VARIANCE ESTIMATION

Note to CD-Rom users: this section originally contained tables of standard errors and relative standard errors for estimated total numbers of women and pregnancies, separately for nonblack and black women. For these tables, see: Judkins DR, Mosher WD, Botman S. National Survey of Family Growth: design, estimation, and inference. Vital Health Statistics 2(109), 1991.

Shortcut method for numbers and percents

For users who wish to obtain variance estimates for total numbers or percents of women or their pregnancies, there is an easier method than replicating estimates. Formulas are given in this section that will provide suitable estimates for many applications.

These estimates were derived by designing tables using a number of important dependent and independent variables. Sampling errors were calculated for the estimated numbers in these tables. The ratios of the variance to the square of the estimated number were plotted against the inverse of the estimated number, and a weighted least-squares line was fit to those points. The intercept and slope for these lines are given in this report; they can be used to estimate the standard errors of percents and weighted numbers from the NSFG.

To produce approximate standard errors for the NSFG estimates, first determine the type of characteristic to be estimated, that is, the parameter set in table F to be used. The reader must then determine the type of estimate that is needed. The type of estimated corresponds to there rules.

Rule 1. Use of estimated number of women or pregnancies - For the estimated number of women for whom data are published in this report, there are two cases to consider. For the first case, if the estimated number is any combination of the poststratification cells in table 3, then its value has been adjusted to official U.S. Bureau of the Census figures and its standard error is assumed to be 0.0. This corresponds to parameter set V in table F. As an example, this would be the case for the number of women 15-44 years of age; the number of black women 15-44 years of age; the number of never-married or ever-married women; or the number of women in any 5-year age group. Although the race class "white" is not specifically adjusted to U.S. Bureau of the Census figures, it dominates the poststratification class of women who were not black; consequently, subgroups of white women can be treated as the corresponding subgroup of women who were not black in table L for the purpose of approximating standard errors.

For the second case, the standard errors for all other estimates of numbers of women or pregnancies, such as the number of women using the Pill, are approximated by using the parameters provided in table F and formula 1 below.
If the estimated number $x$ for a characteristic has associated parameters $a$ and $b$, then the approximate standard error for $x$, $SE(x)$, can be computed by the formula

$$SE(x) = \sqrt{ax^2 + bx}$$

See also tables G-K, in which this formula is evaluated at many common levels.

Example of rule 1 - The estimated number of women using the Pill is 10,734,000. For table F, parameter set III, the $a$ and $b$ parameters for the numbers of women are $-0.00018$ and 10,738. Using formula (1), the estimated standard error is

$$\sqrt{(-0.00018)(10,734,000)^2 + (10,738)(10,734,000)} = 307,000$$

An approximate 95-percent confidence interval for the number of women using the Pill is 10,734,000 plus or minus $(1.96)(307,445)$. 

Rule 2. For rates, proportions, and percents when the denominator is generated by the poststratification classes (table 3) - In this case, the denominator has no sampling error. For example, rule 2 would apply to the estimated percent of women using the Pill in a combination of the poststratification cells. Approximate standard errors for such estimates can be computed using the $a$ and $b$ parameters in table F along with formula (2) below.

If the estimate of a rate, proportion, or percent - is the ratio of two estimated numbers $p = x/Y$ (where $p$ may be inflated by 100 for percents or 1,000 for rates per 1,000 women), with $Y$ having no sampling error, then the approximate standard error for $p$ is given by the formula

$$SE(p) = p \sqrt{a + b/x}$$

See also tables L and M, in which this formula is evaluated for many common values.

Example of rule 2 - The estimated proportion of all women 15-44 years of age using the Pill in 1988 was 15.6 percent. For table F, parameter set III, the parameters $a$ and $b$ for number of women are $-0.00018$ and 10,738, respectively. Using formula (2), the estimated standard error for the percent is

$$15.6 \sqrt{(-0.00018) + (10,738/10,734,000)} = 0.4$$

An approximate 95-percent confidence interval for the percent of women using the Pill is $15.6 \pm (1.96)(0.4)$, or 14.8 to 16.4 percent.
Rule 3. Proportions and percents when the denominator is not generated by the poststratification classes - If \( p \) represents an estimated percent, \( b \) is the parameter form table \( F \) associated with the numerator characteristics and \( y \) is the number of persons in the denominator on which \( p \) is based, then the standard error of \( p \) may be approximated by

\[
\text{SE}(p) = \sqrt{\frac{pb(100-p)}{y}}
\]

(If \( p \) is a proportion, then the above formula can be used, but with 100 replaced by 1.0.) See tables N-Q, in which this formula is evaluated at many common levels.)

Example of rule 3 - An estimated 30.7 percent of contraceptors were using the Pill in 1988. This percent is based on the estimated denominator of 34,912,000 women using contraception. From table \( F \), parameter set III, parameter \( b \) is 10,738. Using formula (3), the standard error for the percent is

\[
\sqrt{\frac{(10,738)(30.7)(100-30.7)}{34,912,000}} = 0.8 \text{ percent}
\]

An approximate 95-percent confidence interval for the percent of contraceptors using the Pill is 30.7 plus or minus (1.96) (0.8), or 29.1 to 32.3 percent.