in 1988 and 1995. (An earlier study, using the 1973 and 1976 NSFG data, employed a similar approach.¹³)

The NSFG has long been the primary source of data for estimating contraceptive failure rates in the United States. The data include a monthly history of contraceptive use among women aged 15–44 at the time of the survey, as well as detailed pregnancy histories. Estimates of contraceptive failure are based on reported contraceptive use in the month of conception. However, every round of the NSFG has been affected by underreporting of conceptions resolved by abortion;¹⁴ the mag-

*Women are considered to be at risk for unintended pregnancy if they do not want to become pregnant, are sexually active and are physically able to become pregnant in the absence of contraceptive use (i.e., are not sterile or infertile, have a partner who is not sterile or infertile, and are not pregnant or postpartum).

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nitude of the effect can be substantial, and the extent of underreporting varies considerably by method and by socioeconomic subgroup.¹⁵ Consequently, contraceptive failure rates calculated from NSFG data alone are biased downward.

For our analyses, applying methodology similar to that used in earlier research,¹⁶ we correct for abortion underreporting by using data from surveys of abortion patients conducted in 1987 and 1994–1995 by The Alan Guttmacher Institute (AGI).^{*} Although the problem of underreporting of abortion is widely acknowledged, the extent to which it affects estimates of contraceptive failure rates is in dispute. Some researchers have argued that using independent surveys to adjust for underreporting of conceptions ending in abortion may lead to overestimations of failure rates, because women in both the NSFG and the AGI surveys may overreport their contraceptive use at the time they became pregnant.¹⁷ Implicit in the argument against adjustment is the assumption that overall, across all methods and for all socioeconomic subgroups, the overreporting effect balances the underreporting bias. This assumption has not been tested and lacks an empirical basis.

We do not expect the overreporting bias to be large, because care was taken in designing and pretesting the Abortion Patients Survey to minimize opportunities for overreporting contraceptive use. Nevertheless, our estimated rates represent the upper limit for failure rates, since they correct for abortion underreporting but not for contraceptive overreporting.

This article represents three advances over previous work: Failure rates are presented over the first two years of use rather than the first year only. Additionally, rates are calculated separately for users younger than 18 and those aged 18–19 (because concerns about unintended pregnancy and the ability to use contraceptives effectively are greatest for younger teenagers), and for poverty status groupings typically used for determining eligibility for free or reduced-fee publicly funded family planning services.

Finally, indications of the statistical significance of differences between methods and among socioeconomic subgroups of users are presented.

Methodology

Data

Usable contraceptive history data from the 1988 NSFG cover the period from January 1984 until three months before participants were interviewed (i.e., October 1987 to May 1988). For the 1995 survey, usable histories began in February 1991, and the cutoff date was 10 months before the interview (i.e., March–December 1994). In both surveys, the cutoff was prior to the interview month to allow for the fact that respondents may not have detected new pregnancies by the time of the survey.[†] The 1995 NSFG did not collect information on the starting date of use for women younger than 25 who were using contraceptive methods in January 1991, leaving us unable to determine what month of use these women were in at that time. Therefore, we included only intervals of use that began in February 1991 or later. This was not necessary for the 1988 NSFG, since all women were asked when they began periods of method use covered in the survey's contraceptive calendar. We used data sets constructed for earlier analyses of each NSFG to form separate use-segment files, following procedures applied in earlier studies.[‡]

A use segment can begin at one of three times: when a woman begins use of a contraceptive method (for the first time or after a period of a month or longer during which she was using another method or no method); when she changes union status, but continues to use the same method; or, for 1988 NSFG respondents who were ongoing method users at the beginning of that survey's contraceptive history calendar, at the beginning of observation. A use segment ends if conception occurs (contraceptive failure), if the woman discontinues using the method for any reason other than conception, if the woman's union status changes or if the observation period ends. Use segments that

began during the study observation periods are initiated in the first month of use (duration 0), but those resulting from a change in union status or ongoing use at first observation in the 1988 NSFG enter the analysis in the month of use since the segment began. The analysis used the following variables for each contraceptive use segment: the date and duration of use at which the segment started; the date the segment ended; how the segment ended, including the outcome of conception (both birth and abortion); the most effective method used in the segment (if a woman used multiple methods[§]); and various demographic and socioeconomic characteristics of the woman.

In terms of time period and design, AGI's 1987 and 1994–1995 Abortion Patients Surveys are reasonably well suited to supplement the 1988 and 1995 NSFGs. The self-administered questionnaires (which were completed by 9,480 and 9,985 women, respectively) used measures of contraceptive use at the time of conception, as well as measures of various socioeconomic characteristics, that were as similar as possible to those in the corresponding NSFG.¹⁹ The results of each AGI survey were weighted to represent the number and distribution of abortions for the year in which it was fielded.

Measures

We estimated failure rates for the pill; the condom; the diaphragm; the IUD, injectable and implant; withdrawal; periodic abstinence; and spermicides. Segments of female condom use were few and are included in the condom category. We combined the IUD, injectable and implant because the samples were small and because these are all long-acting methods with similarly high levels of use-effectiveness.[§] Failure rates are estimated for each of the first two years of use and for both years combined.

We examined the following age-groups: younger than 18, 18–19, 20–24, 25–29 and 30–34. Earlier analyses measured women's age at the beginning or end of an interval of use.²⁰ Often, however, when pe-

*Past analyses of these NSFG data sets have used a similar methodology to assess group differences (sources: reference 1; and Fu H et al., 1999, reference 9). However, we could not use the data or results from those studies, for several reasons. We were interested in examining smaller groups than have been studied in the past, and in measuring 24-month failure rates, in addition to 12-month rates. We also used a consistent methodology for weighting the data from AGI's 1987 and 1994 surveys. Previous analyses did not include calculation of standard errors, making statistical comparison of rates difficult; however, wherever direct comparison was possible, rates

for individual waves based on our analyses were similar to those that AGI obtained in the past.

†Ten months is used for the 1995 data instead of the conventional three months because the 1995 survey did not collect information on the beginning date of current pregnancies.

‡From most to least effective, the method hierarchy used was as follows: implant, injectable, IUD, pill, condom, diaphragm, cervical cap, spermicides (foam, jelly, cream, suppository and sponge), periodic abstinence and withdrawal.

§The major reversible, long-acting method available during the period covered by the 1988 NSFG was the IUD. We do not present rates for the IUD, since almost all IUDs were withdrawn from the U.S. market in the mid-1980s, the period covered by the analysis of 1988 rates (source: reference 1). Moreover, the failure rates for the IUD obtained from the 1988 NSFG alone are abnormally high, compared with results from clinical trials, perhaps because of errors in women's understanding of what constitutes IUD failure (source: reference 7). However, the IUD was included in the overall contraceptive failure rate in 1988.

riods of observation are long, a woman's age can differ enough from the beginning to the end of a use segment to shift her into an older age-group. Since we are examining fairly long intervals, we used age at the midpoint of each interval.

We considered three categories of union status: not in union, cohabiting and married. Union status was treated as a time-varying covariate, so every use interval following a change in union status was treated as a new use segment. However, duration was calculated as of the start of method use, rather than as of the change in union status.

Women's poverty status is classified as being less than 100%, 100–249%, or 250% or more of the federal poverty level. Poverty status was measured as of the time the woman was interviewed for the NSFG or the AGI survey, and was defined on the basis of her current family size and her family income in the prior 12 months. The use of current poverty status is somewhat problematic. First, a birth resulting from a contraceptive failure may change a woman's poverty status by altering her family size and income. Second, because family income was missing from a considerable proportion of questionnaires, some values of the poverty status variable were imputed by the National Center for Health Statistics.* However, because we use very broad categories of poverty levels, it is unlikely that substantial movement occurred across the three poverty groups that we used, either over the observation period or as a consequence of increased family size resulting from contraceptive failure.

Three racial or ethnic groups are examined: black, Hispanic, and white and other women.† Parity was also considered, but was not used in the final models, since it did not add significantly to the predictive power of the regression once the other variables were included.

Analytic Technique

Matching abortions from the AGI surveys to the NSFG data involved a number of steps. First, the number of abortions in each AGI survey had to be weighted to reflect the number of abortions that had occurred during the period covered by the NSFG contraceptive use calendar. Separate inflation factors were applied for each possible combination of age and race or ethnicity. Weights had to be further adjusted to account for the changing distribution of methods used by women's marital status. Adjustments to the 1994–1995 weights were also made to reflect that some abortions in the AGI data occurred

during contraceptive use segments that started before the reference date of the NSFG sample period. Accordingly, deflation factors derived from data on the distribution by duration of contraceptive use were applied to the AGI data. Finally, weights were adjusted to reflect that the length of open-ended use segments (segments censored by survey date) varied by interview date.

The basic premise of our methodology is that we can correctly estimate conceptions due to contraceptive failure if we adjust the number of abortions from the level reported in the NSFG to the actual level. (Conceptions that led to births or miscarriages and pregnancies that were continuing at the time of the survey were not adjusted, because they are considered to be completely reported.‡) Clearly, individual records cannot be corrected, because we do not know which women underreported abortions. Therefore, we made the correction and carried out the analysis at the aggregate level.

From the NSFG data on contraceptive use segments and pregnancies that did not end in abortion, and from AGI abortion data, we constructed subgroups of women defined by combinations of method used, months covered by the use segment (0–2, 3–11 and 12–23) and selected socioeconomic characteristics. We used the NSFG and AGI pregnancy data to estimate, for each subgroup, total unintended pregnancies during contraceptive use (the numerator of the failure rate), and the NSFG data on use segments to estimate contraceptive exposure (the denominator). Subgroups in which the AGI survey indicated that an abortion had occurred but the NSFG indicated no contraceptive exposure were dropped from the analysis.‡

We adjusted each NSFG data set separately before combining the two into a single file for analysis. Although the two surveys were conducted seven years apart, no significant changes in use-effectiveness occurred between them. The average failure rate for all methods was 13% in both 1988 and 1995 (Table 1). Only small and nonsignificant changes were evident for almost all subgroups of women; the exception is that among black women, the failure rate rose from 17% to 20%. The lack of obvious improvement in use-effectiveness is disappointing for substantive reasons, but it supports our decision to pool data from the two surveys to analyze contraceptive failure rates.

The combined data included 13,032 first-year use segments and 4,916 second-year segments (Table 2, page 22). Despite

Table 1. Percentage of women experiencing an accidental pregnancy during the first 12 months of contraceptive use, by selected characteristics, 1988 and 1995 National Surveys of Family Growth

Characteristic	1988	1995
Total	13.1	12.5
Method used		
IUD/injectable/implant	na	2.9
Pill	7.5	8.3
Condom	14.4	14.5
Other	23.5	22.4
Age		
<20	13.1	13.7
20–24	15.3	14.5
25–29	12.2	12.3
30–44	10.6	9.6
Union status		
Married	10.6	9.3
Not in union	14.0	13.8
Cohabiting	24.3	22.3
Poverty status		
<200%	10.3	9.9
200%	18.7	17.5
Race/ethnicity		
Black	17.2	19.7*
Hispanic	15.6	15.4
White/other	12.1	10.8

*p .05. Notes: Rates are adjusted for abortion underreporting. na=not applicable, because rates for the IUD (the only long-acting method available in 1988) are not presented.

the substantial difference, the number of segments for the second year was sufficiently large to allow us to obtain failure rates for most subgroups.

During the first year of use, the pill and the condom accounted for the largest proportions of use segments—39% and 36%, respectively. Each remaining method represented 4–6% of use segments. The duration of use averaged 6.7 months and varied little by women's socioeconomic characteristics.

Adjustment of the NSFG data with data from the AGI survey increased the number of first-year failures by 62%, from 665 to 1,074. The adjustment effect varied with method and socioeconomic group, reflecting differentials in abortion underre-

*For example, in the 1995 NSFG, the total income variable was missing for 11% of the respondents. The imputed values were obtained through a regression model using information from the 1995 NSFG and the 1993 National Health Interview Survey. (Source: Potter FJ et al., Sample design, sampling weights, imputation, and variance estimation in the 1995 National Survey of Family Growth, *Vital and Health Statistics*, 1998, Vol. 2, No. 124.)

†In this article, women classified as black, white or "other" are non-Hispanic; those classified as Hispanic may be of any race.

‡In prior analyses, such segments were pooled, to retain information on abortions. We replicated those analyses without the pooling procedure and found very small differences in the estimated failure rates.

Table 2. Number and percentage distribution of segments of contraceptive use, average length of use segments, and reported and corrected number of pregnancies, by selected characteristics of women, according to period of method use, combined 1988 and 1995 NSFG

Characteristic	First year					Second year				
	Use segments			Pregnancies		Use segments			Pregnancies	
	N	%	Avg. length (mos.)	Reported	Corrected	N	%	Avg. length (mos.)	Reported	Corrected
Total	13,032	100.0	6.7	665	1,074	4,916	100.0	8.0	258	335
Method used										
IUD/injectable/implant	623	4.8	7.4	16	14	269	5.5	8.8	6	8
Pill	5,029	38.6	7.5	186	283	2,408	49.0	8.1	86	113
Diaphragm	643	4.9	6.9	40	56	273	5.6	8.5	22	28
Condom	4,721	36.2	6.0	230	409	1,376	28.0	7.8	87	110
Periodic abstinence	537	4.1	6.9	74	85	201	4.1	7.8	24	26
Withdrawal	713	5.5	5.5	64	104	197	4.0	8.0	18	25
Spermicide	766	5.9	5.6	55	119	192	3.9	7.7	15	28
Age										
<18	1,737	13.3	5.9	91	131	468	9.5	7.5	26	32
18–19	1,634	12.5	6.1	88	143	571	11.6	7.9	26	35
20–24	3,644	28.0	6.6	207	386	1,439	29.3	8.0	82	111
25–29	2,993	23.0	6.9	154	251	1,203	24.5	8.0	66	92
30–44	3,024	23.2	7.2	125	163	1,235	25.1	8.4	58	65
Union status										
Married	5,270	40.4	7.2	290	351	2,276	46.3	8.2	136	148
Not in union	6,658	51.1	6.4	309	581	2,198	44.7	8.1	95	146
Cohabiting	1,104	8.5	5.6	66	142	442	9.0	7.0	27	41
Poverty status										
<100%	2,309	17.7	6.6	178	301	825	16.8	7.9	68	84
100–249%	3,812	29.3	6.5	216	373	1,356	27.6	7.9	86	118
250%	6,911	53.0	6.8	271	396	2,735	55.6	8.1	104	134
Race/ethnicity										
Black	3,194	24.5	6.9	172	375	1,291	26.3	8.1	83	120
Hispanic	1,547	11.9	6.5	103	147	524	10.7	8.0	33	35
White/other	8,291	63.6	6.6	390	552	3,101	63.1	8.0	142	180

Note: Corrected number of pregnancies reflects adjustment for abortion underreporting.

porting and underlying socioeconomic differentials in the composition of users of each method. Adjustment increased the number of pregnancies least among women using periodic abstinence (15%) and most among users of the condom (78%) and spermicides (116%).

Socioeconomic differentials in underreporting are fairly large. The corrected numbers of failures for black women and cohabiting women are more than double the reported numbers. The impact of correction is also large for women aged 20–24 (86%), women who are not in any union (88%) and women with incomes less than 250% of the poverty level (69–73%). It is smallest (21–46%) among married women, women aged 30–44, white women, Hispanic women and women in the highest poverty-status category.

For most methods, the distribution of use segments in the second 12 months differs little from that in the first year. Between the two periods, however, the proportion of use segments represented by the pill increased by 10 percentage points, and the proportion represented by the condom decreased by about eight points.

Correcting abortion reporting in the

NSFG data for the second 12 months of use caused a 30% increase in the number of failures (from 258 to 335). Some differences in the pattern of abortion underreporting between the first and second years of contraceptive use are evident. The second-year correction for the condom is 26%—only one-third as large as that for the first year. And in the second year, the correction for pill users is slightly higher (31%) than that for condom users. The impact of correction continues to be highest for users of spermicides (87%) and lowest for users of periodic abstinence (8%). Hispanic women require the smallest amount of correction by the second year of use (less than 10%). Among most other groups, correction has less of an impact than in the first year (45–60%), and the ranking of groups by degree of impact remains largely unaltered from the first year.

The mean duration of use increases from 6.7 months in the first year of use to eight months in the second year. Thus, use of methods in the first year is characterized by a greater proportion of short segments. Women contributing short-term use are filtered out by the end of the first year, because they become pregnant or stop meth-

od use for other reasons; presumably, therefore, users who continue into the second year may be more satisfied and more conscientious users. Duration of use varies little across socioeconomic subgroups. These fairly short average durations of use reflect that it is common for women to discontinue method use, because they become pregnant, are no longer sexually active, desire to become pregnant, change to another method or stop practicing contraception even if they are at risk of unintended pregnancy. The failure rates we present, however, estimate what women's experience would be if they continued method use for each of the first two years and for the two years combined.

We used a piecewise exponential regression model with grouped data for the analysis. The number of events in each covariate cell was treated as having a Poisson distribution, and the parameter of the distribution was taken to be a log-linear function of the covariates.²² The regression used the log of unweighted exposure, but weights from the NSFG were utilized in the calculation of the rates, which are weighted sums of the Poisson parameters. NSFG weights were also used in the cal-

ulation of standard errors, following a method that employs the normal approximation of the Poisson distribution.²³ Confidence intervals for weighted sums of Poisson parameters obtained by these methods are reasonable as long as rates do not approach zero.²⁴ We present indications of statistical significance of differences between methods and between subgroups within duration intervals, but not across duration intervals.*

We estimated one model for each 12-month period and one for the entire 24 months.[†] The 24-month model was constructed as a nonproportional hazards model to account for possible interaction effects between socioeconomic predictors and duration of use. To capture nonlinearities in the impact of length of use, we used duration segments of three and nine months in the 12-month models, and segments of three, nine and 12 months in the 24-month model.[‡] The correction of data at the aggregate level rather than at the individual level limited the number of subgroups we could analyze, because with too many groups, exposure in some groups would have been unreasonably small. Predicted failure rates from the best-fitting regression model for each duration period were used to obtain the final exposure-weighted rates for each method and socioeconomic category.

In all regression models, method, age, union status, poverty level, and race or ethnicity were significant predictors of use-failure rates. Duration of use was not significant in the first-year model, but emerged as a significant predictor in the 24-month model. Race or ethnicity interacted with type of method and with poverty in the analysis for the first year and for the two-year period, and with union status in the 24-month model. No other two-way interactions affected the predictive power of the models.[§]

Results

Estimated Failure Rates

In all three periods, condom users are significantly more likely than users of long-acting methods and the pill to have an unintended pregnancy; the effectiveness of the diaphragm is comparable to that of the condom (Table 3). The first-year failure rate is 14% for the condom, 4% for long-acting methods and 8% for the pill. Periodic abstinence, withdrawal and spermicides are less effective than the condom, with failure rates of 23–28%. These failure rates, calculated directly from the model (i.e., unstandardized rates) represent users' actual experiences, which reflect differences in ef-

fectiveness across methods and differences in characteristics of women using each method.

On average, the failure rate for all methods combined declines from 13% to 8% between the first and second 12-month periods, but the extent of decline varies with the method. Couples using withdrawal, spermicides or periodic abstinence experience the largest average decline (about 40%). Failure rates for the condom and pill also decline substantially in the second year (about 30%). By comparison, rates fall by 15% or less for users of long-acting methods and the diaphragm. While the relative ranking of methods remains substantially similar in the second year, the differentials between them change somewhat. For example, compared with the failure rate for long-acting methods, the failure rate for the condom is about four times as high in the first year, but only three times as high in the second year.

The average failure rate for the entire 24-month period is 19%. Thus, one in five women who begin using a reversible method become pregnant within two years if they do not change or discontinue methods for other reasons. Eight percent of women using a long-acting method and 13% of pill users experience a contraceptive failure by the end of two years. Rates are higher among users of other methods—about one-fifth among condom and diaphragm users, and more than a third among those relying continuously on periodic abstinence, spermicides or withdrawal.

The standardized failure rates indicate what the method-specific failure rates would be if users of each method had the same characteristics as the entire population of contraceptive users within each period. Thus, the comparison of these rates with unstandardized rates shows the extent to which failure rates are affected by the socioeconomic composition of method users.

During the first 12 months of use, standardized rates are generally within 4% of the unstandardized rates. The exceptions are for long-acting methods and the pill: Standardized rates are 9% and 7%, respectively, below the unstandardized rates, indicating that these methods are somewhat more likely than others to be used by women from subgroups with an above-average chance of failure.

Larger differences between standardized and unstandardized rates are apparent in the second year of use. The greatest relative differences are for long-acting methods and spermicides (for which the standardized rates are 17% and 14%, re-

Table 3. Percentage of women experiencing an accidental pregnancy, by method, according to period of method use, combined 1988 and 1995 NSFG

Method	First year	Second year	First two years
Total	12.5	8.0	19.4
Unstandardized			
IUD/injectable/implant	3.5***	3.0***	7.5***
Pill	7.5***	5.3***	12.9***
Diaphragm	13.1	12.0	22.6
Condom (ref)	13.7	9.9	22.3
Periodic abstinence	22.9***	14.5**	36.6***
Withdrawal	24.5***	14.0***	35.2***
Spermicide	27.6***	17.0***	39.7***
Standardized†			
IUD/injectable/implant	3.2***	2.5***	6.6***
Pill	7.0***	4.8***	11.7***
Diaphragm	13.1	11.5	23.2
Condom (ref)	14.2	10.6	23.7
Periodic abstinence	23.5***	13.4**	36.8***
Withdrawal	24.1***	12.4*	36.4***
Spermicide	28.1***	14.7***	40.6***

*Rate is significantly different from rate for the condom at p .05.

**Rate is significantly different from rate for the condom at p .01.

***Rate is significantly different from rate for the condom at p .001.

†Standardized to the socioeconomic distribution of all method users. Notes: ref=reference group. Percentages are corrected for abortion underreporting. Variables included in the model are method, duration of use (except in the model for the second year), age, union status, poverty level, and race or ethnicity.

spectively, below the unstandardized rates). Standardized rates are 8–11% lower for the pill, periodic abstinence and withdrawal, indicating that longer-term users of these methods tend to be from subgroups whose chance of method failure is greater than average. By contrast, long-term condom users are somewhat more likely to be from subgroups with below-average failure rates: Their standardized rate is 7% higher than the unstandardized rate. By and large, however, differences between standardized and unstandardized failure rates are sufficiently small that only a small proportion of the differences in average effectiveness across methods can be attributed to differences in the composition of users.

To assess the impact of changes in socioeconomic characteristics from the first

*Tests of significance between the first- and second-year duration intervals, assuming them to be from independent samples, suggested that almost all differences were statistically significant. However, these tests are not conclusive because the samples are not independent.

†Rates for the 24-month model cannot be computed directly from the other two, because the set of predictors varied from model to model.

‡Preliminary analysis using the Kaplan-Meier method and results from Poisson models for the two-year period indicated that the failure rate falls off after the first three months.

§The regression estimates are available from the authors upon request or can be obtained on-line by accessing this article at <<http://www.agi-usa.org/journals/>>.

Table 4. Percentage of women experiencing an accidental pregnancy, by selected characteristics, according to period of method use, combined 1988 and 1995 NSFG

Characteristic	First year	Second year	First two years
Total	12.5	8.0	19.4
Age			
<18	12.4	8.6	21.1
18–19 (ref)	14.0	7.1	20.2
20–24	15.2	8.4	22.2
25–29	11.6*	9.9**	19.8
30–44	9.5***	6.1	14.2***
Union status			
Married	10.0***	7.9	17.1**
Not in union (ref)	13.6	7.7	20.3
Cohabiting	21.2***	10.9***	28.4***
Poverty status			
<100%	20.5***	11.3	30.0***
100–249% (ref)	15.5	10.8	24.6
250%	9.1***	6.2***	14.6***
Race/ethnicity			
Black	18.1**	11.7***	27.0***
Hispanic (ref)	15.5	8.9	22.1
White/other	11.2***	7.3**	17.8***

*Rate is significantly different from rate for the reference group at p .05. **Rate is significantly different from rate for the reference group at p .01. ***Rate is significantly different from rate for the reference group at p .001. Notes: ref=reference group. Percentages are corrected for abortion underreporting. Variables included in the model are method, duration of use (except in the model for the second year), age, union status, poverty level, and race or ethnicity.

to the second year of use, we carried out a second standardization, assuming that overall and for each method, users in year two had the same characteristics as users in year one. In this analysis, the overall drop in the second-year failure rate (3.8 percentage points) was less than the drop seen among actual users (4.5 percentage points). Thus, about one-sixth of the observed improvement in average use-effectiveness between the two years resulted from the shift toward more effective methods and subgroups of women more likely to be effective users (the selection effect). As shown in Table 2, a higher proportion of second than of first-year users are using long-acting methods or the pill, and they are older, are more likely to be married and have higher income.

If characteristics of users of each method had remained the same in the second year as in the first year, the failure rates of some methods would have been only slightly different from the observed second-year rates—long-acting methods (3%), the pill (5%), the diaphragm (12%), the condom (10%) and periodic abstinence (15%). Thus, for these methods, most of the decline in the failure rate between the first and second years among actual users is due to improved effectiveness of use (the practice effect), rather than to changes in the characteristics of users.

However, if user characteristics had remained the same in both years, failure rates for other methods would have decreased—withdrawal (12%) and spermicides (16%). This finding suggests that shifts toward less-effective groups of women using these methods over longer durations diluted the apparent improvement in method effectiveness with increased duration of use.

Socioeconomic Differentials

Marked differences in contraceptive failure rates are apparent across subgroups. (The estimated failure rates for all methods for each subgroup of users are the average actual rates for the subgroup; they are not standardized to adjust for differences in methods used.) The average failure rate in the first year of use is greater than 10% for all users except women aged 30–44, married women and women in the highest poverty-status category (Table 4).

Between the first 12 months and the second 12 months of use, failure rates decline by roughly 15–50% among all groups. The decline is smallest among women aged 25–29 (15%) and married women (21%), and largest among 18–19-year-olds and cohabiting women (about 50%). In the second year of use, average failure rates exceed 10% only among cohabiting women, women with family incomes less than 250% of poverty and black women. During the first two years of reversible contraceptive use, 20% or more of users become pregnant accidentally in all subgroups except 30–44-year-olds, married women, those with the highest poverty status and white women.

Failure rates in the first 12 months peak at ages 20–24, but this pattern does not hold beyond the first year. While rates for the two adolescent age-groups do not differ in the first year of use, women younger than 18 have significantly lower rates than those aged 20–24 (p .05). In the first year of use, married women have the lowest failure rate by union status, but in the second year, rates for married women and women not in union converge, and cohabit-

ing women continue to experience the highest failure rates. Failure rates decrease steeply with rising economic status for the first 12 months of use; by the second year, however, the poorest group has caught up with the middle group, while women at the high end of this scale still have a significantly lower failure rate. However, evidence of the linear effect with poverty remains manifest in the rates for the entire 24-month period. In all time periods, Hispanic women have lower failure rates than black women and higher failure rates than white women.

Differences in contraceptive failure rates across subgroups tend to narrow with increased duration of use. For example, in the first 12 months, the failure rate for cohabiting women is more than twice the rate for married women, and the rate for women not in union is 36% above that for married women. During the second year of use, women not in any union have as low a failure rate as married women, and cohabiting women are only 38% more likely than married women to become pregnant accidentally. Similarly, rates for Hispanic women become closer to those of white women by the second year, although the difference remains significant.

Marked changes in the pattern of differences by age-group occur between the first and second years of use, even though the range in failure rates across age-groups narrows less (from six to four percentage points) than the range for other charac-

Table 5. Percentage of women experiencing an accidental pregnancy, by union status, poverty status and period of use, according to race or ethnicity, combined 1988 and 1995 NSFG

Characteristic and period	Black	Hispanic (ref)	White/other
UNION STATUS			
First year			
Married	13.7*	12.0	9.4**
Not in union	18.5	17.0	12.0***
Cohabiting	25.9	25.6	19.3***
First two years			
Married	23.1*	20.7	15.3***
Not in union	27.5	26.6	18.7***
Cohabiting	37.6***	20.0	28.7***
POVERTY STATUS			
First year			
<100%	18.7***	25.6	19.6***
100–249%	20.7**	16.1	14.5
250%	15.3***	8.5	8.5
First two years			
<100%	29.4*	33.8	29.4**
100–249%	29.8**	25.6	23.0*
250%	23.2***	14.1	14.0

*Rate is significantly different from rate for Hispanic women at p .05. **Rate is significantly different from rate for Hispanic women at p .01. ***Rate is significantly different from rate for Hispanic women at p .001. Notes: ref=reference group. Percentages are corrected for abortion underreporting. Variables included in the model are method, duration of use (except in the model for the second year), age, union status, poverty level, and race or ethnicity.

teristics. Compared with 18–19-year-olds, women aged 25–29 have a significantly lower first-year failure rate but a significantly higher second-year failure rate. Women aged 30–44 have a significantly lower failure rate than 18–19-year-olds in the first year, but in year two, rates for these groups do not differ.

Since significant interactions between race and union status, as well as between race and poverty status, were evident in the regression analysis, we examined failure rates for each racial or ethnic group according to women's union and poverty status (Table 5). In the first 12 months, the rate for black women exceeds that for Hispanic women only among married users; rates are comparable for the other union-status groups. White women are considerably more effective users than Hispanic women (and by implication, than black women), regardless of marital status. White women continue to have lower failure rates than Hispanic women for all 24 months of use, but black women who are married or cohabiting experience markedly higher failure rates (23–38%) than their Hispanic counterparts (20–21%).

Among those below the poverty level, black and white women have similar failure rates and are more effective contraceptive users than Hispanic women; this pattern is evident in the first year and the first two years of use. Failure rates for both Hispanic and white women decline as income increases; above the poverty level, the two groups do not differ, and both are considerably more effective contraceptive users than black women. By the end of two years of use, Hispanic and white women at or above 250% of the poverty level continue to have lower failure rates than black women, and white women at 100–249% of poverty have significantly lower failure rates than Hispanic women.

Estimated method-specific failure rates for each subgroup of women (i.e., unstandardized rates) show generally similar patterns to those seen for all methods combined, although levels of significance are sometimes different and the same patterns do not necessarily hold for each method. Notably, overall failure rates at all durations are higher for black women than for Hispanic women and are lower for white women (Table 4). However, only black women who use condoms or spermicides have higher failure rates at all durations than their Hispanic counterparts, and only white women who use the pill or the condom have consistently lower failure rates than Hispanics (Table 6). There are no significant differences across

Table 6. Percentage of women experiencing an accidental pregnancy, by duration of method use and characteristic, according to method, combined 1988 and 1995 NSFG

Duration and characteristic	IUD/injectable/implant	Pill	Diaphragm	Condom	Periodic abstinence	Withdrawal	Spermicides
FIRST TWO YEARS							
Age							
<18	8.2	13.8	u	25.8	46.1	40.7	53.0
18–19 (ref)	8.5	14.0	21.8	27.5	44.0	43.1	49.8
20–24	10.9*	14.9	36.0***	28.2	53.6*	42.7	54.1
25–29	7.5	11.9	26.7	21.8*	39.6	32.4**	41.8
30–44	4.5**	6.9***	16.1	13.6***	26.0**	23.8***	28.9***
Union status							
Married	6.4	10.8	20.0*	17.2***	33.4**	30.7**	34.4**
Not in union (ref)	8.0	13.3	25.4	25.5	42.7	39.1	44.3
Cohabiting	13.7***	20.5***	36.3**	34.2***	52.3**	48.1**	58.7***
Poverty status							
<100%	10.7	22.2***	44.2**	38.8***	60.5**	52.1***	57.5*
100–249% (ref)	8.8	16.3	33.1	29.3	48.6	40.7	50.0
250%	4.7**	8.8***	18.6***	15.9***	28.5***	27.7***	33.4***
Race/ethnicity							
Black	7.1	20.4	37.1***	37.3***	28.5**	47.7***	47.5***
Hispanic (ref)	6.4	18.7	17.4	28.7	36.3	27.8	28.3
White/other	7.9	10.7***	22.1*	19.4***	37.4	35.5**	39.3***
FIRST YEAR							
Age							
<18	3.5	7.4	u	14.5	u	24.8*	30.4
18–19 (ref)	4.3	8.6	u	17.7	u	31.3	36.8
20–24	5.1	9.0	21.2**	17.8	33.8***	29.6	37.2
25–29	3.1	6.4	12.7	11.8**	21.9	20.7**	26.7**
30–44	2.2**	4.5**	9.6	8.9***	16.6	17.5***	19.7***
Union status							
Married	2.7*	5.7**	10.4**	9.6***	19.6***	19.5***	21.2***
Not in union (ref)	3.8	8.1	17.2	15.8	28.5	27.0	32.9
Cohabiting	6.5**	13.5***	23.3**	23.8***	38.0**	38.8***	41.6**
Poverty status							
<100%	5.3	13.6***	28.9***	25.3***	43.4***	38.8***	43.7**
100–249% (ref)	4.0	9.0	18.7	17.3	28.8	28.9	34.7
250%	2.2**	4.9***	10.2***	9.4***	17.0***	18.3***	22.0***
Race/ethnicity							
Black	3.8	11.5	27.9***	24.1**	22.6	33.8***	36.5***
Hispanic (ref)	3.4	12.8	12.3	18.8	25.4	19.5	21.4
White/other	3.5	6.0***	12.2	11.6***	22.6	24.5**	26.8**
SECOND YEAR							
Age							
<18	3.8	5.5	u	11.2	u	14.3	u
18–19 (ref)	3.8	4.9	u	10.1	u	15.3	20.5
20–24	4.2	5.8	16.8	11.9	23.7	16.9	21.5
25–29	3.7	5.9	16.9	12.5	18.4	15.8	22.4
30–44	1.7*	2.8*	8.1**	6.2*	10.0**	9.3**	12.1**
Union status							
Married	2.6	4.9	11.2	8.8	13.1*	13.4	16.4
Not in union (ref)	3.3	5.1	12.4	10.6	17.3	13.3	17.1
Cohabiting	5.7**	7.8**	17.1*	13.8*	27.5***	23.9***	25.0**
Poverty status							
<100%	4.3	8.3	20.2	15.3	25.7	20.3	29.4*
100–249% (ref)	3.7	7.1	19.5	13.8	21.0	17.6	23.0
250%	1.8*	3.7**	10.1***	7.4***	11.1***	10.6***	13.8***
Race/ethnicity							
Black	4.8	8.4*	16.8	16.2**	24.2***	21.0	24.8*
Hispanic (ref)	3.6	6.3	15.9	11.4	14.1	17.9	20.2
White/other	2.2	4.6*	11.6*	8.8*	13.5	12.8**	15.2*

*Rate is significantly different from rate for the reference group at p .05. **Rate is significantly different from rate for the reference group at p .01. ***Rate is significantly different from rate for the reference group at p .001. †Where data for 18–19-year-olds are unavailable, the reference category is 25–29. Notes: ref=reference group, u=unavailable. Variables included in the model are method, duration of use (except in the model for the second year), age, union status, poverty level, and race or ethnicity.

racial and ethnic groups in the effectiveness of long-acting method use. For most other methods, the direction of differences is generally consistent, but differences are not significant across all durations. In contrast to the overall pattern, white women are significantly more likely than Hispanic women to become pregnant during 24

months of diaphragm use, and in the first 12 months and 24 months of withdrawal and spermicide use.

Women are most likely to be successful at avoiding accidental pregnancy if they rely on long-acting methods, the pill or, in some cases, the condom. Annual failure rates are 5% or less for women using long-

acting methods (except those in cohabiting unions) and for some groups of pill users—those aged 30–44 and those with the highest incomes (in both years); and those who are aged 18–19, are married or not in union, or are white (in the second year only). Failure rates in one or both years are also no higher than 10% for most other groups of pill users; condom users who are 18–19 or 30–44 years old, married, in the highest poverty-status category or

users are often thought of as especially prone to difficulties in successful method use, we found no difference in contraceptive failure rates between those younger than 18 and 18–19-year-olds. Since our analysis did not include information on frequency of intercourse, we could not directly assess whether less exposure might mask higher failure rates among the younger women. However, in the three months before the 1995 NSFG,

women younger than 18 who were sexually active and using a reversible method had had intercourse with about the same frequency as those aged 18–19. Some 55% in both age-groups had had sex, on average, at least once a week, although 18–19-year-olds were slightly more likely than 15–17-year-olds

to have had intercourse two or more times a week (39% vs. 32%).²⁵ These data add weight to the finding that effectiveness of use differs little between younger and older adolescents. It is also noteworthy that failure rates among women aged 20–24 are similar to those among 18–19-year-olds, but younger teenagers have lower failure rates than women in their early 20s.

Failure rates typically begin to decline among women aged 25 and older, and are consistently lowest among users aged 30–44. While this pattern is often attributed to a lower likelihood of correct and consistent method use among younger women and their partners,²⁶ it may also reflect a higher frequency of intercourse and fecundity among those who are younger. Differences in factors such as the predictability of sexual intercourse and access to the resources needed to obtain contraceptives likely also underlie these and other observed socioeconomic differentials in effectiveness of use. Age, union status and poverty status may also reflect times or situations in a woman's life that are more or less conducive to successful method use, such as variations in expertise for method use, types of sexual relationships, communication with a partner, access to services and control over life circumstances.

The reasons for the impacts of race and Hispanic ethnicity on use-effectiveness rates are less clear. These characteristics are, of course, markers for other factors that affect method success and that also vary by race and ethnicity. For example, women

who are married have the lowest failure rates, but only 20% of black women using reversible contraceptives are married, compared with more than half of white and Hispanic users. In general, higher-income users have lower failure rates than those who are poorer, and white users are almost twice as likely to be in the highest-income group (67%) as are Hispanic and black users (38% and 39%, respectively).²⁷ Yet, racial and ethnic differences are not completely explained by the poverty and union status variables we have used. And failure rates differ less by poverty status among black women than among Hispanic and white women. More focused analyses with larger data sets are needed to better understand these subgroup differences.

For users of all methods, second-year failure rates are lower than those for the first year of use. This decline may be due to several factors. First, women are more likely to make errors and become pregnant during the early months of use, when they are getting accustomed to their method, than later, when they have developed some expertise with it. Second, some women and their partners have difficulty using methods consistently and correctly. These users are likely to become pregnant more quickly than more careful users, so those who use methods for a longer time are selected for their greater ability to use them effectively. Finally, some women are more fecund—i.e., likely to become pregnant more quickly—than others, regardless of what method they use. Since more fecund women are more apt to become pregnant early in use, women who continue into a second year of use without becoming pregnant may, on average, be somewhat less fecund than women who conceive during the first year.

All subgroups of users experience a decline in failure rates as duration of use increases, confirming that there is both a practice effect and a selection effect, and each narrows differentials between groups over time. However, although the decline is universal, most of the socioeconomic differentials present in the first year of use persist into the second year, indicating that subgroup differentials in the factors that make for poor use-effectiveness continue over long periods.

As noteworthy as the wide subgroup differences are, they are smaller than differences between methods. All groups of women are most likely to be successful when using long-acting methods, the pill, the diaphragm or condom, and least likely to avoid accidental pregnancy while relying on periodic abstinence, withdraw-

“...most of the socioeconomic differentials present in the first year of use persist into the second year, indicating that subgroup differentials in the factors that make for poor use-effectiveness continue over long periods.”

white; diaphragm users who are 30–44, in the highest poverty-status category or married; and users of periodic abstinence and withdrawal aged 30–44.

At the other end of the spectrum, women using periodic abstinence, withdrawal and spermicides have the greatest difficulty using their method successfully. Users of all of these methods have first-year failure rates of 30% or higher if they are younger than 25 (except withdrawal users younger than 18), cohabiting or poor. Rates are similarly high among users of withdrawal or spermicides who are black, and among spermicide users who are not in union and are at 100–249% of poverty.

Discussion

Contraceptive failure rates are high in the United States for both short-term and longer-term users. About 13% of women beginning reversible contraceptive use become pregnant in a year's time, and another 8% experience accidental pregnancy in their second year of use. Failure rates are lowest among users of long-acting methods and the pill. The women most likely to experience method failure are those who use spermicides, withdrawal or periodic abstinence. Yet, differences emerge across subgroups of users of most methods.

Four socioeconomic characteristics evaluated in this analysis are significantly related to how effectively contraceptive methods are used: women's age, union status, poverty status, and race or ethnicity. Although the youngest contraceptive

al or spermicides. Yet women and their partners base their choice of method on a number of factors, such as the importance of the potential effectiveness rate; the specific requirements of using the method; ease of use, given an individual's lifestyle and patterns of sexual activity; and ease of access to method services and supplies. More research is needed on the development of new methods that would be less dependent on user intervention and that would be more acceptable and easy to use, perhaps with wider tolerance for variations in use. These could include condoms that promote sexual pleasure or oral contraceptives whose regimens are more "forgiving" of missed pills.

Family planning providers must educate couples about the need to choose methods that are appropriate for them at a given point in their life, taking into account the variety of methods available and the individuals' and couple's characteristics and preferences. In addition, providers should give increasing attention to the relationship between method users' characteristics and the probability of failure, with a view to understanding the underlying reasons. The decline in failure rates with duration of use also suggests that providers should specifically address discontinuation of use to help users to continue with their methods as long as they do not intend to become pregnant.

More research needs to be done to identify user and method characteristics that favor continued contraceptive use by women at risk of unintended pregnancy. Family planning providers can apply the lessons learned not only to properly advise clients on methods that they are most likely to use successfully, but also to counsel them on how to be consistent users and

to avoid behaviors that contribute to method failure.

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