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ORIGINAL ARTICLE

Effectiveness of Long-Acting Reversible Contraception

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ABSTRACT

BACKGROUND

The rate of unintended pregnancy in the United States is much higher than in other developed nations. Approximately half of unintended pregnancies are due to contraceptive failure, largely owing to inconsistent or incorrect use.

METHODS

We designed a large prospective cohort study to promote the use of long-acting reversible contraceptive methods as a means of reducing unintended pregnancies in our region. Participants were provided with reversible contraception of their choice at no cost. We compared the rate of failure of long-acting reversible contraception (intrauterine devices [IUDs] and implants) with other commonly prescribed contraceptive methods (oral contraceptive pills, transdermal patch, contraceptive vaginal ring, and depot medroxyprogesterone acetate [DMPA] injection) in the overall cohort and in groups stratified according to age (less than 21 years of age vs. 21 years or older).

RESULTS

Among the 7486 participants included in this analysis, we identified 334 unintended pregnancies. The contraceptive failure rate among participants using pills, patch, or ring was 4.55 per 100 participant-years, as compared with 0.27 among participants using long-acting reversible contraception (hazard ratio after adjustment for age, educational level, and history with respect to unintended pregnancy, 21.8; 95% confidence interval, 13.7 to 34.9). Among participants who used pills, patch, or ring, those who were less than 21 years of age had a risk of unintended pregnancy that was almost twice as high as the risk among older participants. Rates of unintended pregnancy were similarly low among participants using DMPA injection and those using an IUD or implant, regardless of age.

CONCLUSIONS

The effectiveness of long-acting reversible contraception is superior to that of contraceptive pills, patch, or ring and is not altered in adolescents and young women. (Funded by the Susan Thompson Buffet Foundation.)

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Unintended pregnancy is a major problem in the United States. Approximately 3 million pregnancies per year — 50% of all pregnancies — are unintended, and this rate is significantly higher than that in other developed countries.[1] Unintended pregnancy in the United States results in 1.2 million abortions per year,[2] has negative effects on women's health and education and the health of newborns, and imposes a considerable personal burden as well as a financial burden on families and society.[3] Approximately half of unintended pregnancies result from contraceptive failure, usually owing to incorrect or inconsistent use of contraception, and the remainder are due to nonuse.[4-6]

The most commonly used contraceptive method in the United States is the oral contraceptive pill.[7] Because the pill requires daily compliance, failure rates calculated on the basis of "perfect use" differ from real-world failure rates calculated on the basis of typical use. Annual failure rates with typical use of oral contraceptive pills are estimated at 9% for the general population, 13% for teenagers, and 30% or higher for some high-risk subgroups.[4,8] Prior estimates of the failure rates with typical oral-contraceptive use have relied on retrospective survey data, primarily from the National Survey of Family Growth.[9]

Long-acting reversible contraceptive methods, including intrauterine devices (IUDs) and subdermal implants, are not user-dependent and have very low failure rates (less than 1%), which rival those with sterilization.[9] Despite their proven safety in women and adolescents of all ages,[10,11] IUDs are used by only 5.5% of women who use contraception in the United States.[7] Other developed countries, such as the United Kingdom and France, where IUDs are used more frequently, have rates of unintended pregnancy that are lower than those in the United States.[12]

Prospective data on contraceptive failure from a large number of women in the United States are limited. We analyzed data from a cohort of participants at risk for unintended pregnancy, who received contraceptive counseling and free contraception, to compare the rate of failure of long-acting reversible contraception (IUDs and implants) with the failure rates for other commonly prescribed contraceptive methods (pills, transdermal patch, vaginal ring, and depot medroxyprogesterone acetate [DMPA] injection).

METHODS

STUDY ENROLLMENT

The Contraceptive CHOICE Project is a prospective cohort study with the primary goal of promoting the use of long-acting reversible contraceptive methods as a means of reducing unintended pregnancies.[13] From August 2007 through September 2011, we enrolled 9256 participants at risk for unintended pregnancy. All participants chose a contraceptive method and received it at no cost. Study participants were a convenience sample of women and adolescents in the St. Louis region, recruited by means of referrals from medical providers, newspaper reports, study flyers, and word of mouth.

The study protocol was approved by the local institutional review board before recruitment was initiated. All participants provided written informed consent.

Eligible participants were 14 to 45 years of age, were not currently using a contraceptive method or were willing to switch to a new reversible contraceptive, had no desire for pregnancy for at least the next 12 months, were sexually active or were planning to become sexually active with a male partner during the next 6 months, resided in the St. Louis region, and spoke English or Spanish. Persons were excluded if they had undergone a hysterectomy or sterilization procedure.

STUDY DESIGN

Before enrollment in the study, all potential participants were read a standardized script regarding long-acting reversible contraceptive methods that stated that the two IUDs and the subdermal implant were the most effective methods of contraception (see the Supplementary Appendix, available with the full text of this article at NEJM.org). If they were eligible for enrollment, participants received contraceptive counseling regarding all reversible contraceptive methods, including their effectiveness, side effects, risks, and benefits. Each participant was then provided with a reversible contraceptive method of her choice at no cost for 3 years (first 5090 participants) or 2 years (remainder of cohort). Participants were permitted to discontinue or switch methods as many times as desired during the follow-up period. A comprehensive baseline interview was performed, and participants were screened for sexually transmitted infections.

Participants were followed prospectively, with telephone interviews at 3 and 6 months and every 6 months thereafter for the duration of follow-up. Participants received a $10 gift card for every completed follow-up interview. In the baseline and follow-up interviews, we collected comprehensive information on demographic characteristics and reproductive history.

This analysis includes the first 7486 participants who used an IUD, implant, DMPA injection, pills, patch, or ring during the study. Periods of condom use or other contraceptive method use (e.g., diaphragm or natural family planning) were excluded from the analysis of contraceptive failure. At each survey, participants were asked about missed menses and possible pregnancy. Any participant who thought she might be pregnant was asked to come in for urine pregnancy testing. A pregnancy log was used to record all pregnancies. Participants who had a pregnancy were asked if it was intended and what contraceptive method (if any) they were using at the time of conception. The conception date was estimated from the date of the last menstrual period or from the gestational-age assessment on ultrasonography. Contraceptive-method failure was defined as conception that occurred during a period when the contraceptive method was used. If the participant stated that she had stopped using the method, this was listed as "no method" and was not considered a contraceptive-method failure. We excluded conception that occurred after a participant stopped using a method owing to a desire to conceive (intended pregnancy).

Table 1. Characteristics of Study Participants, According to Contraceptive Method Chosen at Baseline.*

Characteristic	PPR (N=1527)	DMPA (N=176)	LARC (N=5781)
Age — yr	23.9±4.7	23.9±5.5	25.5±6.0
Race — no./total no. (%)†			
Black	639/1519 (42.1)	122/176 (69.3)	2846/5750 (49.5)
White	752/1519 (49.5)	43/176 (24.4)	2471/5750 (43.0)
Other	128/1519 (8.4)	11/176 (6.3)	433/5750 (7.5)
Educational level — no./total no. (%)‡			
High school or less	364/1527 (23.8)	90/175 (51.4)	2065/5778 (35.7)
Some college	684/1527 (44.8)	70/175 (40.0)	2423/5778 (41.9)
College degree or higher	479/1527 (31.4)	15/175 (8.6)	1290/5778 (22.3)
Monthly income — no./total no. (%)§			
≤$1,600	1170/1467 (79.8)	162/175 (92.6)	4574/5707 (80.1)
>$1,600	297/1467 (20.2)	13/175 (7.4)	1133/5707 (19.9)
Receiving public assistance — no. (%)¶			
No	1218 (79.8)	106 (60.2)	3468 (60.0)
Yes	309 (20.2)	70 (39.8)	2313 (40.0)
Trouble paying basic expenses — no. (%)‖			
No	969 (63.5)	79 (44.9)	3522 (60.9)
Yes	558 (36.5)	97 (55.1)	2259 (39.1)
Health insurance — no./total no. (%)**			
None	631/1507 (41.9)	102/176 (58.0)	2304/5748 (40.1)
Private	796/1507 (52.8)	55/176 (31.3)	2438/5748 (42.4)
Public	80/1507 (5.3)	19/176 (10.8)	1006/5748 (17.5)
Parity — no. (%)			
0	1088 (71.3)	90 (51.1)	2384 (41.2)
1	279 (18.3)	34 (19.3)	1530 (26.5)
2	115 (7.5)	32 (18.2)	1152 (19.9)
≥3	45 (2.9)	20 (11.4)	715 (12.4)

Table 1. (Continued.)

Characteristic	PPR (N=1527)	DMPA (N=176)	LARC (N=5781)
Previous unintended pregnancies — no./ total no. (%)††			
0	829/1522 (54.5)	61/176 (34.7)	1839/5770 (31.9)
1	393/1522 (25.8)	44/176 (25.0)	1566/5770 (27.1)
2	159/1522 (10.4)	36/176 (20.5)	1064/5770 (18.4)
≥3	141/1522 (9.3)	35/176 (19.9)	1301/5770 (22.5)
Previous abortions — no. (%)			
0	1072 (70.2)	106 (60.2)	3672 (63.5)
1	331 (21.7)	41 (23.3)	1294 (22.4)
2	87 (5.7)	21 (11.9)	530 (9.2)
≥3	37 (2.4)	8 (4.5)	285 (4.9)
History of STI — no. (%)‡‡			
No	1008 (66.0)	90 (51.1)	3397 (58.8)
Yes	519 (34.0)	86 (48.9)	2384 (41.2)

* Plus–minus values are means (±SD). P<0.001 for comparisons of the three groups. The total number of participants does not equal 7486 because 2 participants chose natural family planning as their contraceptive method at baseline but then went on to choose another method later in the study. Percentages may not necessarily add up to 100 because of rounding. DMPA denotes depot medroxyprogesterone acetate; LARC long-acting reversible contraception (intrauterine device or implant); PPR pill, patch, or ring; and STI sexually transmitted infection.
† Race was self-reported. Data were missing for 8 participants in the PPR group and 31 in the LARC group.
‡ Data on educational level were missing for 1 participant in the DMPA group and 3 in the LARC group.
§ Data on monthly income were missing for 60 participants in the PPR group, 1 in the DMPA group, and 74 in the LARC group.
¶ "Receiving public assistance" was defined as self-reported current receipt of food stamps; vouchers from the supplementary nutritional program for women, infants, and children (WIC); welfare; or unemployment benefits.
‖ "Trouble paying basic expenses" was defined as self-reported difficulty in paying for transportation, housing, health or medical care, or food.
** Data on health insurance were missing for 20 participants in the PPR group and 33 in the LARC group.
†† Data on previous unintended pregnancies were missing for 5 participants in the PPR group and 11 in the LARC group.
‡‡ Data are based on a self-reported history of chlamydia infection, gonorrhea, syphilis, trichomoniasis, genital herpes, human papillomavirus infection, or human immunodeficiency virus infection.

Information about periods of contraceptive use, including start and stop dates, was collected from three sources: scheduled telephone interviews; pharmacy data obtained from the partner pharmacy where participants obtained pills, patch, or ring; and the participant contraceptive-method log, which documented in our research records when the participant initiated or discontinued use of a method or switched to another method (i.e., insertion or removal of an IUD or implant; receipt of an initial pill supply, patch, or ring; and DMPA injection). A participant was considered to have used DMPA for the 3-month interval after a record of an injection. In the case of expulsion of an IUD, if the participant knew the device had fallen out and she became pregnant, the unintended pregnancy was attributed to "no method" (unless an alternative method was used). However, if the participant was unaware that the device had fallen out, the pregnancy was attributed to IUD failure.

At each follow-up interview, we asked participants if they were still using the same contraceptive method, if they had stopped using it, and their start and stop dates. For participants who did not answer these questions, we reviewed their contraceptive-method log and pharmacy-refill records to confirm their status. If the data from the log, follow-up interview, and pharmacy records were conflicting, we used the data source with the most detailed information. If multiple contraceptive methods were used simultaneously (e.g., pills and condoms), the most effective method was assigned.[9] Data from participants who were lost to follow-up were censored at the time of their last completed interview.

STUDY OUTCOMES

The primary outcome of the study was contraceptive failure. We also evaluated pregnancy rates by age group as a secondary outcome. Our hypotheses were, first, that participants using pills, patch, or ring would have higher rates of contraceptive failure than those using long-acting methods and, second, that the rate of failure with the pills, patch, or ring would be higher among younger women and adolescents (<21 years of age) than among older women.

STATISTICAL ANALYSIS

Statistical analyses were performed with the use of Stata software, version 11 (StataCorp). The significance level (alpha) was set at 0.05. To describe the demographic characteristics of the study participants, we used means, standard deviations, frequencies, and percentages. For the comparison among users of different contraceptive methods, Student's t-test was used for continuous variables and a chi-square test was performed for categorical data.

We measured distinct segments of contraceptive-method use that represented the months each participant used the method. We calculated participant-years of use for each method by capturing all segments of use. Thus, participants who switched methods contributed distinct segments to multiple methods. Cox proportional-hazard models were used to estimate the hazard ratios for unintended pregnancy with different methods. We used clustering of variance–covariance estimation methods to account for the effect of correlation among different periods of contraceptive use and multiple pregnancies for the same participant. Effect modification was assessed by including an interaction term between the method and the covariate of interest in the model. The final multivariate model included adjustment for confounders and other variables with the potential to influence the outcome.

Table 2. Baseline Characteristics of Participants with No Pregnancy and Those with an Unintended Pregnancy during the Study Period.*

Characteristic	No Pregnancy (N=7152)	Unintended Pregnancy (N=334)	P Value
Age — yr	25.2±5.8	23.6±5.1	<0.001
Race — no./total no. (%)†			<0.001
Black	3408/7113 (47.9)	200/334 (59.9)	
White	3163/7113 (44.5)	104/334 (31.1)	
Other	542/7113 (7.6)	30/334 (9.0)	
Educational level — no./total no. (%)‡			<0.001
High school or less	2356/7148 (33.0)	163/334 (48.8)	
Some college	3044/7148 (42.6)	134/334 (40.1)	
College degree or higher	1748/7148 (24.5)	37/334 (11.1)	
Monthly income — no./total no. (%)§			0.01
≤$1,600	5629/7025 (80.1)	279/326 (85.6)	
>$1,600	1396/7025 (19.9)	47/326 (14.4)	
Receiving public assistance — no. (%)			0.002
No	4606 (64.4)	187 (56.0)	
Yes	2546 (35.6)	147 (44.0)	
Trouble paying basic expenses — no. (%)			<0.001
No	4409 (61.6)	162 (48.5)	
Yes	2743 (38.4)	172 (51.5)	
Health insurance — no./total no. (%)¶			<0.001
None	2872/7102 (40.4)	165/331 (49.8)	
Private	3179/7102 (44.8)	111/331 (33.5)	
Public	1051/7102 (14.8)	55/331 (16.6)	

Table 2. (Continued.)

Characteristic	No Pregnancy (N=7152)	Unintended Pregnancy (N=334)	P Value
Parity — no. (%)			0.002
0	3436 (48.0)	127 (38.0)	
1	1738 (24.3)	106 (31.7)	
2	1239 (17.3)	60 (18.0)	
≥3	739 (10.3)	41 (12.3)	
Previous unintended pregnancies — no./total no. (%)‖			<0.001
0	2664/7137 (37.3)	66/333 (19.8)	
1	1896/7137 (26.6)	107/333 (32.1)	
2	1195/7137 (16.7)	64/333 (19.2)	
≥3	1382/7137 (19.4)	96/333 (28.8)	
Previous abortions — no. (%)			<0.001
0	4661 (65.2)	190 (56.9)	
1	1584 (22.1)	82 (24.6)	
2	592 (8.3)	47 (14.1)	
≥3	315 (4.4)	15 (4.5)	
History of STI — no. (%)			<0.001
No	4337 (60.6)	159 (47.6)	
Yes	2815 (39.4)	175 (52.4)	

* Plus–minus values are means (±SD). Percentages may not add up to 100 because of rounding.
† Data on race were missing for 39 participants in the no-pregnancy group.
‡ Data on educational level were missing for 4 participants in the no-pregnancy group.
§ Data on monthly income were missing for 127 participants in the no-pregnancy group and 8 in the unintended-pregnancy group.
¶ Data on health insurance were missing for 50 participants in the no-pregnancy group and 3 in the unintended-pregnancy group.
‖ Data on previous unintended pregnancies were missing for 15 participants in the no-pregnancy group and 1 in the unintended-pregnancy group.

RESULTS

CHARACTERISTICS OF THE PARTICIPANTS

From August 2007 through May 2011, a total of 8445 participants enrolled in the study, and 7486 met the eligibility criteria for this analysis. We identified 334 unintended pregnancies; of these, 156 were attributed to IUD, implant, DMPA injection, pill, patch, or ring failure. Table 1 summarizes the demographic and reproductive characteristics of the participants, according to the method of contraception chosen at baseline. Participants who chose pills, patch, or ring at enrollment, as compared with those who chose other contraceptive methods, were more likely to be nulliparous, more likely to have private health insurance, and less likely to have had a previous unintended pregnancy, abortion, or sexually transmitted infection. Participants who chose DMPA injections were more likely to be black, to be less educated, to have a lower socioeconomic status, to have no health insurance, and to have a history of a sexually transmitted infection. Participants who chose an IUD or implant were more likely to be older, to have public health insurance, and to have higher parity.

Table 2 shows the baseline characteristics of participants who had no pregnancy and those who had an unintended pregnancy during the study period. Participants who had an unintended pregnancy were younger, less educated, more likely to be black, and more likely to rely on public assistance or to report difficulty paying for basic expenses. They were also more likely to have a history of unintended pregnancy, abortion, or sexually transmitted infection.

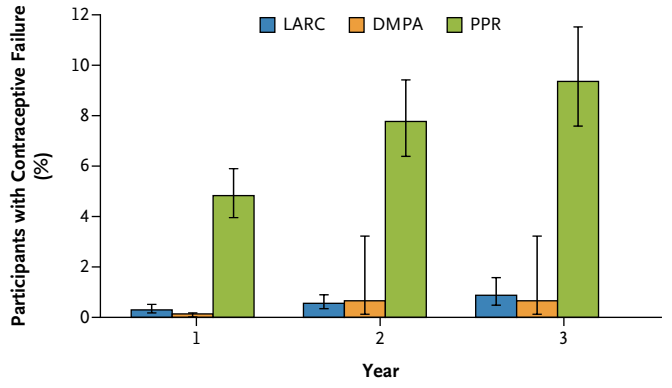

Figure 1. Cumulative Percentage of Participants Who Had a Contraceptive Failure at 1, 2, or 3 Years, According to Contraceptive Method.

Bars depict the cumulative percentage of participants who had a contraceptive failure with long-acting reversible contraception (LARC), depot medroxyprogesterone acetate (DMPA), or pill, patch, or ring (PPR) at 1, 2, or 3 years. Participants using PPR had significantly more unintended pregnancies than those using LARC (P<0.001) or DMPA (P<0.001).

CONTRACEPTIVE FAILURE RATES

Figure 1 shows the cumulative percentage of participants with a contraceptive failure at 1, 2, or 3 years, according to the contraceptive method. At all three time points, participants using pills, patch, or ring had higher rates of unintended pregnancy than those using long-acting reversible contraception. Failure rates in the group of participants who used the pills, patch, or ring were 4.8%, 7.8%, and 9.4% in years 1, 2, and 3, respectively; the corresponding rates in the group using IUDs or implants were 0.3%, 0.6%, and 0.9% (P<0.001). The failure rates among participants who used DMPA injections were similar to those among participants who used IUDs or implants (0.1%, 0.7%, and 0.7% for years 1, 2, and 3, respectively; P=0.96).

Table 3 shows the risks of contraceptive failure associated with the chosen contraceptive methods and other characteristics of the participants. The failure rate for the pills, patch, or ring was 4.55 per 100 participant-years, as compared with 0.22 for DMPA injections and 0.27 for IUDs or implants (P<0.001 for both comparisons). The risk of unintended pregnancy among participants using pills, patch, or ring was markedly higher than that among participants who used long-acting reversible contraception (hazard ratio after adjustment for age, educational level, and number of previous unintended pregnancies, 21.8; 95% confidence interval [CI], 13.7 to 34.9).

To determine whether participants less than 21 years of age who used pills, patch, or ring had a higher rate of unintended pregnancy than older women using these methods, we stratified our sample according to age. Participants less than 21 years of age who were using pills, patch, or ring had almost twice the risk of unintended pregnancy as older women (hazard ratio after adjustment for educational level and history with respect to unintended pregnancy, 1.9; 95% CI, 1.2 to 2.8) (Fig. 2). The rate of contraceptive failure did not differ significantly according to age group among participants who used DMPA injections or among those who used long-acting reversible contraception, but numbers for these analyses were smaller and the power to detect differences was low.

DISCUSSION

We found that participants using oral contraceptive pills, a transdermal patch, or a vaginal ring had a risk of contraceptive failure that was 20 times as high as the risk among those using long-acting reversible contraception. The failure rate among participants who used pills, patch, or ring was 4.55 per 100 participant-years, as compared with 0.22 for those who used DMPA and 0.27 for those who used an IUD or implant. Participants less than 21 years of age who used pills, patch, or ring had almost twice the risk of unintended pregnancy as older women using the same methods.

Our findings on contraceptive-method effectiveness are supported by previous studies. The National Survey of Family Growth estimates that 9% of women using oral contraceptive pills will have an unintended pregnancy within the first year, as compared with only 0.001%, 0.14%, and 0.7% of women who use the subdermal implant, levonorgestrel IUD, or copper IUD, respectively.[8] However, these data were derived from retrospective surveys that asked women to recall their contraceptive use and pregnancies over the past (on average) 3.75 years.[4,8] The failure rate for DMPA injections in our study is lower than other reported rates because we categorized a pregnancy as a contraceptive failure only in users who had returned for injections; thus, these rates represent "perfect use" rather than typical use, given that more than 40% of women who use DMPA will discontinue use in the first year.[10]

Half of all pregnancies in the United States are unintended, and half of those result from con-

Table 3. Hazard Ratio for Unintended Pregnancy, According to Contraceptive Method and Selected Characteristic.

Variable	Unintended Pregnancy (N=156)*	Total Participant-Years	Incidence	Hazard Ratio (95% CI)†	
				Unadjusted	Adjusted
		no.	*no./100 participant-years*		
Contraceptive method					
LARC	21	7655	0.27	1.00	1.00
DMPA	2	902	0.22	0.72 (0.17–3.09)	0.70 (0.16–3.03)
PPR	133	2924	4.55	16.05 (10.19–25.29)	21.84 (13.67–34.88)
Age					
<21 yr					1.83 (1.25–2.69)
≥21 yr					1.00
Educational level					
High school or less					1.00
Some college					0.73 (0.52–1.03)
College degree or higher					0.49 (0.28–0.87)
Previous unintended pregnancies					
0					1.00
1					3.22 (1.99–5.19)
2					3.95 (2.29–6.81)
≥3					5.77 (3.40–9.81)

* The remaining 178 of the 334 unintended pregnancies were attributed to failure of condoms, withdrawal, or any form of contraception that was not included in this analysis. Only periods of index contraceptive-method use (pills, patch, ring, DMPA injection, implant, or intrauterine device) and associated pregnancies were included in this analysis.
† Hazard ratios were adjusted for age, educational level, and number of previous unintended pregnancies.

traceptive failure.[1,4] Among women using reversible contraception, 70% use pills or condoms,[7] and one in every eight users of reversible methods will have a contraceptive failure in the first year.[4] We have previously shown in the same cohort that participants using long-acting reversible methods of contraception have higher continuation rates (>80%) at 12 months than participants using other reversible methods (range, 49 to 57%).[10] If more women used the highly effective, long-acting reversible methods, we would expect a decrease in the number of unintended pregnancies, because there would be more women continuing to use contraception.[14]

There are few contraindications to long-acting reversible contraception; almost all women are eligible for an IUD or implant. The U.S. Medical Eligibility Criteria for Contraceptive Use provides guidelines from the Centers for Disease Control and Prevention that are endorsed by the American College of Obstetricians and Gynecologists.[15] Modern IUDs do not carry an increased risk of pelvic inflammatory disease after the first 20 days following insertion.[16] Women who are at average risk for sexually transmitted infections are good candidates for IUDs, as long as they do not have cervicitis at the time of insertion.[15] IUDs and implants are also associated with acceptable adverse-event rates among adolescents and nulliparous women; satisfaction rates among adolescents and young women using the levonorgestrel IUD or the implant are similar to the rates among older women.[10,11,17] Implants also have very few contraindications. Unpredictable bleeding is the most common side effect and the most frequent reason for discontinuation.[18]

In our age-stratified analysis, participants less than 21 years of age who used pills, patch, or ring had a significantly increased risk of contraceptive failure, as compared with older women; in

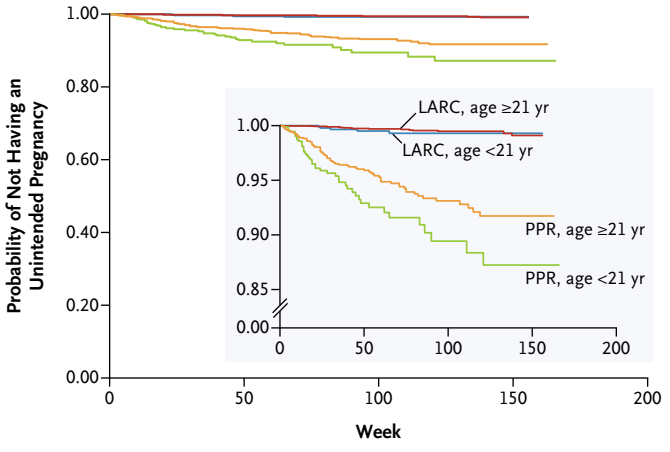

Figure 2. Probability of Not Having an Unintended Pregnancy, According to Contraceptive Method and Age.

Survival curves show the probability of not having an unintended pregnancy, stratified according to age group. LARC methods were the most effective, and failure rates did not vary according to age (P=0.49). PPR methods were less effective, and failure rates in participants younger than 21 years old were twice as great as in women 21 years of age or older (P=0.02).

contrast, younger and older participants who used an IUD, implant, or DMPA had similarly low risks of pregnancy. Other study data have also indicated that the risk of contraceptive failure with pills is more than twice as high among teenagers as it is among women older than 30 years of age.[4] The increased risk of contraceptive failure among adolescents, as compared with women, may reflect lower adherence to a daily pill regimen. In a sample of girls who were 14 to 17 years of age and who were seeking primary care, 25% of those who used oral contraceptive pills reported that they missed taking two or more pills per cycle.[19] These data underscore the potential benefits of offering adolescents long-acting reversible contraception (which does not require daily, weekly, or monthly compliance) to reduce unintended pregnancies in this high-risk age group.

The strengths of our study include the prospective design of the Contraceptive CHOICE Project, a large sample, multiple sources of data for assessment of contraceptive use (including objective pharmacy data), and a low rate of loss to follow-up. There are few prospective reports in the medical literature that assess the effectiveness of contraceptive methods in large, diverse U.S. populations. One limitation of our study is the nonrandomized design, resulting in potential confounding of the association between contraceptive method and outcomes by characteristics associated with the choice of contraception. However, women who chose long-acting methods tended to be less educated and to have higher rates of previous pregnancies and abortions — features expected to be associated with higher (not lower) rates of unintended pregnancy. In addition, study participants were a selected group (at high risk for unintended pregnancy and willing to begin using a new method). Insofar as women may be more likely to consistently use a method they have chosen than one they have been assigned, the compliance rates may be higher, and failure rates lower, than would be expected in a randomized trial. Another potential limitation of our study is generalizability. Participants were at high risk for unintended pregnancy and had to be willing to switch to a new contraceptive method, which may have resulted in overestimation of contraceptive failure rates, as compared with rates in the general U.S. population. However, contraception was provided at no cost, which may have improved adherence and led to an underestimation of failure rates, counterbalancing this potential bias.

In conclusion, we found that long-acting reversible methods of contraception (IUDs or implants) were more effective in preventing unintended pregnancy than contraceptive pills, patch, or ring and worked well regardless of age.

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Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

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