ARTICLES

Contraceptive Failure Rates: New Estimates From the 1995 National Survey of Family Growth

By Haishan Fu, Jacqueline E. Darroch, Taylor Haas and Nalini Ranjit

Context: *Unintended pregnancy remains a major public health concern in the United States. Information on pregnancy rates among contraceptive users is needed to guide medical professionals' recommendations and individuals' choices of contraceptive methods.*

Methods: *Data were taken from the 1995 National Survey of Family Growth (NSFG) and the 1994–1995 Abortion Patient Survey (APS). Hazards models were used to estimate method-specific contraceptive failure rates during the first six months and during the first year of contraceptive use for all U.S. women. In addition, rates were corrected to take into account the underreporting of induced abortion in the NSFG. Corrected 12-month failure rates were also estimated for subgroups of women by age, union status, poverty level, race or ethnicity, and religion.*

Results: *When contraceptive methods are ranked by effectiveness over the first 12 months of use (corrected for abortion underreporting), the implant and injectables have the lowest failure rates (2–4%), followed by the pill (9%), the diaphragm and the cervical cap (13%), the male condom (15%), periodic abstinence (22%), withdrawal (26%) and spermicides (28%). In general, failure rates are highest among cohabiting and other unmarried women, among those with an annual family income below 200% of the federal poverty level, among black and Hispanic women, among adolescents and among women in their 20s. For example, adolescent women who are not married but are cohabiting experience a failure rate of about 47% in the first year of contraceptive use, while the 12-month failure rate among married women aged 30 and older is only 8%. Black women have a contraceptive failure rate of about 20%, and this rate does not vary by family income; in contrast, overall 12-month rates are lower among Hispanic women (16%) and white women (11%), but vary by income, with poorer women having substantially greater failure rates than more affluent women.*

Conclusions: *Levels of contraceptive failure vary widely by method, as well as by personal and background characteristics. Income's strong influence on contraceptive failure suggests that access barriers and the general disadvantage associated with poverty seriously impede effective contraceptive practice in the United States.*

About three million pregnancies in the United States (48%) were unintended in 1994. Some 53% of these occurred among women who were using contraceptives.[1] Thus, improving contraceptive use would go a long way toward reducing the level of unintended pregnancy among sexually active couples at risk.

Some contraceptives are inherently more effective than others at preventing pregnancy. Pregnancy rates among contraceptive users also differ by women's socioeconomic characteristics, however, most likely because of variations in how consistently and correctly methods are used.[2] Indeed, errors in method use are thought to account for the overwhelming majority of unintended pregnancies among contraceptive users. Thus, there is a pressing need to know which contraceptive users are more likely to have difficulty avoiding unintended pregnancies and whether some groups have heightened dificulty with any specific methods.

Two types of information contribute to our understanding of contraceptive method effectiveness and its variation across subgroups of women.* Most available information comes from clinical trials, especially for newer methods. The advantage of these data is that they are collected in a prospective manner, with relatively close monitoring of users. However, participants in clinical trials are usually self-selected, and they often have received more intense patient education and clinical attention than the typical user experiences once a method is widely available.

Survey data collected from general populations of users have the opposite advantages and disadvantages: Respondents are more likely to represent typical users under conditions of actual method availability, but surveys usually collect retrospective data, which may be affected by recall and reporting error. Moreover, there are few (if any) checks on the accuracy of the information reported.

The divergence between the method-specific failure rates observed in national surveys and the failure rates for near-perfect use during clinical trials reflects the influence of a number of unmeasured individual-level factors on typical use-effectiveness.[3] These include personal, couple and social factors (such as motivation to use a method, the ability to communicate and negotiate use with a partner, comfort and experience with the method, and

---

*Although some methods (such as the male condom and withdrawal) are actually used by men, studies of contraceptive effectiveness have invariably focused on women.

access to contraceptive services and supplies), as well as biological factors that affect the probability of pregnancy (such as fecundity and the frequency and predictability of intercourse). To the extent that women's demographic and socioeconomic characteristics reflect differences in their attitudes and behaviors with respect to contraceptive use, these can be used as proxies for behavioral and attitudinal differences among individual users. It is important to recognize, however, that socioeconomic characteristics are markers for differences in patterns of method use, rather than risk factors in and of themselves.

Contraceptive effectiveness rates derived from national surveys are usually underestimated, because a large proportion of unintended pregnancies resulting from contraceptive failure end in induced abortion and because abortion is typically underreported in surveys of women in the general population. This is clearly a problem with failure rates estimated solely from the National Survey of Family Growth (NSFG), the data set most commonly used for analyses of contraceptive use.[4] While almost half of unintended pregnancies end in induced abortions (47% in 1994[5]), abortions were underreported in the 1995 NSFG by more than 40%.[6]

In this article, we provide new estimates of method-specific failure rates among women in the United States, using the most recent information from the 1995 NSFG and adjusting for abortion underreporting. These failure rates represent the actual experience of method users rather than the failure levels that might be achieved if all methods were always used correctly and consistently.* To correct for underreporting of abortion in the NSFG, we applied a methodology for estimating contraceptive effectiveness used for earlier waves of the NSFG.[7] We present contraceptive failure rates during the first six and during the first 12 months of use. In addition to differentials by method used and by duration of use, we consider the differences according to women's characteristics, such as age, union status, race or ethnicity, poverty status and religion, that have been found to be associated with use-effectiveness.[8]

Methodology
Measures
In this article, we define the contraceptive failure rate as the proportion of method users who experienced failure within the first six and 12 months of use. Ideally, contraceptive failure would be defined as a con-

ception occurring in an act of intercourse when a contraceptive method was in use. However, it is often difficult to link conception to any specific act of intercourse, and the correctness of use—and even actual use—of a method can vary within a short time period. Therefore, we have defined a contraceptive failure as a conception that occurred during a month in which a woman (or her partner) was using a contraceptive method, as long as she did not report that she (or he) had stopped use before having become pregnant.†

The numerator for the failure rate consists of all pregnancies resulting from method failure during the relevant time period, whether they ended in live births, miscarriages or induced abortions. The denominator is the number of months of contraceptive method use during the same time period. The reported pregnancies could have resulted from inherent limitations of the method itself or from incorrect or inconsistent use.

Contraceptive Use
For this analysis, we constructed from 1995 NSFG data a contraceptive use segment file containing information on months of contraceptive use, reasons that method use was terminated and the respondent's socioeconomic characteristics. In the NSFG, a nationally representative sample of 10,847 women 15–44 years of age was interviewed between January and October 1995.[9] Respondents provided month-by-month reports on their contraceptive use from January 1991 to the time of the interview. However, because the survey did not obtain beginning dates of use for methods used in January 1991 by women younger than 25, we included in the analysis only method-use segments that began in February 1991 or later. In addition, since the NSFG did not ascertain the month of conception for women pregnant at the time of the interview, we ended the observation period for each respondent in the 10th month prior to the interview (i.e., between March and December 1994). By limiting our analysis in this way, we ensured the consistency of observations contributed by women of all ages and avoided missing pregnancies that occurred during contraceptive use.

Since we defined a method-use segment as the interval of use (in months) of a given contraceptive, each time a respondent changed methods, we started a new segment from duration zero, even if the woman had used the new method at some time in the past. For example, if a woman had used the condom for four months,

switched to the pill for eight months and then went back to using the condom for two months, she would have contributed two separate segments of condom use and one segment of pill use, each beginning at month zero. A new segment was also created with every change in union status (the only time-varying covariate other than age). Unless the method used changes at the same time, we began duration of use in new segments resulting from changes in union status with the total cumulative months used to the date of the change in union status. Thus, if the woman married one year after beginning pill use, she contributed two segments of pill use—one (beginning at month zero) while she was unmarried, and the other (beginning in month 12 of pill use) as a married woman.

When a respondent used more than one method in a month, we attributed both method use and method failure to the most effective of the methods mentioned.‡ We excluded male and female sterilization (the only two nonreversible methods) from our analysis, because accidental pregnancy is rare with these methods.[10]

There were 7,376 contraceptive use segments available for analysis, ranging up to 45.5 months in length; the mean duration was 9.1 months, and the median duration was 5.5 months. Only 6% of the segments (448) began with a change in union status during ongoing use. The male condom and the pill represented the largest share of use segments (41% and 32%, respectively); the remaining segments were divided among withdrawal (6%), spermicides (4%), periodic abstinence (4%), the injectable (3%), the diaphragm or cervical cap (3%), the implant (2%) and other methods (5%).

---

*In this article, the term "failure rate" refers to the "use-failure" rate—i.e., the probability of pregnancy during use of a contraceptive method in the general population. (This is also sometimes called the typical use-failure rate, to distinguish it from the method failure rate occurring during perfect use.)

†Method-use segments were identified as having terminated in failure if the ending date of use followed the date of conception, or if use ended in the same month as conception and the respondent reported that she or her partner had not stopped using the method at the time she became pregnant. In a few cases, respondents reported having used a method for many months after pregnancy began. If a woman used a method for five or more months after conception, we defined the case as a failure only if the pregnancy was reported as unintended or mistimed.

‡We assigned methods in the following descending order of assumed effectiveness: female sterilization, male sterilization, implant, injectable, IUD, pill, condom (male and female), diaphragm, cervical cap, spermicides (foam, jelly, cream, suppository or sponge), periodic abstinence and withdrawal.

Contraceptive Failures

•*NSFG data.* Information in the pregnancy history section of the NSFG indicated that 568 (8%) of the contraceptive use segments during the observation period had ended because of an accidental pregnancy. Of these, 71% (404) resulted from contraceptive failure during the first 12 months of method use; the remainder occurred in subsequent months.

Reporting of live births and miscarriages in the NSFG is considered to be of good quality.[11] However, conceptions that ended in abortion were seriously underreported. Only 45% of abortions that occurred in 1991–1994 were reported in the main NSFG interview—the primary source of information for this analysis. Moreover, abortion underreporting tended to vary by method used and by women's socioeconomic and demographic characteristics.[12] In the presence of such underreporting, data from the NSFG represent an undercount of the true number of failures, and therefore yield underestimates of contraceptive failure rates that vary in size, depending on the method and the woman's characteristics.

•*Correcting for missing abortions.* In this analysis, we used an approach developed earlier to correct NSFG data for underreporting of abortions.[13] This correction was done at the aggregate level: The numbers of failures reported in the 1995 NSFG to have ended in abortion were replaced by the numbers estimated to have actually occurred, based on national abortion data. This substitution was made for subgroups by contraceptive method, duration of use, age and other socioeconomic characteristics specific to each analytical model.

By adding the estimated correct number of abortions to the number of births or miscarriages reported in the NSFG data, we obtained more accurate numerators (contraceptive failures) for analysis. The amount of exposure to the risk of failure (the denominator of failure rate), however, was not corrected for any change that might be introduced by the corrected counts of failure in the numerator. This might bias the resulting failure rate estimates downwards, but the effect should be small.[14]

Data on the distribution of abortions by contraceptive method, duration of use and socioeconomic subgroup were from The Alan Guttmacher Institute (AGI) 1994–1995 Abortion Patient Survey (APS), a survey fielded specifically to get this information to complement the NSFG. The APS obtained information from 9,985 abortion patients in 1994–1995.[15] In addition to applying sample weights to the individual APS data, we carried out a series of adjustments to the APS data to yield nationally representative numbers of abortions during the relevant time period, by subgroup.[16]

We estimated the total national number of conceptions that ended in abortion, by age and race or ethnicity, for the study's observation period. For the NSFG data on contraceptive use and on conceptions ending in birth or miscarriage, this period started in February 1991 and ended between March and December 1994 (because respondents were interviewed over a 10-month period). Since respondents contributed four months of exposure during March–December 1994, on average, and since the median gestational age at abortion is about eight weeks, we inflated the APS data to equal the numbers of abortions by age and race for the United States between April 1991 and August 1994. This process yielded a total of 5,112,300 conceptions from February 1991 through June 1994.[17]

The APS abortion data were also adjusted for secular changes in contraceptive method prevalence during the period February 1991 to December 1994. For example, the implant and injectable were each introduced around the beginning of our observation period. Implant prevalence increased quickly and then dropped off, while prevalence of the injectable increased more steadily. Between 1988 and 1995, pill use declined from 31% to 27% of all users, and IUD use declined from 2% to 1%. Condom use increased from 15% to 20%.[18]

We interpolated the proportion of all contraceptive users relying on each method at the midpoint of the observation period (January 1993). We then took from the APS the estimated national number of abortions to women who had been using each method and multiplied it by the ratio of the estimated proportion of U.S. contraceptive users using that method in January 1993, relative to the 1995 NSFG proportion. Since the failure rate calculations used unweighted NSFG data rather than national estimates, we also adjusted the national APS estimates to a similar scale by applying age-specific and race-specific ratios of the unweighted to weighted months of method use in the NSFG sample.

We also needed to take into account the fact that the study observation period began with method use commencing in February 1991. No adjustment was needed for conceptions ending in birth or miscarriage, since we included only those in the NSFG that resulted from failure during method-use segments that began within the study observation period.

However, some nationally estimated abortions from conceptions occurring during the February 1991–December 1994 study period resulted from failures in contraceptive use segments that began before February 1991. Thus, we deflated the estimated number of abortions that resulted from contraceptive failures in the first 12 months of use to take into account the likelihood that method use was begun before February 1991.

Correcting for unreported abortions had a large impact on estimates of contraceptive failure. The NSFG yielded a weighted estimate of 2,157,473 conceptions during the observation period resulting from contraceptive failure within the first 12 months of use (excluding failures of contraceptive sterilization). Of these, 540,693 (25%) ended as abortions. Estimates based on the APS and national data indicated that 1,430,790 abortions resulted from conceptions during the first 12 months of contraceptive use in the study period. This difference implies that only 38% of abortions resulting from contraceptive failure during the first 12 months of use during the study period were actually reported in the NSFG—lower than the estimated 45% of all abortions reported in the main NSFG interview.

This difference may accurately measure differences in underreporting in the NSFG between abortions that resulted from contraceptive failure and those that did not. Alternatively, it may reflect some tendency of women having abortions to overreport the extent of their contraceptive use in the month they conceived or to report a shorter time using the method than women in the NSFG.[19] Thus, the corrected estimates represent an upper bound to contraceptive failure rates. However, given the high level of abortion underreporting in the NSFG, the failure to adjust for abortion underreporting clearly would result in estimates that are too low.[20]

Substituting the APS-based number for the abortions reported in the NSFG increases the proportion of contraceptive failures over the first 12 months of use ending in abortion from 25% to 47%, fairly close to the estimate that 51% of pregnancies in 1994 among contraceptive users ended in abortion.[21] The abortion correction raised the total number of contraceptive failures in this analysis by 41%, to 3,047,570.

Modeling Strategy

•*Definition of variables.* We evaluated effectiveness for nine categories of contraceptive methods: implant, injectable, pill, male condom, diaphragm or cervical cap,

spermicides, periodic abstinence, withdrawal and "other." The category "spermicides" includes those using foam, jelly or cream, the suppository or sponge, with sponge users representing 40% of all spermicide cases. Periodic abstinence refers to rhythm or to the safe period by calendar method (used by 86% of all NSFG respondents who were relying on any type of periodic abstinence), as well as to the safe period by temperature or cervical mucus test method or natural family planning (used by the remaining 14%).[22] "Other" was a residual category that included a variety of methods. For example, because the IUD accounted for only 1% of all use segments, it was grouped in this category (where it accounted for 16% of use segments). Similarly, the female condom was placed in this category, also because of a small number of use segments. "Other methods" also included combinations of methods used sequentially in the same month. Sequential use accounted for 3% of all use segments in the data file, and 54% of all segments of "other" use.*

Failure rates are usually measured as the proportion of women experiencing unintended pregnancies during the first year of use. However, there has been an increasing need for estimates of contraceptive failure rates during early stages of use, for comparison to results from six-month clinical trials. Therefore, we included duration of use as a covariate (the first through sixth months of use vs. the seventh through 12th months of use), and we estimated method-specific failure rates during the first six and the first 12 months of use.

The technique that we used to correct for abortion underreporting required that there be at least as many months of exposure to the risk of failure (in the denominator) as the sum of the NSFG births and miscarriages and the estimated abortions (in the numerator).[23] This limited the number of covariates we were able to include in each statistical model, as well as the number of categories of some covariates. In small numbers of cases, we moved an estimated abortion to another similar socioeconomic subgroup in order to avoid having the numerator for a cell be larger than the denominator. Despite these constraints, we were able to examine the relationships between the probability of contraceptive failure and age, union status, poverty status, race or ethnicity, and religion—key factors that have been found to affect contraceptive efficacy in previous studies.[24]

We categorized individual variables to maximize their substantive information in the context of the sample size limitations of the available data. Respondent's age was measured at the end of a use segment in four categories—younger than 20, 20–24, 25–29 and 30 or older. Union status, which combined formal marital status with information on cohabitation, consisted of three categories: currently married, cohabiting (either formerly married or never married) or unmarried and not cohabiting. Race and ethnicity were combined to form a single, three-category variable: Hispanic, non-Hispanic black and non-Hispanic white. (The latter category also included a small number of women not in the first two groups, mostly Asians, Pacific Islanders and Native Americans.)

We classified women by poverty status according to whether their household income fell above or below 200% of the federal poverty level ($15,141 for a family of four in 1995).[25] To study the potential influence of religious affiliation on contraceptive use effectiveness, we distinguished Roman Catholic from Protestant women and grouped women who reported other religions (e.g., Jewish women) with those who reported no religious affiliation (since each group was too small to permit separate analysis).

• *Statistical models*. We estimated the failure rates using piecewise-constant hazards model analysis.[†] Hazards models are extended life-table procedures that permit simultaneous examination of the relationship between the probability of contraceptive failure and multiple covariates. We ignored possible variation within segments in the degree of exposure to risk, because of differences in fecundity or in frequency of intercourse, as data on these are not available in the NSFG.

We considered a series of model specifications focusing on selected subsets of covariates at a time. We estimated all models without applying the sampling weights. Although black women were oversampled in the 1995 NSFG, we are able to control for the sampling variation in the data to some extent by controlling in every model for poverty status, which is highly correlated with race and ethnicity. Parameter estimates, standard errors and other estimates obtained from each model are not shown in this article, but are available from the authors. Under a given model, we first examined the significance of each covariate, as well as the potentially important interactions among the covariates, through log-likelihood ratio tests; we then derived a simple model containing the main effect of each factor and any significant interactions between covariates.

Using only the reported NSFG data, we first estimated uncorrected six-month and 12-month failure rates among all users of reversible contraceptives with a model containing duration of use as the only covariate. Next, we calculated method-specific failure rates using a second model that included method and duration-of-use covariates, as well as the interaction between them. We then repeated these models using the NSFG data that were corrected for abortion underreporting. Comparing the uncorrected and corrected results indicates the magnitude of bias in the failure rate estimates caused by abortion underreporting.

In a third model, we added age, union status and poverty status (as well as the interaction between age and union status) to the variables in the second model, using the corrected data. We computed standardized method failure rates to control for the facts that failure rates vary across social and demographic subgroups and that method users also differ in their characteristics. To do this, for each method, we applied the subgroup-specific failure rates from the third model to the percentage distribution of exposure by each age, union status and poverty status subgroup, weighted by NSFG sampling weights. Parameter estimates from this model were used to calculate 12-month method-specific failure rates for each subgroup of women by age, union status and poverty status.

In a fourth model, again using the corrected data, we investigated effects of race or ethnicity and of poverty status. The variables for this analysis included age, poverty status, race or ethnicity, and the interaction between poverty status and race or ethnicity, in addition to the main effects of method and duration and the interaction effect between them.

Finally, we estimated a model to explore effects of religion on contraceptive effectiveness. This model differed from the fourth by substituting religion for race or ethnicity. However, we found that religion was not significantly correlated with the probability of contraceptive failure, and that none of the interactions between re-

---

*Because "other" was a residual category consisting of unrelated methods and sequences of methods, we did not calculate failure rates for this category.

†The piecewise-constant hazards models used for these analyses are equivalent to log-linear regression models for Poisson count data, and were estimated using the statistical package SAS (see: Allison PD, *Event History Analysis,* Newbury Park, CA: Sage Publications, 1989; McCullagh P and Nelder JA, *Generalized Linear Models,* London: Chapman and Hall, 1984; and StataCorp, *Stata Statistical Software: Release 5.0,* College Station, TX: Stata Corporation, 1997).

Table 1. Percentage of U.S. women experiencing contraceptive failure, by duration of use and method, according to correction for abortion underreporting, 1995 National Survey of Family Growth

Duration and method	Uncorrected	Corrected	
		Unstandardized	Standardized
FIRST SIX MONTHS OF USE			
Total	**5.5**	**7.9**	**7.7**
Implant	0.0	0.1	0.1
Injectable	1.3	1.2	1.0
Pill	3.0	4.4	4.3
Diaphraghm/cervical cap	5.5	7.2	8.6
Male condom	5.6	8.9	8.8
Spermicides	7.8	16.2	17.1
Withdrawal	12.4	15.6	16.3
Periodic abstinence	13.2	14.9	17.5
FIRST 12 MONTHS OF USE			
Total	**9.9**	**13.1**	**12.9**
Implant	1.8	2.0	1.4
Injectable	2.8	3.5	2.6
Pill	7.3	8.5	8.1
Diaphraghm/cervical cap	9.2	13.2	15.9
Male condom	9.7	14.9	14.7
Spermicides	16.6	28.2	29.0
Withdrawal	20.1	26.0	27.1
Periodic abstinence	20.2	21.8	25.3

Notes: Total contraceptive failure rates, uncorrected and corrected but unstandardized, are from a model including no covariate other than duration of use. Uncorrected and corrected but unstandardized method-specific failure rates are calculated from a model including duration of use, method and the interaction between duration of use and method. Corrected and standardized rates are based on a model including duration of use, method, age, union status, poverty status, the interaction between duration of use and method, and the interaction between age and union status. In the latter model, abortion data in 19 (5%) of 391 cells were transferred to adjoining cells because of lack of exposure. "Other" reversible methods were included in all models, but separate estimates for these methods are not shown, as they do not reflect experience with any specific method.

ligion and other covariates were statistically significant. Therefore, we do not present rates by religion in this article.

Results
Method-Specific Failure Rates
Table 1 presents the estimated failure rates during the first six months and the first year of use. Correcting for abortion underreporting increases the six-month failure rate among users of all reversible methods from about 6% to 8% and raises the 12-month failure rate from 10% to 13%. The underreporting of abortion is more pronounced for some methods than for others. Correcting for missing abortions changes the NSFG-reported six-month and 12-month failure rates for the implant, the injectable, the pill and periodic abstinence and the six-month rate for the diaphram or the cervical cap by less than two percentage points. The abortion adjustment has the biggest effect on failure rates for spermicides, roughly doubling the six-month rate and increasing the 12-month rate by 70%.

The corrected, unstandardized rates reflect the actual experience of women relying on each of these methods during the study period. The implant and the injectable—two relatively long-term hormonal methods with little scope for user error—have very low failure rates in ac-

tual use: 0.1% and 1%, respectively, during the first six months of use, and 2% and 4% over the first 12 months of use.

The pill, in contrast, has substantially higher failure rates (4% during the first six months of use and 9% during the first year), although these are the lowest rates for methods that require ongoing action by the user. At the other end of the spectrum are periodic abstinence, withdrawal and spermicides, which all have first-year failure rates exceeding 20%. The diaphragm or cervical cap and the male condom fall in the middle of the range, with 12-month failure rates of 13% and 15%, respectively.

Overall, the probability of failure during the first six months of use accounts for more than half (60%) of failure within the first year of use. This pattern reflects both the greater difficulty in using a relatively new method correctly and consistently and the higher likelihood of continued use among those who are more comfortable with their method and able to carry out the steps needed to use it successfully.

Periodic abstinence has a particularly high chance of failure during the early stages of use; 68% of the probability of failure occurs in the first half of the 12-month period. The six-month failure rates for the pill, the diaphragm or cervical cap, the condom, spermicides and withdrawal are 52–60% of the 12-month rates, suggesting that for these methods the risk of failure is more evenly distributed over time. The failure rate for the injectable is even less concentrated in the first half of the initial year of use (34%). Implants have the lowest probability of failure at both six and 12 months. It is not clear whether the relatively large difference between the six-month (0.1%) and 12-month (2.0%) failure rates is due to measurement error or to other factors, such as the device's drug release pattern (in which hormonal levels fall steadily in the early months of use and then plateau at a very low level).[26]

Part of the difference across methods in the unstandardized failure rates reflects

the fact that some groups of women are more or less likely to choose specific methods. The standardized rates in Table 1 show the rates for each method if the women were the same in terms of age, union status and poverty status. Standardization increased the 12-month failure rates for the diaphragm or cervical cap and for spermicides, withdrawal and periodic abstinence. This indicates that these methods are more likely than others to be used by women from social and demographic subgroups that tend to have lower overall failure rates. Conversely, standardization decreased failure rates for long-acting methods, the pill and the condom, showing that these methods are more likely than others to be chosen by subgroups of women more prone to contraceptive failure.

Variation by Characteristics
•*Method-specific failure rates.* Table 2 shows 12-month failure rates for subgroups by women's age, union status and poverty status. (In preliminary analyses, we found these three variables to be significantly associated with the probability of contraceptive failure.) Poorer women experience a higher probability of failure, regardless of their age or union status or the method that they used. Adolescents and adult women younger than 25 tend to have higher failure rates than do women aged 25–29, whose rates in turn are higher than those of women aged 30 and older. Moreover, women in cohabiting unions generally experience higher rates of contraceptive failure than either married or other unmarried women.

While all three of these factors exert independent effects on the probability of contraceptive failure, age and union status tend to interact. We found no significant interactions between contraceptive method and women's socioeconomic variables in preliminary analyses, indicating that the variation in failure rates by age, union status and poverty status is similar across methods.

For example, the lowest failure rates for each method are among higher income married women aged 30 and older: Their 12-month probability of becoming pregnant while using contraceptives ranges from 1% or less with implants or injectables to 12–14% with spermicides, withdrawal or periodic abstinence. The highest failure rates for each method are among low-income cohabiting women younger than 20, although there were enough women for analysis only for implants, the injectable, the pill and the con-

dom. For these methods, failure rates range from 11% among users of the implant to 72% among condom users. In fact, the failure rate for implants in this subgroup is so much higher than those derived from clinical trials that it may indicate pregnancies in the month of implant removal before another method was begun (since fertility returns immediately after removal). The relatively high failure rate associated with injectable use may reflect the experience of women who did not return for their next injection on schedule. Similarly, the very high failure rates for the pill and the condom undoubtedly reflect high levels of inconsistent or incorrect use of these methods, as well as condom use for STD protection rather than pregnancy prevention.

Overall, failure rates among users of long-acting reversible methods were very low in most subgroups—2% or less for implants and 4% or less for injectables during the first 12 months of use, except among low-income cohabiting users younger than 25. Rates of 3–8% for the pill were seen among all higher income married and unmarried women, as well as among older cohabiting women with a higher income and in the oldest group of married and unmarried lower income women.

In contrast, in some subgroups, 30% or more women become pregnant over the first 12 months of use. These include pill and condom users who were cohabiting and were younger than 20, as well as condom users who had a low income, were cohabiting and were 20–24 years of age. Failure rates among women using spermicides, withdrawal and periodic abstinence are at least 30% in 14 of the 19 age–union status subgroups of women with incomes less than 200% of poverty and with at least five method-use segments, as well as for two of five subgroups of higher income cohabiting women.

• *Failure rates by age and union status.* Table 3 summarizes the differences in failure rates by age and union status. These rates reflect the effects of age and union status, as well as differences among contraceptive users in each subgroup according to various characteristics.

Both age and union status have significant effects on contraceptive failure. Unmarried cohabiting women exhibit the highest overall failure rate (22%) during the first 12 months of use. Unmarried, noncohabiting women are much less likely to experience an unintended pregnancy while practicing contraception (14%), but are more likely to have done so than are married women (10%). Overall failure

Table 2. Percentage of women experiencing contraceptive failure during the first 12 months of method use, after correction for abortion underreporting, by characteristic, according to method

Characteristic	Implant	Injectable	Pill	Diaphragm/ cervical cap	Condom	Spermicides	Withdrawal	Periodic abstinence
<200% OF POVERTY								
Married								
Age <20	2.4	4.2	12.9	ns	23.1	ns	ns	ns
Age 20–24	2.1	3.7	11.4	ns	20.6	ns	37.5	37.5
Age 25–29	1.6	2.9	9.1	22.2	16.6	34.2	30.8	30.8
Age ≥30	1.0	1.8	5.7	14.5	10.7	23.0	20.5	20.5
Unmarried, not cohabiting								
Age <20	2.4	4.2	12.9	ns	23.2	45.7	41.6	41.5
Age 20–24	2.3	4.1	12.6	ns	22.7	44.9	40.8	40.7
Age 25–29	2.4	4.3	13.2	ns	23.6	46.4	42.2	ns
Age ≥30	1.5	2.6	8.1	ns	14.9	31.1	27.9	27.9
Cohabiting								
Age <20	10.8	18.6	48.4	ns	71.7	ns	ns	ns
Age 20–24	4.7	8.3	24.3	ns	41.1	ns	ns	ns
Age 25–29	ns	ns	13.2	ns	23.7	ns	ns	ns
Age ≥30	ns	ns	10.8	ns	19.5	ns	ns	ns
≥200% OF POVERTY								
Married								
Age <20	ns	ns	7.6	ns	13.9	ns	ns	32.4
Age 20–24	1.2	2.1	6.7	ns	12.3	26.3	23.5	23.4
Age 25–29	0.9	1.7	5.3	13.4	9.8	21.2	18.9	18.9
Age ≥30	0.6	1.0	3.3	8.5	6.2	13.8	12.3	12.2
Unmarried, not cohabiting								
Age <20	1.4	2.4	7.6	ns	14.0	29.4	26.4	26.3
Age 20–24	1.3	2.4	7.4	ns	13.7	28.8	25.8	25.8
Age 25–29	ns	2.5	7.7	19.2	14.3	29.9	26.9	26.8
Age ≥30	0.8	1.5	4.7	12.0	8.8	19.1	17.0	17.0
Cohabiting								
Age <20	ns	ns	31.4	ns	51.3	ns	ns	ns
Age 20–24	ns	ns	14.7	ns	26.1	50.3	45.9	ns
Age 25–29	ns	ns	7.8	19.3	14.3	ns	27.0	ns
Age ≥30	ns	ns	6.3	15.8	11.7	24.9	ns	22.2

Notes: ns=not shown, because subgroups had fewer than five method-use segments. All estimates are based on a model including duration of use, method, age, union status, poverty status, the interaction between duration of use and method, and the interaction between age and union status. In this model, abortion data in 19 (5%) of 391 cells were transferred to adjoining cells because of lack of exposure. Estimates for "other" reversible methods were included in all the models, but estimates are not shown separately because they do not reflect experience with any specific method.

rates are highest for women younger than 20 (16%), and decrease steadily with age, to 9% for women aged 30 and older.

While age and union status are each significantly associated with the likelihood of contraceptive failure, their effects are interactive—i.e., the effect of age tends to vary by union status, and vice versa. For example, among adolescents and women in their early 20s, failure rates for unmarried, noncohabiting women are comparable to those for married women, and both groups are much less likely to experience contraceptive failure than are unmarried women cohabiting with a partner (12-month rates of 47% for cohabiting women younger than 20 and 25% for those aged 20–24). At ages 25–29, contraceptive failure is most likely among unmarried women, whether or not they are cohabiting, while for those aged 30 and older, failure rates are again highest among cohabiting women.

Across all union subgroups, however, women 30 or older have the most success

using their contraceptive methods. There are only small differences in failure rates across age-groups less than 30 years of age for unmarried noncohabiting women, but steep decreases are seen for cohabiting women and somewhat smaller decreases are found for married women. Across all age-groups, failure rates for unmarried,

Table 3. Percentage of women experiencing contraceptive failure during the first 12 months of use, after correction for abortion underreporting, by age, according to union status

Age	All	Married	Unmarried, not cohabiting	Cohabiting
Total	**12.9**	**9.9**	**14.1**	**21.9**
<20	16.4	15.7	15.2	47.0
20–24	14.7	13.1	14.0	25.1
25–29	12.5	10.8	15.2	14.6
≥30	9.1	7.8	10.8	15.0

Notes: Based on model including duration of use, method, age, union status, poverty status, the interaction between duration of use and method, and the interaction between age and union status. In this model, abortion data in 19 (5%) of 391 cells were transferred to adjoining cells because of lack of exposure.

Table 4. Percentage of women experiencing contraceptive failure during the first 12 months of use, after correction for abortion underreporting, by race/ethnicity, according to poverty level

Race/ethnicity	All	<200% of poverty	≥200% of poverty
Total	**12.9**	**18.2**	**10.2**
Black	20.3	20.6	20.0
Hispanic	16.1	20.4	11.5
White	11.2	16.8	9.0

Notes: Estimates by poverty status and race or ethnicity are based on a model including duration of use, method, age, poverty status, race or ethnicity, the interaction between duration of use and method, and the interaction between poverty status and race or ethnicity. In this model, abortion data in 13 (3%) of 401 cells were transferred to adjoining cells because of lack of exposure. The category "white" includes other nonwhite, non-Hispanic women who were not black.

noncohabiting women are no more than four percentage points higher than for married women in comparable age-groups.

•*Failure rates by poverty status and race and ethnicity.* In Table 4, we present estimates of overall failure rates by race or ethnicity and by poverty status. Both race or ethnicity and poverty status are significantly associated with the likelihood of contraceptive failure. Black women are more likely to experience contraceptive failure than Hispanic women, who in turn experience higher failure rates than white women. Differences in failure rates by poverty status are notable—18% among women with an income below 200% of poverty, compared with 10% among those with an income at or above the poverty threshold.

However, these differences are not consistent across racial and ethnic subgroups: The 12-month failure rates for poor white and Hispanic women are substantially higher than those of their more affluent counterparts, while black women experience similar rates of contraceptive failure, regardless of poverty status. More affluent Hispanic women are slightly more likely to experience contraceptive failure than are their white counterparts, while poorer Hispanic women share the same level of contraceptive failure as black women. This suggests that relative access to resources (poverty status) is an important factor mediating the effect of race for white and Hispanic women, but not for black women.*

---

*In an analysis of 1988 NSFG data, poor black women were found to experience higher rates of failure than were more affluent black women (Source: Jones EF and Forrest JD, 1992, reference 2). However, in that analysis, the group "black" also included nonwhite, non-Hispanic women; in contrast, in this article, we assumed that the characteristics and behavior of such women would more closely resemble that of white women. Thus, we grouped nonwhite, non-Hispanic women who were not black into the category "white." This may explain the difference between our findings and those from the analysis of 1988 data.

Discussion

Women and men who are sexually active and fecund but who do not want to have a child soon have a variety of contraceptive options, ranging from nonprescription methods for use at coitus to nonpermanent medical methods of varying duration and to permanent methods. Among the many factors that enter into people's decisions about what method to use at any particular time in their lives are such issues as how a method is used, its potential negative and positive health effects, and the method's costs and ease of accessibility, as well as personal preferences and relationship characteristics.

A method's effectiveness is also a factor in contraceptive choice. However, method effectiveness is neither particularly simple to measure nor easy to convey. Contraceptive failure due to the method alone (often called method failure or perfect-use failure) cannot be observed directly, since there is always some error in people's typical use of contraceptives.

Estimates of contraceptive failure during typical use that are presented here for U.S. women relying on nonpermanent contraceptives indicate that method choice makes a large difference in users' success at avoiding unplanned pregnancy. The range of expected contraceptive failure is wide, from 2–4 accidental pregnancies in a year among 100 women using the long-acting hormonal methods to more than 20 per 100 women who begin a year using spermicides, withdrawal or periodic abstinence.

Most pregnancies during contraceptive use result from incorrect or inconsistent use. Exactly how a woman and her partner use a contraceptive method is likely to be related to a number of issues, including (but not limited to) the degree of communication and cooperation between the woman and her partner; the predictability and frequency of intercourse; the attitudes of the woman and her partner about sexuality, the method itself and having an unintended pregnancy; the amount of experience or practice each has had using a particular method; and how easy it is to obtain and to afford contraceptive medical care and supplies. While we have not been able to investigate the impact of such factors directly, social and demographic variables available in the NSFG reflect some of these differences.

The strong influence of income on contraceptive failure rates suggests that access barriers and the general disadvantage and disruption of poverty continue to interfere with effective contraceptive use.

However, while the total 12-month failure rate for women at and above 200% of poverty remained essentially stable between 1988 (10%)[27] and 1995 (10%), the failure rate among lower income women fell slightly, from 21% to 18%. It is unclear whether this decline is attributable to improved access—for example, through such developments as expanded eligibility for family planning services under Medicaid and the efforts of the national Title X family planning program. Other factors in poor women's lives may also play a role. For example, lower income women are more likely than others to rely on long-acting reversible methods, primarily injectables and implants: In 1995, 12% of women with an income less than 200% of poverty who were using reversible methods of contraception were relying on long-acting methods, compared with only 5% of higher income women.[28]

The higher failure rates among younger women are consistent with special concerns about adolescents' ability to avoid unplanned pregnancies when they are sexually active. Yet these data make clear that age itself is not the sole determinant of method effectiveness. Among unmarried women who are not living with a man (the overwhelming majority of sexually active adolescents), adolescents' failure rates are similar to those of women in their early and late 20s. Moreover, there is only a small difference between the failure rates of married adolescents and married women in their early 20s. The only group in which adolescents have markedly different failure rates is unmarried cohabiting women, among whom failure rates are highest for teenagers.

These findings suggest that union status is more important than age in predicting contraceptive failure. The highest failure rates at almost every age are among unmarried women, especially among those who are cohabiting. Indeed, among all women, cohabiting women (especially teenagers) are most likely to experience a method failure during the first year of use. The lowest rates are for married women, especially for higher income married women aged 30 and older.

The value of race and ethnicity in predicting contraceptive failure depends on income. The racial and ethnic differences in failure rates were in fact much smaller among lower income women than among higher income women. Lower income Hispanic women and white women are more likely to have difficulties using methods successfully than are higher income women, while income makes little difference among

black women. Moreover, there is no significant variation in contraceptive effectiveness across religious groups (at least as those groups were defined in this analysis).

Our findings show that regardless of a woman's social and demographic characteristics, she is most likely to successfully avoid a pregnancy if she uses long-acting hormonal methods. If not, her chances of success are better if she chooses oral contraceptives. With methods that must be used around the time of intercourse, her likelihood of becoming pregnant is much less with the diaphragm or cervical cap and with condoms than with spermicides alone, withdrawal or periodic abstinence. This information is consistent with most recommendations, and can help women and their partners decide among methods.

These analyses go further, however, to provide direction in identifying social and demographic subgroups of women most likely to have unintended pregnancies, no matter what reversible method they use—lower income women, women younger than 30, unmarried women (especially those who are cohabiting), black women and Hispanic women.

These variables undoubtedly are markers for relationship and personal factors that determine actual patterns of method use, but this information can help women identify how similar they are to other women who have greater or less difficulty using contraceptive methods. We hope that such knowledge will not only increase the likelihood that they will select a method that offers them the greatest chance of success, but will also be linked to improved attention and support from medical care providers and others to encourage them to be correct and consistent users of whatever method they select. Both are important steps toward improving overall contraceptive effectiveness and de-

creasing the high level of unplanned pregnancy found in the United States.

References

1. Henshaw SK, Unintended pregnancy in the United States, *Family Planning Perspectives*, 1998, 30(1):24–29 & 46.

2. Jones EF and Forrest JD, Contraceptive failure rates based on the 1988 NSFG, *Family Planning Perspectives*, 1992, 24(1):12–19; and Hatcher RA et al., eds., *Contraceptive Technology*, 17th revised edition, New York: Ardent Media, 1998.

3. Trussell J and Kowal D, The essentials of contraception, in Hatcher RA et al., 1998, op.cit. (see reference 2), pp. 211–248.

4. Trussell J and Vaughan B, Contraceptive failure, contraceptive discontinuation, and resumption of contraceptive use: results from the 1995 National Survey of Family Growth, paper presented at the 1998 annual meeting of the Population Association of America, Washington, DC, Apr. 2–4, 1998.

5. Henshaw SK, 1998, op. cit. (see reference 1).

6. Fu H, Darroch JE, Henshaw SK and Kolb E, Measuring the extent of abortion underreporting in the 1995 National Survey of Family Growth, *Family Planning Perspectives*, 1998, 30(3):128–133 & 138.

7. Jones EF and Forrest JD, Supplementary technical report on the 1988 NSFG analysis of contraceptive failure rates, unpublished manuscript, New York: The Alan Guttmacher Institute (AGI), 1989; Jones EF and Forrest JD, Contraceptive failure in the United States: revised estimates from the 1982 National Survey of Family Growth, *Family Planning Perspectives*, 1989, 21(3):103–109; and Jones EF and Forrest JD, 1992, op. cit. (see reference 2).

8. Jones EF and Forrest JD, 1992, op. cit. (see reference 2); and Trussell J and Vaughan B, 1998, op. cit. (see reference 4).

9. National Center for Health Statistics (NCHS), *NSFG Cycle 5 Main Study Questionnaire, CAPI Reference Version*, Hyattsville, MD: NCHS, 1994.

10. Harlap S, Kost K and Forrest JD, *Preventing Pregnancy, Protecting Health: A New Look at Birth Control Choices in the United States*, New York: AGI, 1991.

11. Fu H et al., 1998, op. cit. (see reference 6).

12. Ibid.

13. Jones EF and Forrest JD, Supplementary technical report…, 1989, op. cit. (see reference 7); Jones EF and Forrest JD, Contraceptive failure…, 1989, op. cit. (see reference 7); and Jones EF and Forrest JD, 1992, op. cit. (see reference 2).

14. Hammerslough CR, Correcting survey-based contraceptive failure rates for abortion underreporting, doctoral dissertation, Princeton, NJ: Princeton University, 1987.

15. Henshaw SK and Kost K, Abortion patients in 1994–1995: characteristics and contraceptive use, *Family Planning Perspectives*, 1996, 28(4):140–147 & 158.

16. Ibid.; and Henshaw SK and Silverman J, The characteristics and prior contraceptive use of U.S. abortion patients, *Family Planning Perspectives*, 1988, 20(4):158–168.

17. Henshaw SK, Abortion incidence and services in the United States, 1995–1996, *Family Planning Perspectives*, 1998, 30(6):263–270 & 287; and Fu H et al., 1998, op. cit. (see reference 6).

18. Piccinino LJ and Mosher WD, Trends in contraceptive use in the United States: 1982–1995, *Family Planning Perspectives*, 1998, 30(1):2–10 & 46.

19. Trussell J and Vaughan B, 1998, op. cit. (see reference 4).

20. Jones EF and Forrest JD, 1992, op. cit. (see reference 2).

21. Henshaw SK, 1998, op. cit. (see reference 1).

22. AGI, Special tabulations from the 1995 NSFG, January 1999.

23. Jones EF and Forrest JD, Use of supplementary survey of abortion patients to correct contraceptive failure rates for underreporting of abortion, in Department of International Economic and Social Affairs, *Measuring the Dynamics of Contraceptive Use*, New York: United Nations, 1991, pp. 139–152.

24. Jones EF and Forrest JD, Supplementary technical report…, 1989, op. cit. (see reference 7); Jones EF and Forrest JD, Contraceptive failure…, 1989, op. cit. (see reference 7); and Jones EF and Forrest JD, 1992, op. cit. (see reference 2).

25. NCHS, *Public Use Data File Documentation, National Survey of Family Growth Cycle 5: 1995, Users' Guide,* Hyattsville, MD: NCHS, 1997.

26. Sivin I et al., Levonorgestrel concentrations during use of levonorgestrel rod (LNG ROD) implants, *Contraception,* 1997, 55(2):81–85.

27. Jones EF and Forrest JD, 1992, op. cit. (see reference 2).

28. AGI, Special tabulations from the 1995 NSFG, January 1999.