

# Determinants of Early Implant Discontinuation Among Low-Income Women

By Debra Kalmuss, Andrew R. Davidson, Linda F. Cushman, Stephen Heartwell and Marvin Rulin

*The determinants of contraceptive implant discontinuation within six months of insertion were examined among 786 low-income women attending family planning clinics in three U.S. cities. The six-month cumulative life-table discontinuation rate was 7.6%. Menstrual side effects were the most common reasons given for early implant removal, although women who discontinued use were no more likely than those who continued with the method to report menstrual irregularities. Women who opted for early removal were more likely than those who continued with the method to experience headaches, hair loss, weight gain and arm infection. Logistic regression analysis indicates that dissatisfaction with prior contraceptive methods, a partner who wants a child within the next two years, perceived pressure from health care providers to choose the implant, exposure to negative media coverage and the number of implant side effects significantly predict early implant discontinuation. Women's social and demographic characteristics, Medicaid status and motivation to avoid an unplanned pregnancy were not significantly related to early removal.*

(Family Planning Perspectives, 28:256-260, 1996)

In December 1990, the U.S. Food and Drug Administration approved a contraceptive method that offered women the first dramatically new reversible birth control alternative in more than 30 years: a subdermal implant containing the synthetic progestin levonorgestrel that required no ongoing user effort and provided up to five years of contraceptive protection at levels of efficacy comparable to female sterilization.<sup>1</sup>

The contraceptive implant may not be an appropriate option for women who desire short-term contraceptive protection, however. It is the only reversible method that requires minor surgery for insertion and removal, and while these procedures are simple and relatively risk-free, they nonetheless entail the invasiveness inherent in any surgical intervention. The expense of the implant also makes long-

term use more appropriate. While the cost of most reversible contraceptives is distributed fairly evenly throughout the period of use, the implant carries a substantial initial expenditure: The median cost of implant insertion ranges from \$425 to \$550.<sup>2</sup> Thus, its cost-effectiveness is directly related to the duration of its use.<sup>3</sup>

These distinctions highlight the need to understand what factors might predict early implant discontinuation. Women seeking long-term contraceptive protection are likely to find that the benefits of this method outweigh the costs. However, women who opt for early removal undergo two surgical procedures and incur the same expense as women who use the method for a full five years, yet they reap little contraceptive benefit. Moreover, discontinuation of the implant—or of any contraceptive method—heightens the risk of unintended pregnancy, an outcome that may prove costly to the women and to society at large.<sup>4</sup>

Nonetheless, early implant discontinuation has received surprisingly little study. The limited information available is based primarily on data from developing countries<sup>5</sup> or from clinical trials in the United States.<sup>6</sup> Other studies of implant discontinuation in the United States have been based on relatively small samples or have focused on adolescents.<sup>7</sup> Those U.S. studies that have employed larger samples and wider age distributions have not examined the determinants of implant discontinuation within a multivariate framework.<sup>8</sup>

## Methodology

This article examines early implant discontinuation using data from a large, longitudinal, multisite study of implant use in the United States. Our approach was to ask women who had had their implant removed within six months of insertion why they had done so. We then compared the implant experiences of early removers with those of women who had continued with the method. Finally, we estimated a multivariate model of early implant discontinuation to identify which variables best predict early removal.

Our model included a set of factors found to be related to contraceptive discontinuation: social and demographic characteristics, motivation to avoid an unintended pregnancy and satisfaction with previous contraceptive methods.<sup>9</sup> We also included method-related side effects, which have been shown to be a key determinant of implant discontinuation.<sup>10</sup> Our model also incorporated two additional factors that previous inquiries have frequently omitted: partner's fertility attitudes and the adequacy of contraceptive counseling that a woman receives.

We added a final variable to our model to assess the effects of negative media reports on early implant removal. Since the media are also an important source of influence over women's contraceptive decisions, negative publicity about a method of birth control can dramatically affect its acceptability: The marked decline in domestic use of the IUD subsequent to negative publicity about the Dalkon Shield is one such example.

Approximately one year into our 18-month recruitment period, a barrage of negative publicity about the contraceptive implant appeared in both the English and Spanish media: In summer 1994, several class-action suits were initiated against the U.S. distributor of Norplant (the brand name under which the implant is commercially sold) and the media carried numerous stories, some quite sensational, about the alleged risks associated with use of the implant. The coverage began slowly in June 1994, increased dramatically in July and remained heavy through fall 1994.

In a prior analysis of data from a longi-

Debra Kalmuss is associate professor of public health, Andrew R. Davidson is associate professor of public health and Linda F. Cushman is assistant professor of public health at the Center for Population and Family Health, Columbia University School of Public Health, New York. Stephen Heartwell is associate professor of public health in the Department of Obstetrics and Gynecology and director of the Division of Maternal Health and Family Planning, University of Texas Southwestern Medical School, Dallas. Marvin Rulin is professor, Department of Obstetrics, Gynecology and Reproductive Sciences, Magee Women's Hospital, Pittsburgh. This research was supported by grant R01-HD29638 from the National Institute of Child Health and Human Development and by grant 93-1071 from the Henry J. Kaiser Family Foundation. Wyeth-Ayerst Laboratories provided Norplant kits free of charge for a portion of the study participants.

tudinal study of contraceptive implant use, we found that women recruited into the study during this period of negative press attention were significantly less likely to choose the implant than were women who were recruited prior to the onset of the media coverage.<sup>11</sup> In this analysis, we examine whether women whose first six months of implant use coincided with the media coverage were more likely to have the implant removed than were women whose first six months of use preceded the media coverage.

Our analysis of the data is guided by several hypotheses. We predict that early implant removal will be negatively related to those factors that strengthen a woman's motivation to avoid an unintended pregnancy (parity, number of unplanned pregnancies and how unhappy a woman would be if she were to become pregnant within the next year). We also predict that implant removal will be positively related to the presence of a partner who wants to have a child within the next two years.

We further expect that women who have a history of method dissatisfaction will be less tolerant of the side effects associated with the implant and more likely to discontinue use than women who were satisfied with their previous methods.

Two aspects of the preinsertion counseling that a woman receives are likely to be associated with her decision to continue with the implant: More thorough counseling will be negatively associated with early discontinuation, and the perception that a health care provider or counselor attempted to influence a woman's choice of the implant will be positively associated with early removal.

We hypothesize that the decision to undergo early removal will be positively associated with the number of implant-related side effects that a woman reports. Finally, we expect that women who adopted implant use within six months of the beginning of the negative media coverage will be more likely to discontinue the method than women who completed their first six months of use prior to the negative press exposure.

We offer no directional hypotheses regarding the effects of social and demographic variables on early implant discontinuation. Prior research relying on bivariate analyses has found no relationship between age, race and ethnicity, and educational attainment, and implant discontinuation.<sup>12</sup> These factors are included as control variables, as well as to assess whether, in a multivariate context, they affect early method discontinuation.

### **Sample**

This article reports on data from a longitudinal study of implant choice among low-income clinic patients in three U.S. cities—Dallas, New York and Pittsburgh. Women aged 15 or older were recruited from hospital-based family planning clinics. Those who had received contraceptive counseling at the clinic within the three months prior to the baseline interview and who were choosing the implant for the first time were eligible for inclusion in the study. Eligibility was assessed by a screening form distributed in the clinic waiting room to women who had completed pre-insertion counseling, and all women who met the study criteria were asked to participate.

Interviews were conducted in the clinics between June 1993 and October 1994. More than 95% of the women who were approached completed the interviews (n=910). Eighty-six percent of the women who completed the baseline interview were reinterviewed by telephone six months later (or upon removal of the implant, if the woman discontinued use before the six-month follow-up occurred). These 786 women comprise the sample discussed in this article. Comparison of the women who were successfully followed with those lost to follow-up indicated no significant differences between these two groups on age, race and ethnicity, educational attainment, parity or age at first birth.

### **Measures**

A woman's decision to have the contraceptive implant removed within the first six months of use was the outcome variable for this study. The social and demographic variables were measured as a series of dummy variables: Age was coded 1 if the woman was a teenager and 0 if she was aged 20 or older; educational attainment was coded 1 if the women had completed high school and 0 if she had not; and receipt of Medicaid was coded 1 and nonreceipt was coded 0. Race and ethnicity were measured with a series of dummy variables that distinguished between each of the three racial and ethnic groups in our sample (white, black and Hispanic).

Fertility motivation was assessed using three variables: parity; number of unplanned pregnancies; and a four-point scale measuring the level of satisfaction or dissatisfaction that a woman would feel were she to become pregnant within the next year. Dissatisfaction with previous methods was defined as the number of methods that a woman had used that she reported being somewhat or very dissatisfied with:

Respondents were asked whether they had used each of seven contraceptive methods, and their level of satisfaction with each of the methods used was assessed. Additionally, partner's fertility desires were measured by whether a woman perceived that her partner wants her to get pregnant within the next two years.

The quality of preinsertion services was assessed with two items. The first was a summary measure of topics covered during counseling, scored from 0–3. The second measure assessed whether a respondent perceived that a counselor or health care provider at the clinic tried to influence her to use the implant.

Exposure to negative media coverage about the implant was coded as a dichotomous variable. Women who completed their first six months of implant use or had their implant removed after June 30, 1994, were coded 1 on this variable; all other women were coded 0.

We developed several measures of negative implant experiences. We first asked women to indicate whether they had experienced each of 12 negative outcomes of implant use. We then measured the severity of each outcome on a four-point scale ranging from "did not experience the outcome" to "a very severe occurrence of the outcome." In addition, we developed a measure indicating the number of negative implant outcomes that a woman reported. (This variable had a range of 0–12.) Finally, we used open-ended questions to assess women's main reasons for implant discontinuation.

All predictor variables, with the exception of method side effects, were measured prior to implant insertion. Thus, we are assured that the independent variables in our model were measured prior to our outcome variable, early implant discontinuation. We used a multivariate logistic regression to analyze early implant discontinuation. The coefficients in this model represent the change in the log odds of having discontinued implant use versus continuing use at six months postinsertion.

### **Results**

The social and demographic characteristics of the sample are presented in Table 1 (page 258). The women in the sample were young, poor and primarily from minority racial and ethnic backgrounds. Only 55% had completed high school, and 22% were currently employed. Ninety-four percent of the sample reported at least one pregnancy; 70% had had at least one unintended pregnancy and 29% reported two or more such pregnancies. Only 8% of the

**Table 1. Percentage distribution of women obtaining the contraceptive implant at family planning clinics in Dallas, New York and Pittsburgh, by selected characteristics, June 1993–October 1994**

Characteristic	% (N=786)
<b>Age</b>	
<20	33
20–23	31
24–29	27
≥30	9
<b>Race/ethnicity</b>	
Black	23
White	16
Hispanic	61
<b>Education</b>	
<high school	45
≥high school	55
<b>Employment</b>	
Currently employed	22
Not currently employed	78
<b>Income</b>	
<\$5,000	33
5,000–9,999	29
10,000–14,999	19
15,000–19,999	9
≥20,000	10
<b>Number of pregnancies</b>	
0	6
1	26
2	33
≥3	35
<b>Number of unplanned pregnancies</b>	
0	30
1	41
2	19
≥3	10
<b>Number of live births</b>	
0	8
1	38
2	38
≥3	16
<b>Age at first birth</b>	
<20	60
≥20	40
Total	100

women had had no live births, while 54% had had two or more. Finally, among those with a live birth, 60% were younger than 20 at the time of their first birth, and more than one-third (36%) were 17 or younger.

Fifty-eight women discontinued implant use within six months of insertion, yielding a cumulative life-table six-month discontinuation rate of 7.6%. This rate is consistent with published one-year discontinuation rates, which range from 10–20%.<sup>13</sup> Using life-table analysis over a six-month interval, we found an extremely low risk of removal in the first month of use (0.38). This risk increased approximately 2.5 times in month two (to 1.02) and increased again in month three to 1.55. During months four through six, the risk of removal remained close to 1.50 (not shown).

Table 2 presents responses to the open-ended question probing the main reasons for implant removal. The most frequently cited main reasons for removal of the implant were menstrual side effects (28%) and headaches (19%), findings consistent with previous research.<sup>14</sup> Approximately 10% of respondents cited arm discomfort or infection and another 9% cited weight changes (primarily weight gain) as their main reason for early removal. Seven percent attributed discontinuation to mood changes, while 5% mentioned either hair loss, chest pains or negative media reports as their reason for removal. None of the women who discontinued implant use early cited wanting to have a baby as their main reason for removal.

Table 3 presents the results of the closed-ended questions on 12 method-related side effects experienced by women who continued use of the implant compared with those who discontinued use. The single most common side effect, reported by approximately three-quarters of women in both groups, was less regular menstrual periods. Moreover, the two groups of women did not differ in the likelihood of experiencing six of the 12 identified side effects: Women who discontinued the method were no more likely than those who continued to report any of the three menstrual side effects (heavier menstrual flow, less regular periods and increased spotting), or to report acne, pain at insertion or that the device was visible.

However, the two groups did differ significantly in their experience of several negative outcomes. Women who discontinued the method before six months of use were significantly more likely than those who continued method use to report headaches (73% vs. 38%), hair loss (48% vs. 33%), weight gain (59% vs. 42%) and health problems that respondents believed would be long-term (37% vs. 2%). Those who discontinued early were also more likely than continuing users to consider these side effects severe and to perceive use of the implant as inconvenient. Finally, women who sought early removal were significantly more likely than those who continued with the method to report arm infection, but they were only marginally more likely to rate the experience as severe (p=.057).

Table 4 presents the results of the logistic regression of early implant discontinuation. The first column presents findings on the preinsertion factors that influenced early implant discontinuation. A history of dissatisfaction with previous methods, partner's desire for a child, exposure to negative media coverage and

the perception that a health care provider tried to influence a woman's method choice were all significant predictors of removal within the first six months of use. None of the social or demographic variables or the measures of motivation to avoid an unplanned pregnancy had a significant impact on early discontinuation.

The second column of Table 4 shows the results of a model that included the number of implant-related side effects that a woman experienced. While this variable was strongly related to early discontinuation, its inclusion did not substantially alter the results. However, in this expanded model, women who reported more negative feelings toward becoming pregnant within the next year were marginally more likely to have had the implant removed early (p=.053), and black women were significantly more likely than Hispanics to have done so.

To more fully examine the effects of specific implant experiences on early removal, we estimated a final model that included assessments of the severity of each of the 12 specified side effects. In this model, only headaches, the perception that the implant was inconvenient to use and the perception that long-term health problems would result from implant use predicted early removal (not shown). Severity of an arm infection resulting from implant use was marginally related to early removal (p=.062). Finally, while those who discontinued implant use cited menstrual disturbances as their main reason for removal, the severity of each of three different menstrual outcomes was not significantly related to early removal.

## Discussion

The rate of early implant discontinuation in this population was low: Only 7.6% of women using the method discontinued within the first six months of use. This rate compares favorably with discontinuation rates of other reversible contraceptive methods. For example, data from a na-

**Table 2. Percentage distribution of main reasons for implant removal within six months (N=58)**

Reason	%
Menstrual side effects	28
Headaches	19
Arm discomfort or infection	10
Weight change	9
Mood changes	7
Hair loss	5
Chest pain	5
Negative media reports	5
Miscellaneous	12
Total	100

tionally representative sample of currently married women indicate a one-year discontinuation rate of 28% among pill users.<sup>15</sup> However, rates of pill discontinuation are much higher among young, poor, urban, primarily minority women—populations whose social and demographic characteristics more closely resemble those of our sample. Studies based on inner-city adolescent clinic samples indicate that approximately 45% of women using the pill discontinue use within the first six months,<sup>16</sup> while in a sample of 412 injectable users recruited from the same population as our implant sample, the discontinuation rate after a single injection was 31%.<sup>17</sup> The low rate of early implant discontinuation that we report is encouraging, as it suggests that few women are exposing themselves to the costly and relatively invasive implant procedure without gaining the benefit of long-term contraceptive protection.

Our findings indicate that the impact of exposure to negative media coverage was relatively modest: While fully one-third of our sample experienced at least part of their first six months of use during a period of intense negative coverage, and those exposed were more likely than others to have an early removal (15% vs. 3%), 85% of the women confronted with negative messages continued to use the implant. In fact, these women were very satisfied with the method. During follow-up interviews, 81% of implant users contacted after the onset of the media coverage reported that they would recommend the method to a friend. Eighty-six percent reported no regret about their decision to use the implant, and nearly three-quarters (72%) indicated they would make the same decision if they were to do it again. Almost two-thirds of the women (63%) reported that they plan to use the implant for the full five years. These findings contradict the common impression that the negative publicity regarding the implant induced most users to discontinue the method.

Another key finding is that negative experiences associated with the implant clearly play a role in a woman's decision to discontinue method use. Those who had their implant removed early were significantly more likely to report six of the 12 specified side effects. Moreover, the number of side effects was a strong predictor of early discontinuation, although only three of the 12 specific negative experiences were significantly related to early removal.

Our findings point to the need for further research examining the relationship

**Table 3. Percentage of implant users experiencing side effects and mean level of severity, both by whether use continued beyond six months**

Side effect	% experiencing effect			Mean level of severity	
	Total (N=786)	Continued (N=728)	Discontinued (N=58)	Continued (N=728)	Discontinued (N=58)
Periods less regular†	76.1	76.3	73.2	2.8	3.0
Increased spotting†	54.5	54.1	60.0	2.0	2.4*
Heavier menstrual flow†	43.2	42.4	53.6	1.9	2.4**
Weight gain†	43.1	41.9*	58.8	1.8	2.3**
Headaches†	40.2	37.6***	73.2	1.8	2.9***
Implant visible†	38.3	38.2	39.3	1.6	1.7
Hair loss†	34.3	33.2*	48.2	1.7	2.1*
Acne†	26.4	25.9	33.9	1.4	1.7
Insertion pain†	17.6	17.2	23.2	1.3	1.3
Implant inconvenient to use†	4.7	3.7***	18.2	1.3	2.1***
Long-term health concerns‡	4.7	2.2***	37.0	1.0	1.8***
Arm infection‡	1.2	0.7***	7.3	1.0	1.2

\*p<.05. \*\*p<.01. \*\*\*p<.001. Notes: †Severity scored as 1=not at all; 2=a little; 3=some/somewhat; 4=very/a lot. ‡Severity scored as 1=not at all; 2=minor; 3=moderate; 4=severe.

between implant experiences and method discontinuation. The most common side effects reported by all implant users were menstrual changes, and women were most likely to report these changes as their main reason for method discontinuation in our multivariate models. However, those who discontinued were no more likely than others to report experiencing each of the three most common menstrual side effects examined. While two of these outcomes were rated as significantly more severe among the women who discontinued early than among those who did not, in the multivariate model that included measures of severity, none of the menstrual side effects were significantly related to early removal. Other researchers have noted similar findings.<sup>18</sup>

The prevalence of menstrual side effects related to the method may explain why these factors are not reliable predictors of early implant discontinuation. Women are likely to be thoroughly informed about them during preinsertion counseling, which may encourage realistic expectations that temper method dissatisfaction. In addition, the counseling may serve to discourage women for whom such menstrual changes would be intolerable, thus removing them from the pool of potential users. Nonetheless, while women who discontinued the implant were no more likely than others to report menstrual side effects, they identified these side effects as their main reason for removal. This inconsistency warrants further study.

An important predictor of implant discontinuation that is often overlooked in contraceptive counseling is partner's fertility desires. The counselors in our study explored women's fertility desires in depth, in an attempt to match women who sought long-term protection with an appropriate

method. The success of these efforts is reflected in the data from our baseline interviews, indicating that no woman choosing the implant reported that she wanted to have a baby within the next two years. However, women's partners did not necessarily agree, and, in fact, women whose partners wanted a child within the next two years were significantly more likely than others to have an early removal. This suggests that family planning professionals should explore a woman's perceptions of her partner's desires in addition to those

**Table 4. Odds that women will discontinue the implant within six months, by characteristics, according to whether regression includes implant side effects**

Characteristic	Without side effects	With side effects
Age <20	-0.102	-0.178
Black vs. white	0.388	0.686
Hispanic vs. white	0.015	-0.233
Black vs. Hispanic	0.373	0.919*
Completed high school	-0.232	-0.213
Receives Medicaid	0.116	-0.001
Number of live births	0.024	0.056
Number of unplanned pregnancies	-0.057	-0.118
Negative feelings about pregnancy within next year	0.196	0.237†
Dissatisfaction with previous contraceptive methods	0.353*	0.382*
Partner's fertility desires‡	1.023**	0.871*
Adequacy of preinsertion counseling	0.441	0.403
Perceived pressured to choose implant	1.069*	1.072*
Exposure to negative media coverage	1.815**	1.714*
Number of implant side effects	na	0.436***
-2 x log likelihood	362.23	386.67
Degrees of freedom	14	15

\*p<.05. \*\*p<.01. \*\*\*p<.001. †.07>p>.05. ‡Respondents with no partners were coded as 60 on this variable, and a dummy variable was included in the model (coded 1) if the respondent had no partner. Note: na=not applicable

of the woman when counseling her about selecting a contraceptive method.

Our findings regarding counselor influences caution family planning providers against attempting to influence women to choose a specific method. While only a small minority of our sample reported that a provider had tried to convince them to use the implant (6%), women who perceived such influences were more likely than those who did not to have had their implant removed within the first six months of use. Thus, even when providers "succeed" in influencing a woman's choice of method, the "success" can be short-lived, as it may place a woman at higher risk of early discontinuation. The best counseling approach appears to entail the provision of information that enables women to fully evaluate the strengths and weaknesses of their contraceptive options, so that they can ultimately make free and informed contraceptive choices.

Our findings offer implications for future research as well. In this analysis, we focused on implant removals occurring within six months of method insertion. However, assessing the rates of removal at longer postinsertion intervals is also necessary. Future research should examine whether the variables that significantly affect implant removal within the first six months of use remain significant in later decisions to discontinue implant use. Finally, subsequent investigations should assess whether factors that are not key determinants of early discontinuation, such as women's fertility motivations and desires, become significant after longer intervals of use.

## References

1. J. Trussell and K. Kost, "Contraceptive Failure in the United States: A Critical Review of the Literature," *Studies in Family Planning*, 18:237-283, 1987; and A. Thomas,

Jr., and S. LeMelle, "The Norplant System: Where Are We in 1995?" *Journal of Family Practice*, 40:125-127, 1995.

2. J. J. Frost, "The Availability and Accessibility of the Contraceptive Implant for Family Planning Agencies in the United States, 1991-1992," *Family Planning Perspectives*, 26:4-10, 1994; and L. Kaeser, "Public Funding and Policies for Provision of the Contraceptive Implant, Fiscal Year 1992," *Family Planning Perspectives*, 26:11-16, 1994.

3. J. Trussell et al., "The Economic Value of Contraception: A Comparison of 15 Methods," *American Journal of Public Health*, 85:494-503, 1995.

4. Institute of Medicine, *The Best Intentions: Unintended Pregnancy and the Well-Being of Children and Families*, National Academy Press, Washington, D. C., 1995; J. Trussell et al., 1995, op. cit. (see reference 3); and P. Lee and F. Stewart, "Failing to Prevent Unintended Pregnancy Is Costly," *American Journal of Public Health*, 85:479-480, 1995.

5. J. Diaz et al., "Bleeding Complaints During the First Year of Norplant Implants Use and Their Impact on Removal Rate," *Contraception*, 53:91-95, 1996; T. Kane, G. Farr and B. Janowitz, "Initial Acceptability of Contraceptive Implants in Four Developing Countries," *International Family Planning Perspectives*, 16:49-54, 1990; G. Lopez et al., "Two-Year Prospective Study in Colombia of Norplant Implants," *Obstetrics and Gynecology*, 68:204-208, 1986; F. Lubis et al., "One-Year Experience with Norplant Implants in Indonesia," *Studies in Family Planning*, 14:181-184, 1983; I. Sivin, "Norplant Clinical Trials," in S. E. Samuels and M. D. Smith, eds., *Dimensions of New Contraceptives: Norplant and Poor Women*, Henry J. Kaiser Family Foundation, Menlo Park, Calif., 1992, pp. 1-19; and S. Stavapan, K. Kanchanasinith and S. Varakamin, "Perceptions and Acceptability of Norplant Implants in Thailand," *Studies in Family Planning*, 14:170-176, 1983.

6. P. Darney et al., "Acceptance and Perceptions of Norplant among Users in San Francisco, USA," *Studies in Family Planning*, 21:152-156, 1990; and I. Sivin, 1992, op. cit. (see reference 5).

7. V. Cullins et al., "Preliminary Experience with Norplant in an Inner City Population," *Contraception*, 47:193-203, 1993; —, "Comparison of Adolescent and Adult Experiences with Levonorgestrel Contraceptive Implants," *Obstetrics and Gynecology*, 83:1026-1032, 1994; M. Polaneczky et al., "The Use of Levonorgestrel Implants (Norplant) for Contraception in Adolescent Mothers," *New England Journal of Medicine*, 331:1201-1206, 1994; S. Rosenthal et al., "Experience with Side Effects and Health Risks Associated with Norplant Implant Use in Adolescents," *Contraception*, 52:283-285, 1995; A. Berenson and

C. Wiemann, "Use of Levonorgestrel Implants Versus Oral Contraceptives in Adolescence: A Case-Control Study," *American Journal of Obstetrics and Gynecology*, 172:1128-1135, 1995; and —, "Patient Satisfaction and Side Effects with Levonorgestrel Implant: Use in Adolescents 18 Years of Age or Younger," *Pediatrics*, 92:257-260, 1993.

8. M. Frank et al., "Characteristics and Experiences of American Women Electing for Early Removal of Contraceptive Implants," *Contraception*, 52:159-165, 1995; and —, "One-Year Experience with Subdermal Contraceptive Implants in the United States," *Contraception*, 48:229-243, 1993.

9. W. Grady, M. Hayward and F. Florey, "Contraceptive Discontinuation Among Married Women in the United States," *Studies in Family Planning*, 19:227-235, 1988; C. Hammerslough, "Characteristics of Women Who Stop Using Contraceptives," *Family Planning Perspectives*, 16:14-18, 1984; and L. Tyrer, "Obstacles to Use of Hormonal Contraception," *American Journal of Obstetrics and Gynecology*, 170:1495-1498, 1994.

10. M. Frank et al., 1995, op. cit. (see reference 8); —, 1993, op. cit. (see reference 8); and J. Diaz et al., 1996, op. cit. (see reference 5).

11. D. Kalmuss et al., "The Determinants of Norplant Use," paper presented at the annual meeting of the Population Association of America, San Francisco, Calif., April 6-8, 1995.

12. M. Frank et al., 1995, op. cit. (see reference 8); and —, 1993, op. cit. (see reference 8).

13. J. Diaz et al., 1996, op. cit. (see reference 5); and I. Sivin, 1992, op. cit. (see reference 5).

14. P. Darney et al., 1990, op. cit. (see reference 6); I. Sivin, 1992, op. cit. (see reference 5); and A. Berenson and C. Wiemann, 1993, op. cit. (see reference 7).

15. R. Hatcher et al., *Contraceptive Technology*, 16th revised ed., Irvington Publishers, New York, 1994.

16. A. Berenson and C. Wiemann, 1995, op. cit. (see reference 7); and M. Polaneczky et al., 1994, op. cit. (see reference 7).

17. A. Davidson et al., "Rates of Injectable Contraceptive Discontinuation and Subsequent Unintended Pregnancy Among Low-Income Women," paper submitted for publication.

18. S. Rosenthal et al., 1995, op. cit. (see reference 7); and L. Dugoff et al., "Assessing the Acceptability of Norplant Contraceptive in Four Patient Populations," *Contraception*, 52:45-49, 1995.