

Union Status, Marital History and Female Contraceptive Sterilization in the United States

By Amy L. Godecker, Elizabeth Thomson and Larry L. Bumpass

Context: Much of what is known about the choice of sterilization as a contraceptive method is based on data from married women or couples. Because of increasing rates of cohabitation, divorce and repartnering, however, the relationship context in which sterilization decisions are made has changed.

Methods: The 1995 National Survey of Family Growth includes the complete birth and union histories of 10,277 white, black and Hispanic women. The distribution of union status and marital history at the time of tubal sterilization was estimated for these three racial and ethnic groups among the 799 women who had had a tubal ligation in 1990–1995 before age 40. Cox proportional hazard regression models were used to estimate the effects of union status and marital history on the risk of tubal sterilization. The analysis controlled for the woman's age, parity, race and ethnicity, education, region, experience of an unwanted birth and calendar period.

Results: Among women who obtained a tubal sterilization, most whites (79%) and Hispanics (66%) were married when they had the operation, compared with only 36% of black women. At the time of their sterilization, 46% of black women had never been married. Among all women, regardless of race and ethnicity and net of all controls, the probability of tubal sterilization is about 25% lower for single, never-married women than for cohabiting or married women. Cohabitation does not reduce the likelihood in comparison to marriage, however. Higher rates of tubal sterilization among Hispanic women are accounted for by their higher parity at each age; differences in parity or marriage by race only partially account for the relatively higher rates of tubal sterilization among black women.

Conclusions: Because women currently spend greater proportions of their lives outside of marriage or in less-stable cohabiting partnerships than they did in the past, they are increasingly likely to make the decision to seek sterilization on their own. As a result, the gender gap in contraceptive sterilization will likely increase. The possibility of partnership change is an important consideration in choosing sterilization as a contraceptive method.

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Sterilization is now the most prevalent method of contraception in the United States. Recent analyses of data from Cycle 5 of the National Survey of Family Growth (NSFG) show that approximately 28% of women who practice contraception have had a tubal sterilization, a proportion that just exceeds the 27% who rely on oral contraceptives.¹ An additional 11% of women are married to or living with a man who has had a vasectomy.

Compared with other methods, sterilization has many positive features. It is virtually 100% effective in preventing pregnancy, requires a one-time action without major side effects and does not interfere with sexual intercourse. The cost of sterilization is much more likely than that of other methods to be covered by insurance.² The method's main drawback, however, is that it precludes the possibility of having another child.

Although sterilization is an option for married, cohabiting and single persons,

many analyses of its use focus on married or ever-married women and, in some cases, on their partners.³ This strategy enables researchers to consider vasectomy and tubal sterilization as competing alternatives, but it misses the experience of women who do not form unions or who cohabit instead of marry. This is particularly problematic because as women and men spend greater proportions of their reproductive years living without a partner or in a cohabiting relationship, the context in which decisions about sterilization are made is changing. For example, sterilization of one's current partner does not guarantee the end of exposure to pregnancy risk; furthermore, the possibility of new partnerships may increase the value of maintaining one's ability to have a child.⁴

In this article, we investigate the extent to which women choose tubal sterilization in the context of marital or cohabiting partnerships. We also investigate the effects of prior marriage and divorce—

a proxy for expectations of union stability—on tubal sterilization. The analyses are based on union and birth histories from the 1995 NSFG.

We find that many women are unmarried when they obtain a tubal sterilization, and cohabiting women and married women with the same characteristics have similar rates of sterilization. With high rates of union dissolution and repartnering, increasing proportions of unmarried or cohabiting women are likely to seek tubal sterilizations, which will probably increase the gap between rates of tubal sterilizations and vasectomies. These changes have implications for the provision of sterilization services to women and to men.

Background

Several cross-sectional analyses have demonstrated that many unmarried women use tubal sterilization as their contraceptive method. For example, data from the 1995 NSFG showed that tubal sterilization accounts for 49% of contraceptive use among formerly married women and for 9% of use among never-married women.⁵ Both proportions represent increases from 1982 (from 39% and 4%, respectively), and most of this increase occurred before 1988. Use of tubal sterilization is particularly high among formerly married and never-married blacks who practice contraception (66% and 23%, respectively).

However, because these analyses refer to the women's marital status at the time of their interview, they do not tell us about the partnership context in which the decision to be sterilized was made. Formerly married women may have been sterilized during a previous marriage or when

Amy L. Godecker is a doctoral candidate and research assistant, Elizabeth Thomson is professor and Larry L. Bumpass is professor, Emeritus, all at the Department of Sociology, University of Wisconsin–Madison. An earlier version of this article was presented at the annual meeting of the Population Association of America, Chicago, Apr. 2–4, 1998. The research on which this article was based was supported by a grant from the Graduate School, University of Wisconsin–Madison, and by National Institute for Child Health and Human Development Center Grant HD05876 to the Center for Demography and Ecology, University of Wisconsin–Madison.

they were single (i.e., not living with a sexual partner); never-married women may have been sterilized while they were cohabiting or single. In this analysis, we separate periods of nonmarriage into singlehood and cohabitation (further broken down into never- and formerly married), and observe union status at the time of sterilization, rather than at interview.

A woman's current union status and past marital history may influence her decision to have a tubal sterilization through her desire for a child and the certainty of those desires; by her consideration of her partner's wishes to have a child; and through the relative costs and benefits of sterilization versus other methods, once she is sure she wants no more children. The first two considerations are linked to union stability and to the possibility of new partnerships. A new partner may want a child, and the woman herself may want to have a child with the new partner as a symbol of their commitment and life together.⁶ Thus, we expect that single women would be less likely to choose tubal sterilization than partnered women,⁷ and that cohabiting women would be less likely to choose tubal sterilization than married women.

Similarly, women who have experienced divorce are more likely than those who are still in a first marriage to take into account the possibility of separation. Therefore, divorced women, like cohabiting women, may be less likely than women currently in a first marriage to choose tubal sterilization. Several studies have found that the predominant reason for why women seek a reversal of a tubal sterilization is because they have divorced and remarried.⁸

Among women who are sure that they want no more children with any current or future partner, the relative benefits and costs of sterilization may differ by their union status. The first consideration is whether vasectomy is an option. The relative commitment of both partners to the relationship is likely to be the primary source of any differences by union status in the likelihood of vasectomy as an alternative to tubal sterilization. For example, the partners of single women are the least likely, and the husbands of married women are the most likely, to have a vasectomy as an alternative to the woman having a tubal sterilization.

Compared with married and cohabiting women, single women are more likely to experience periods when they are not involved in sexual relationships and may not anticipate opportunities to engage in

sex. During these periods of abstinence, the benefits of pregnancy protection offered by highly effective, nonpermanent contraceptive methods (such as the pill or injectables) may not outweigh their potential monetary and physical costs.

The experience of being single or being a single parent may also lead women to view birth control decisions as their own responsibility, so tubal sterilization would be a reasonable choice. On the other hand, single women may require protection from sexually transmitted diseases, as well as from pregnancy. If these women plan to use condoms, they may not feel the need for the additional contraceptive protection offered by tubal sterilization.

Race and ethnicity may affect all of these potential effects of union history and marital status on tubal sterilization; indeed, patterns of union formation and stability vary dramatically by these factors.⁹ For example, compared with women of other races, black women have lower rates of marriage, higher rates of cohabitation, higher rates of union disruption and higher rates of childbearing outside of marriage. For these reasons, black women may be aware of the lower likelihood that a relationship will result in marriage, and hence may be less concerned than other women about maintaining their ability to conceive with a potential future husband; they may also be more accustomed to making fertility decisions on their own. Since partners of black women and Hispanic women have particularly low rates of vasectomy,¹⁰ these women's access to an alternative to tubal sterilization is lessened. Among minority groups, therefore, married, cohabiting and single women all face a more limited choice of methods.

The decision to terminate childbearing through sterilization is a major turning point in a woman's life. Foremost in that decision is the woman's life-course position—her age and the timing and number of her previous births. But a decision to be sterilized has implications for a woman's current and possible future partnerships as well. Understanding the effects of union status and history on tubal sterilization and the variations in those effects across race and ethnicity will enhance our understanding of tubal sterilization as a contraceptive choice.

Data

We use data from Cycle 5 of the NSFG, which were collected in 1995 from a nationally representative sample of women aged 15–44. The response rate for this survey was 79%, which yielded a total sam-

ple size of 10,847 women.¹¹ Unlike previous cycles, Cycle 5 included a complete union history, including periods of cohabitation, along with the usual birth history and information on sterilization (of the respondent herself and of her current spouse or partner). We eliminated a small proportion of cases (fewer than 2%) due to missing or conflicting dates given for marriages, periods of cohabitation, births and sterilization procedures. Further, we limited our first analyses to 10,277 women who were non-Hispanic white (6,379), non-Hispanic black (2,387) or Hispanic of any race (1,511).

Because women rarely choose to have a tubal sterilization before age 25,¹² our multivariate analyses were limited to women who were born between 1950 and 1970 and who were therefore approximately aged 25–44 at the time of their interview. This resulted in a final sample of 7,358 women for the multivariate analysis—4,614 white, 1,712 black and 1,032 Hispanic women.

Methods

This article reports the results of several different analyses. Our first uses life-table techniques to estimate the proportion of women who will have had a tubal sterilization by the time they reach age 45. The life-table approach uses information on respondents' ages at tubal sterilization to estimate age-specific sterilization rates. Women who did not yet have a tubal sterilization exit the analysis at their age at interview. These age-specific tubal sterilization rates, derived from a cross-sectional sample, are then treated as a synthetic cohort to estimate the percentage of women who will eventually be sterilized by age 45, assuming these age-specific rates do not change.

In our second analysis, we estimate the percentage of women who are using some form of sterilization as their contraceptive method, by their union status and marital history at the time of the interview. We distinguish among three types of sterilization procedures: tubal sterilization, other female sterilizing operations (primarily hysterectomy) and a partner's vasectomy.

In all of our analyses, we consider tubal sterilization to be the outcome of interest. The vast majority of tubal sterilizations are done with some contraceptive intent, while most hysterectomies are done primarily for medical reasons. Since we are interested in sterilization as a contraceptive choice, we focus on tubal procedures.

While our second analysis looks at union status and marital history at the time

of the NSFG interview, our third analysis examines these characteristics at the time of the sterilization. We selected 799 women who had had a tubal sterilization between 1990 and 1995 and who were younger than age 40 at the time of their operation. For these women, we present the distributions of union status and marital history at sterilization by race and ethnicity.

Our final analyses use a multivariate approach to estimate the effects of union status and marital history on tubal sterilization, net of related characteristics such as age, parity, race and ethnicity, and other factors. We use Cox proportional hazard models in these analyses. This event-history technique predicts the hazard, or rate, of tubal sterilization by a woman's specific age.

Several determinants of sterilization change over a woman's life course. To properly model the sterilization decision for women, we require a method that can incorporate these changes. The Cox model is one such method. We begin observing women at age 13, when almost all of them have no children. The women's age increases continuously, while their parity increases whenever they have a child. In addition to parity, we allow other determinants of sterilization to change, including union status, marital history, historical period and an indicator of whether the respondent has had an unwanted birth. These variables change at the age at which these events occur in the respondent's life. We also include education, race and ethnicity, and region of residence in the models as covariates that do not change over time.

We follow respondents from age 13 until they have a tubal sterilization, another type of female surgical sterilization or until they reach the time of the actual interview unsterilized. As mentioned above, we predict rates of tubal sterilization only. However, we consider women not to be at risk for a tubal sterilization after other female sterilizing operations, so we remove them from our models after such procedures (usually hysterectomy). We discuss our event-history models in more detail below.

Results

Life-Table Estimates

While we might have expected the risk of sterilization to be concentrated in the later childbearing years, life-table estimates of the risk of tubal sterilization for each racial and ethnic group (Figure 1) show that this is not the case: Tubal sterilization increases almost linearly with age because of the

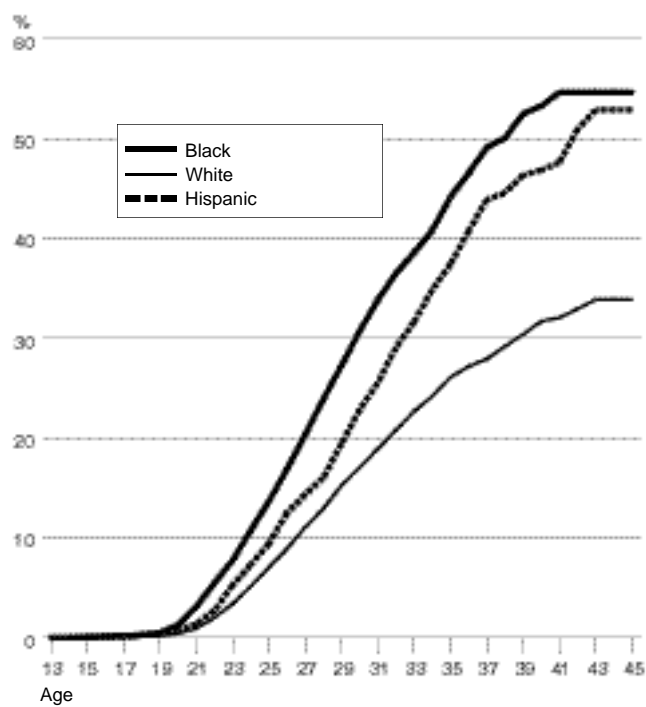
considerable variability in the age at which women begin childbearing and in the number of children women desire. Black women undergo tubal sterilization earlier than either Hispanic or white women, although Hispanic women subsequently reach the same levels of sterilization as black women. White women are less likely to be sterilized at all ages, and do not achieve the same levels of sterilization by the end of their reproductive careers as either black or Hispanic women.

These patterns in tubal sterilization are linked to racial and ethnic differences in ages at childbearing and in completed family size. Black and Hispanic women begin childbearing at earlier ages than do white women, but Hispanic women have more children than blacks, and therefore reach their completed family size at later ages. White women have a smaller completed family size than others, but since they begin childbearing at later ages, they reach their completed family size later in their reproductive careers.¹³ We estimate that more than one-half of minority women, but only one-third of white women, will have a tubal sterilization by age 45 (see Figure 1). Some of this difference is attributable to the fact that white women generally want to have children at later ages than do other groups, but much of it can be explained by the higher rates of vasectomy among married white men relative to other men.¹⁴

Union Status and History at Sterilization

As a first step toward linking women's marital status and union history to the likelihood of having had a tubal sterilization, we consider the proportion of women who reported at the 1995 interview either that they had had a sterilization—a tubal ligation or another sterilizing operation, primarily hysterectomy—or that their current spouse or partner had had a vasectomy (Table 1, page 38). We first classify women's union status at the time of the interview as married, cohabiting or single. The history component is

Figure 1. Cumulative percentage of women aged 15–44 with a tubal sterilization, by age, according to race or ethnicity



Note: Data are life-table estimates from the National Survey of Family Growth, Cycle 5 (1995).

expressed as first and second or later marriage for married women, and as formerly married or never-married for single and cohabiting women. As noted earlier, many women will have experienced changes in marital status and history since the time of their tubal sterilization, so these data do not tell us a great deal about the actual union context in which the decision to be sterilized occurred. They do provide information that will be important in understanding the results of our subsequent analyses, however.

Many of the differences observed in Table 1 can be attributed to the older ages and higher parity of currently married and formerly married women. For example, almost 40% of women who were in their second or later marriage when they were interviewed had had a tubal sterilization, compared with 21% of women in their first marriage. Women who have been married more than once are likely to be older and to have more children than women in their first marriage, and therefore are more likely to be sterilized for contraceptive reasons.

Likewise, approximately 35% of separated, divorced or widowed women who were single when they were interviewed had had a tubal sterilization, while only 4% of single, never-married women had undergone the procedure. Again, this difference is largely explained by the older

Table 1. Percentage distribution of 10,277 white, black and Hispanic women, by sterilization status, according to union status at interview and prior marriage history, 1995 National Survey of Family Growth

Characteristic	Tubal sterilization	Other female sterilization	Partner's vasectomy	Not protected by sterilization	Total
ALL WOMEN					
Married					
First marriage	20.9	2.9	13.9	62.3	100.0
Second or later	39.4	8.2	13.4	39.0	100.0
Cohabiting					
Formerly married	37.5	6.7	4.5	51.3	100.0
Never-married	9.2	1.2	2.1	87.5	100.0
Single					
Formerly married	34.9	5.0	2.7	57.4	100.0
Never-married	3.8	0.8	0.4	95.0	100.0
WHITE					
Married					
First marriage	18.9	2.7	16.2	62.2	100.0
Second or later	36.8	8.3	15.0	39.9	100.0
Cohabiting					
Formerly married	34.9	5.7	4.8	54.6	100.0
Never-married	4.5	0.4	2.4	92.7	100.0
Single					
Formerly married	30.2	5.5	4.0	60.3	100.0
Never-married	1.2	0.6	0.3	97.9	100.0
BLACK					
Married					
First marriage	35.2	4.9	3.4	56.5	100.0
Second or later	56.5	8.6	2.8	32.1	100.0
Cohabiting					
Formerly married	50.8	13.7	5.6	29.9	100.0
Never-married	22.7	2.0	0.4	74.9	100.0
Single					
Formerly married	47.6	5.1	0.3	47.0	100.0
Never-married	11.7	1.6	0.2	86.5	100.0
HISPANIC					
Married					
First marriage	25.1	2.7	5.1	67.1	100.0
Second or later	56.8	6.9	3.3	33.0	100.0
Cohabiting					
Formerly married	41.8	5.7	0.0	52.5	100.0
Never-married	18.2	3.9	2.2	75.7	100.0
Single					
Formerly married	37.8	2.4	0.6	59.2	100.0
Never-married	3.4	0.4	0.9	95.3	100.0

Note: All data are weighted.

ages and higher parity of formerly married women. A slightly higher percentage of women who were cohabiting had had a tubal sterilization, compared with women who were single at the time of their interview. Consistent with the data in Figure 1, black and Hispanic women are more likely than white women to report tubal sterilization in each category of union status and marital history.

Most important for our subsequent analysis is the information presented in the third column of the table—the proportion of women whose partner had had

a vasectomy. Few single women have a vasectomized partner, and male partners of cohabiting women are less likely to have had a vasectomy than are husbands of married women. Again, it is likely that much of this difference is attributable to the younger ages and lower parity of single and cohabiting women relative to married women.

On the other hand, formerly married women are also very unlikely to report that they rely on vasectomy as a contraceptive method when they are single or cohabiting. Among married women, the proportion protected by a partner's vasectomy is much lower for Hispanic and black women than it is for white women.

We now narrow our focus to only women who had had a tubal sterilization in the period 1990–1995 when they were younger than age 40 (Table 2). Thus, we shift the focus from women's situation at the time of the NSFG interview to their situation at the time of their tubal ligation. We consider only women who were recently sterilized because the sample's upper age limit makes the data progressively more se-

lective of a younger age at sterilization, thereby biasing the distribution of tubal sterilization by union status and marital history.

According to the percentage distribution of the 799 women who had had a tubal ligation from 1990 to 1995, most (68%) were married at the time of the procedure—54% in a first marriage and 14% in a second or higher-order marriage. Cohabiting women accounted for 12% of recent sterilizations; these women were about evenly split between those who had ever been married and those who had not.

Almost one in five women who recently had a tubal ligation were single; these women were more likely to have never been married than to have been widowed or divorced (12% versus 8%).

The distribution of union status and marital history at the time of tubal sterilization differs substantially by race and ethnicity: White women who had had a tubal sterilization were less likely to have been unmarried (either single or cohabiting) at the time they had the procedure (21%) than were Hispanics (34%) or blacks (64%). Black women were the most likely to have never been married at the time of their tubal ligation (46%), compared with Hispanics (20%) or whites (9%). Similarly, black women were twice as likely as white women to have been cohabiting at that time (19% versus 9%), but only slightly more likely than Hispanic women (19% vs. 16%). As these comparisons show, Hispanic women tended to fall between black and white women on measures of union status and history at tubal sterilization.

These differences reflect to some extent racial and ethnic differences in the pace of childbearing and in union formation. For example, compared with white women, black women complete intended childbearing earlier, spend more years being single and are less likely to be protected by a partner's vasectomy.¹⁵

Overall, at the time of their sterilization, most women were in their first marriage, or had ended a first marriage but had not yet entered a second one (Table 2). This fact limits potential fertility in higher-order marriages. The exception was black women, who were much more likely to have never been married at the time of their sterilization. Hence, many of those who subsequently marry will have their first-marriage fertility limited as well.

These data tell us that tubal sterilization is often sought by women who are not in stable unions, and who therefore do not have the option of vasectomy. The results may, however, simply reflect the increasing amount of time in which women who have completed their desired childbearing happen to be unmarried or cohabiting. The racial and ethnic differences in the relationship context of tubal sterilization are consistent with differences in the relative prevalence of cohabitation and marriage among these groups. To identify the potential decision processes underlying the choice of tubal sterilization, we now consider the effects of union status and marital history on the likelihood that women will make that choice.

Multivariate Analyses

Many analyses of sterilization risk are based on individuals or couples who do not intend to have any more children. In these analyses, those individuals or couples who *do* want more children are not considered to be at risk of sterilization. Determining the point at which decisions to terminate childbearing are made is no easy task, however. The usual method of ascertaining birth intentions is to use retrospectively reported intentions for prior births and to assume that the woman's intentions after the most recent birth were the same as her intentions reported at the time of the interview. Retrospectively reported intentions may not represent intentions at the time of the pregnancy or birth, however, and intentions reported during the interview may have changed since the most recent birth.

Because we do not have the complete histories of desire for children among women who were interviewed for the NSFG, we consider them to be at risk of a tubal sterilization at any point during the life course. By doing so, we must consider two interpretations of the effects of a particular experience or characteristic on the risk of tubal sterilization: it either influences the woman's decision to terminate childbearing, or it influences the costs and benefits of the procedure for those who have already decided to terminate childbearing. In addition, except as noted below, we must consider a third interpretation: that the choice of tubal sterilization reflects the lack of vasectomy as an alternative.

We used Cox proportional hazards models to estimate the effects of union status and marital history on the risk of a tubal ligation. We constructed a month-to-month history of changes in age, parity, union status and history, and historical period, beginning from the woman's 13th birthday. In the language of hazard regression models, the "event" we observe is a tubal ligation, and women are said to be censored when they either have a sterilizing operation other than tubal sterilization or still have not had a sterilization of any kind by the date of the interview.

Women's exposure to the risk of a tubal sterilization may also end when their partner obtains a vasectomy or when they form a union with a man who has already had a vasectomy. Unfortunately, the NSFG does not provide complete information on the vasectomies of a respondent's prior partners, either resident or nonresident. (Even the woman's recent contraceptive history does not appear to be reliable in this respect; more respondents reported

a partner's vasectomy in the survey's section on sterilization than reported any use of vasectomy in the contraceptive history.)

As Table 1 shows, however, we do know whether the woman's partner at the time of the interview had had a vasectomy; moreover, for women who were married or cohabiting at the time they were interviewed, we know when the vasectomy was obtained. In an effort to assess the impact of vasectomy on our results, we estimated models that censored on these known vasectomies using the date of the procedure for those occurring after the union began, and the date of entry into the union for women who married or began cohabiting with men who had already had a vasectomy.

Censoring on current vasectomies should capture the experience of most women. Women who had been in a previous union—especially a prior marriage—should not be at risk for tubal sterilization during any period in which their partner was protected by a vasectomy, but they would have reentered the risk pool for tubal sterilization when that union ended. We determined that 1,786 out of the 7,358 respondents (24%) who make up the sample for the multivariate analysis had been in a prior marriage that ended (usually a first marriage). We also know that 72% of these first marriages ended when the woman had fewer than two children, which means that they would have been at a low risk for any form of sterilization during that marriage.

Although we believe we have captured most of the periods during which a woman would have been protected by her partner's vasectomy, we found only minor differences between the estimates derived from models that censored at a partner's vasectomy and those derived from models that did not. Because we do not have complete information on vasectomy for all prior partners, we prefer to present models in which all periods of observation are treated the same—i.e., without censoring on a partner's vasectomy.

In our analyses, the baseline "clock" is the woman's age. The cumulative proportion of women who have had a tubal sterilization (shown in Figure 1) corresponds to an almost constant rate of ster-

Table 2. Percentage distribution of women younger than 40 who were sterilized during the period 1990–1995, by union status and marital history, according to race and ethnicity

Characteristic	All (N=799)	White (N=368)	Black (N=277)	Hispanic (N=154)
Married				
First marriage	53.8	61.6	30.7	52.2
Second or later	14.3	17.2	5.7	13.6
Cohabiting				
Formerly married	5.6	6.0	3.7	6.3
Never-married	6.5	2.9	14.9	10.0
Single				
Formerly married	8.0	5.9	14.0	8.3
Never-married	11.9	6.5	31.0	9.5
Total	100.0	100.0	100.0	100.0

Note: All data are weighted. Source: National Survey of Family Growth, Cycle 5 (1995).

ilization at each age, with a decline in the rate for women who reach their mid-30s without having had a tubal sterilization. What does change as the woman ages, however, is her union status, marital history and parity.

In our models, these characteristics are included as time-varying covariates, meaning that the covariate changes when a woman has a child or forms or dissolves a union. Parity at a given age provides a good proxy for whether a woman has reached her desired family size. We also include a time-varying indicator of whether the woman has had an unintended birth. (For each pregnancy, women were asked, "At the time you became pregnant with your [nth] pregnancy, did you yourself actually want to have another baby at some time?") We set the value of this indicator to one after the date of the first (if any) unwanted birth and to zero otherwise. We also specify the historical period (1964–1975, 1976–1985 and 1986–1995) as a time-varying covariate, in recognition of the fact that patterns of fertility and union formation and dissolution have been changing at the same time as tubal sterilization has become more acceptable.

We include as fixed covariates women's census region of residence, racial and ethnic group, and education. Region of residence was observed at the time of the interview and may not reflect the region in which she lived during earlier periods of her life, including the time at which she was sterilized. Because two-thirds of tubal sterilizations occurred within 10 years of the date of the interview, and because most geographic mobility is likely to be within the regional boundaries used in this analysis, we believe that the measure is adequate to capture variations in local norms and medical practice. Similarly, education includes schooling that may have

Table 3. Relative risk of tubal sterilization among women born between 1950 and 1970, by characteristic, according to model

Characteristic	Unadjusted	Model 1	Model 2	Model 3
Parity				
0	0.12***	0.12***	0.14***	0.16***
1	0.54***	0.54***	0.54***	0.55***
2 (ref)	1.00	1.00	1.00	1.00
3	2.46***	2.43***	2.40***	2.48***
4	3.94***	3.88***	3.66***	3.85***
Union status—prior marriage interaction				
Married—first marriage (ref)	1.00	1.00	1.00	1.00
Married—second or later marriage	1.63***	1.52***	1.56***	1.43***
Cohabiting—formerly married	1.38**	1.27	1.19	1.09
Cohabiting—never-married	0.93	1.26*	1.01	0.98
Single—formerly married	0.91	1.00	0.90	0.84*
Single—never-married	0.46***	0.99	0.76***	0.75***
Race/ethnicity				
White (ref)	1.00	na	1.00	1.00
Black	2.02***	na	1.72***	1.55***
Hispanic	1.55***	na	1.06	1.11
Ever had unwanted birth				
Yes	2.45***	na	na	0.73***
No (ref)	1.00	na	na	1.00
Education				
No high school diploma	1.53***	na	na	0.95
High school diploma (ref)	1.00	na	na	1.00
Some college	0.64***	na	na	0.83**
College degree	0.25***	na	na	0.47***
Region				
Northeast	0.64***	na	na	0.75***
Midwest	0.74***	na	na	0.76***
South (ref)	1.00	na	na	1.00
West	0.56***	na	na	0.55***
Period				
1964–1975	0.63**	na	na	0.61**
1976–1985	0.93	na	na	0.95
1986–1995 (ref)	1.00	na	na	1.00
Log-likelihood	na	-16561.9	-16513.2	-16406.0

*p .05. **p .01. ***p .001. Notes: ref=reference group. na=not applicable. Data are unweighted; N=7,358. Respondent's age is the baseline hazard and models are censored at either sterilization other than tubal sterilization or the date of interview.

occurred after periods of exposure, but almost all education will have been obtained prior to the ages at which sterilization usually occurs.

We tested for interactions between a respondent's racial and ethnic background and her union status and marital history, and found no substantial differences by racial and ethnic groups. We also considered interactions between the woman's parity and her union status and marital history; although these interactions slightly improved the fit of the model, they did not alter inferences about the effects of union status and marital history on the risk of tubal sterilization. Finally, we compared estimates from weighted and unweighted data; because we include characteristics (notably race and ethnicity) on which women were oversampled in our models, estimates that relied on weighted and unweighted data were virtually identical. We present results from unweighted data here

to take advantage of the efficiency gained (smaller standard errors) because blacks were oversampled.

The coefficients presented in Table 3 are relative risks, the exponent of coefficients from the Cox proportional hazard regression models. The omitted (reference) category of each variable is given a fixed value of 1.0; women in categories with values above one have a relatively higher risk of tubal sterilization, and those in categories with values below one have a relatively lower risk of being sterilized. (For example, a relative risk of 1.63 means that women in that group have a 63% higher risk of sterilization than the comparison group, while a relative risk of 0.54 means that women in a particular category have a risk of tubal sterilization about one-half that of the reference group.)

The first column of Table 3 shows the unadjusted associations—without controlling for any single variable other than age—between

women's characteristics and the risk of tubal sterilization. We then ran three subsequent models; the first controlled only for parity, union status and marital history; the second added the respondent's race and ethnicity to the controls; and the third, fully adjusted analysis incorporated the remaining covariates of having had an unwanted birth, educational attainment, region of residence and historical period.

The effects of parity are strong and stable across the four models. This probably reflects women's achievement of their desired or intended family size. No matter the individual controls, the relative risk of tubal sterilization for childless women is less than one-sixth that for women with exactly two children, and women with one child have slightly more than one-half the risk of those with two.

For women on the other side of the two-child norm, the risk more than doubles for mothers of three children and almost

quadruples for mothers of four or more. It should be noted that in these comparisons, we are estimating the parity effects at each age; thus, in some ways we are "controlling" for potential effects of age-parity combinations on the risk of tubal sterilization. (Because age serves as the baseline hazard in this Cox model, it is not directly estimated and thus does not appear as a coefficient in Table 3.)

The unadjusted association (first column) between union status and marital history is characterized by a much higher risk of tubal sterilization among women in second or higher-order marriages compared with those in first marriages. When no controls are entered into the analysis, cohabiting women who were previously married are more likely to obtain a tubal sterilization than women in first marriages. The risk of tubal sterilization for single, never-married women is less than one-half that for women in first marriages. It is striking that in the unadjusted analysis, single, formerly married women and cohabiting, never-married women are about as likely to obtain a tubal sterilization as are women in their first marriages.

In Model 1, we see that differences in parity account for the lower risk of tubal sterilization among single, never-married women, because that relationship became nonsignificant once parity was controlled for. The consideration of parity also slightly reduced the elevated risk for women in second or higher-order marriages, and reduced the risk for cohabiting women who were formerly married to marginal significance (p .10). On the other hand, net of parity, cohabiting women who have never been married are more likely than women in a first marriage to have obtained a tubal sterilization.

When we add race and ethnicity to the analysis (Model 2), we find that the higher tubal sterilization risk for Hispanic women found in the bivariate analysis is accounted for by their higher parity and different union statuses compared with white women. However, the elevated risk of tubal sterilization remains significant for black women, although it decreases slightly in magnitude; their high rate of single motherhood suppresses an otherwise negative effect of being single on the risk of tubal sterilization (Model 2 vs. Model 1). However, among all women, the risk of tubal sterilization during periods of singlehood is only 25% lower than that during marriage.

Entering controls for a prior unwanted birth, education, region and historical period produced few changes in the esti-

mated relative risks by union status and marital history (Model 3). In this full model, single, formerly married women have a risk of tubal sterilization approaching that of single, never-married women. We also see a slight reduction in the elevated risk of tubal sterilization among black women.

A striking change occurs, however, in the relationship between a prior unwanted birth and the risk of tubal sterilization once all control variables are included in the model. In the unadjusted analysis, those who had had a child after they wanted to stop childbearing had a higher overall risk of tubal sterilization than those who had never had an unwanted birth. This is consistent with their having already achieved their desired family size. After other covariates (parity in particular) were added, however, the direct effect of an unwanted birth was negative, as it reduced the risk of tubal sterilization by 27%. If controls for parity and other experiences adequately capture attainment of desired family size, then the experience of an unwanted birth may be an indicator of low contraceptive efficacy or limited access to contraceptive services, both of which may lower the likelihood of obtaining a tubal sterilization.

The estimated effects of a woman's education on the risk of tubal sterilization follow the pattern suggested by prior research, in which better-educated women have lower risks for tubal sterilization.¹⁶ Regarding the effect of region of residence, the risk of tubal sterilization was highest for Southern women and lowest for those living in the West. These education and regional effects are linked to known patterns of vasectomy; the groups with lower rates of tubal sterilization are those likely to have as partners men with relatively high rates of vasectomy. On the other hand, our incomplete analysis of vasectomy as a competing risk did not produce substantially different effects of education or region on the risk of tubal sterilization.

Discussion

Tubal sterilization is often sought by unmarried women: More than one-fifth of white women and almost two-thirds of black women were not married when they underwent a tubal sterilization in 1990–1995. Our multivariate analysis shows that although single women have lower rates of tubal sterilization than married or cohabiting women, the differences are not large. On the other hand, the lower rates among single women suggest that, net of current parity, these women may

have stronger concerns about the possibility of having children in new unions. Such concerns probably outweigh the other advantages of sterilization and of single women's ability to make sterilization decisions on their own.

Unexpectedly, cohabitation produced risks of tubal sterilization similar to those of marriage. The lower stability of cohabiting unions compared with marriages does not appear to be a factor in women's decisions on whether to maintain the ability to have children with potential future partners.

We expected that women who had experienced divorce would be more likely than others to consider the possibility of union dissolution and future partnerships, and therefore be less likely to seek tubal sterilization. We found, however, that prior experience of divorce increased the likelihood of tubal sterilization. Perhaps the experience of single parenthood makes a difference for these women; even if they anticipate future unions, they may be less willing to take a chance on ending up with more children as a single parent.

The relatively high rates of tubal sterilization among black women were not accounted for by union status and marital history in our analyses. We hypothesize that these elevated risks are due in part to the virtual absence of vasectomy as an alternative for black women.¹⁷ When we included the incomplete censoring at vasectomy in the model (not shown), the relative risk for tubal sterilization for black women was slightly reduced (from 55% higher than white women in the fully adjusted analysis to about 30% higher).

The remaining difference could result from black women having completed their desired childbearing relatively early in the life course and recognizing that they face a relatively long period of risk of contraceptive failure using other methods. It could also reflect a greater willingness of black women to make decisions about fertility control on their own. A less benign interpretation, however, is that black women's relatively high rates of tubal sterilization, especially for those who have never been married, may reflect a more restricted set of contraceptive alternatives available to these women.

Conclusions

Our research was stimulated by trends in rates of nonmarriage and divorce, which have dramatically changed the union context of contraceptive decisions. Our analyses suggest that an increasing proportion of women will consider tubal sterilization

while they are single, presumably without consulting their partner. The information and services these women seek may differ from those typically offered to married women and their husbands. In particular, single women may require counseling about the possibility of wanting children with a new partner. In a climate of high rates of separation and of divorce, cohabiting and married couples may also need to consider the extent to which decisions to end childbearing are based on the assumption that they will remain together.

To a considerable extent, the increasing gender gap in contraceptive sterilization can be attributed to the relatively high rates of tubal sterilization among single women. Although men are also spending more of their childbearing years being single, gendered patterns of repartnering and childrearing operate to reduce single men's interest in a permanent contraceptive method. Men are more likely than women to find a new partner after separation or divorce, and they are more likely to find a younger partner without children; they are also less likely to have primary responsibility for rearing the children they already have. As a result, men's interest in future childbearing may be greater than that of women in otherwise similar circumstances, and their rates of vasectomy should be correspondingly lower than women's rates of tubal ligation. Adding this difference to the existing gender gap in who gets sterilized among married and cohabiting couples means that contraceptive sterilization remains predominantly a woman's method in the United States.

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(continued on page 49)

Union Status, Marital History...

(continued from page 41)

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