



Editor's Choice

Are LARC Users Less Likely to Use Condoms? An Analysis of U.S. Women Initiating LARC in 2008–2018


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A B S T R A C T

Introduction: Public health professionals have raised concern that increased use of long-acting reversible contraceptives (LARC) could raise women's risk for sexually transmitted infections (STIs), because LARC's superior pregnancy protection may decrease women's motivation to use a barrier method for supplemental pregnancy prevention. This study uses population-based data to examine whether condom use is lower, particularly among young women who are at increased STI risk, after initiating LARC versus moderately effective methods.

Methods: With the 2011–2019 data files of the National Survey of Family Growth, we examine the percent of sexually active months with condom use in the year after LARC or moderately effective method initiation for a nationally representative sample of 2,018 women aged 15–44 years. Multinomial logistic models regressed condom use on method type and age group, as well as their interaction, while adjusting for key confounders.

Results: The unadjusted likelihood of any condom use is substantially lower among women who initiated LARC versus moderately effective methods (12% vs. 37%), and this difference is greater among younger versus older women. After accounting for differences in women's reproductive and sociodemographic profiles, however, a statistically significant difference in condom use by method initiated remains only for those aged 20–34 years.

Conclusions: Crude estimates suggest that condom use is lower after initiating LARC versus moderately effective methods, especially among young women. After accounting for the confounding effects of LARC users' distinct profiles—particularly in terms of parity and teenage childbearing—the difference is decreased overall and no longer significant for adolescent women. Overall results indicate a need for new STI prevention strategies and policies that emphasize the importance of dual prevention for LARC users at risk of STIs.

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An estimated 45% of all U.S. pregnancies were unintended in 2011 (Finer & Zolna, 2016), a substantially higher level than in other high-income countries (Sedgh, Singh, & Hussain, 2014). Highly effective long-acting reversible contraceptives (LARC)—intrauterine devices and implants—attract attention from policymakers, medical professionals, and researchers alike because of their potential to reduce this high level of unintended pregnancy (American College of Obstetricians and Gynecologists, 2015; Parks & Peipert, 2016). When offered as a part of

comprehensive sexual and reproductive health services, LARC could help women to better achieve their reproductive goals, thus benefitting their reproductive autonomy (Eeckhaut, Rendall, & Zvavitch, 2021). Use of LARC methods increased from about 4% of U.S. contraceptive use in 2006 through 2008 to 16% in 2017 through 2019 (Daniels & Abma, 2020; Finer, Jerman, & Kavanaugh, 2012).

Unlike barrier methods (e.g., condoms), which are less effective for preventing pregnancy, LARCs confer no protection against sexually transmitted infections (STIs). Clinical guidelines recommend using a highly effective contraceptive method in conjunction with a barrier method (typically, the male condom) for optimal pregnancy and STI prevention (American College of Obstetricians and Gynecologists, 2018; Gavin et al., 2014). This recommendation is critical for groups at high risk of STIs, including women aged 25 years and younger and women with a

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new male sex partner, multiple male sex partners, or a male sex partner who has other concurrent partners (Gavin et al., 2014).¹ Yet, combined use of male condoms with another contraceptive method is exceedingly low in the United States. For example, Kavanaugh, Pliskin, and Jerman (2021) estimated that only 10.3% of sexually active contraceptive women in 2015 used male condoms with another contraceptive method; Szucs et al. (2020) estimated that only 10.3% of sexually active female high school students in 2019 used male condoms with a more effective contraceptive method. LARC users, in particular, have been found to be less likely to use male condoms (Eisenberg, Allsworth, Zhao, & Peipert, 2012; Pazol, Kramer, & Hogue, 2010; Steiner, Liddon, Swartzendruber, Rasberry, & Sales, 2016); a recent systematic review estimated LARC users to be 40%–60% less likely to use male condoms than moderately effective method users (i.e., users of pills, injectables, patches, or rings; Steiner et al., 2021). This has raised concern among public health professionals that the superior pregnancy protection offered by LARC could be decreasing women's motivation to use condoms because they may see less of a need for supplemental pregnancy prevention (Potter & Soren, 2016; Raidoo, Tschann, Elia, Kaneshiro, & Soon, 2020).

Despite the concern, our understanding of whether and how LARC use impacts condom use is limited, in part because nationally representative studies have typically considered condom use among current LARC users rather than among women initiating LARC (Eisenberg et al., 2012; Pazol et al., 2010; Steiner et al., 2016). Hence, these prior studies are likely affected by differential discontinuation of LARC versus other methods (Rosenstock, Peipert, Madden, Zhao, & Secura, 2012), and typically do not consider women's initial condom use. Following prior clinical and intervention research (Barstow et al., 2018; Bernard, Zhao, & Peipert, 2018; El Ayadi et al., 2017; McNicholas, Klugman, Zhao, & Peipert, 2017), we examine condom use among women initiating LARC during the period from 2008 to 2018—a period with rapidly increasing LARC use—and take account of women's initial condom use (i.e., before initiating LARC). We also consider the extent to which any differences in condom use between women initiating LARC versus other reversible methods could be attributed to the former group potentially being at lower risk for STIs. A recent systematic review found mixed evidence regarding the link between LARC use and having had direct exposure to multiple sex partners (Steiner et al., 2021), a key proximate cause of STI risk (Gavin et al., 2014; Falasinnu et al., 2015). But LARC users tend to be more likely to be parous and to have a coresident partner (Kavanaugh & Jerman, 2018; Xu et al., 2011), characteristics that are associated with less indirect exposure to multiple sex partners (Finer, Darroch, & Singh, 1999); hence, it is important to consider the role of such potential confounders, including the number of recent sexual partners, parity, and union status.

Young women have experienced particularly steep increases in LARC use since 2008 (Kavanaugh & Jerman, 2018; Kavanaugh & Pliskin, 2020) and, compared with older women, they are at increased STI risk—the Centers for Disease Control and Prevention (CDC) estimates that those ages 15–24 years acquired more than one-half of all new STIs in 2019 (CDC, 2021). Recent studies on adolescents and young women have confirmed that LARC users' lower likelihood to use male condoms extends to these younger age groups (Kortsmit et al., 2019; Steiner et al.,

2016, 2021). Yet, it is unclear if the differences in condom use between women initiating LARC versus other reversible methods vary by age and if any potential age variation could be explained by young LARC initiators being even more selective than their older counterparts in terms of characteristics such as parity (Eeckhaut, Sweeney, & Gipson, 2014). We aim to examine these questions by explicitly considering age variations in condom use among women initiating LARC versus other reversible methods and by considering the potential role of young LARC initiators' distinct reproductive and sociodemographic profiles in explaining any potential age variation.

We draw on nationally representative data for 2,018 non-sterilized, sexually active women aged 15–44 years who participated in the National Survey of Family Growth (NSFG) from 2011 to 2019. We compare condom use among LARC initiators and initiators of moderately effective methods. LARC acts as an important alternative to moderately effective methods—not only was the last method used by the majority of LARC users a moderately effective method (Eeckhaut, 2021), but increased LARC access has been associated with declines in pill use (Kelly, Lindo, & Packham, 2020). We address several specific research questions. First, are LARC initiators less likely to use condoms than women initiating moderately effective methods, and do any observed differences in condom use by method vary by women's age? Second, to what extent can differential condom use by method—and potential age variation in differential condom use—be explained by differences in the reproductive and sociodemographic profiles of LARC versus moderately effective method initiators?

Methods

Data Source

Data for this study were drawn from the 2011–2013, 2013–2015, 2015–2017, and 2017–2019 public use data files of the NSFG. Designed and administered by the National Center for Health Statistics, the NSFG was conducted periodically from 1973 to 2002 before moving to a continuous survey design in 2006. NSFG data are representative of the U.S. noninstitutionalized population aged 15–44 years² when properly weighted, and include oversamples of teenage, Black, and Hispanic participants. In-home interviews were conducted by trained female interviewers using computer-assisted personal interviewing. For the 2011–2013, 2013–2015, 2015–2017, and 2017–2019 surveys, response rates were 73%, 71%, 67%, and 65%, respectively, resulting in a total of 5,601, 5,699, 5,554, and 6,141 women being interviewed (National Center for Health Statistics, 2020). The survey was approved by the National Center for Health Statistics Institutional Review Board (IRB; Groves, Mosher, Lepkowski, & Kirgis, 2009) and no additional IRB approval for this study was needed because the data files used are publicly available and include no identifiers, thus meeting the IRB criteria for exemption.

The analytic sample was limited to women aged 15–44 years at interview, who initiated a LARC or moderately effective method during the period covered by the survey's contraceptive calendar. The NSFG contraceptive calendar measures monthly contraceptive use (≤ 4 methods each month) for a period starting 3 calendar years before the survey year (in January) and ending

¹ This recommendation to combine a highly effective contraceptive method with a barrier method also applies to groups such as commercial sex workers and women living in correctional facilities or communities with high sexually transmitted infection prevalence (Gavin et al., 2014).

² The 2015–2017 and 2017–2019 NSFG data are representative of the U.S. noninstitutionalized population ages 15–49, but we limited our analytic sample to respondents aged 15–44 for the current study.

in the month of survey interview. We included only women reporting LARC or moderately effective method use continuously during the 12 months after the month of method initiation. We omitted women who reported initiating LARC or moderately effective methods in the first month of the contraceptive calendar to enable the inclusion of a measure for initial condom use. Women who reported zero months of sexual activity during the 12-month period after LARC or moderately effective method initiation were also excluded, as were women who reported a female sterilization operation before the month of LARC or moderately effective method initiation. Finally, 87 women were excluded because of missing information on the covariate “number of male sex partners in the 12 months before survey interview.” The final analytic sample comprised 2,018 women, covering women initiating LARC or moderately effective methods between 2008 and 2018.

Key Measures

Using the NSFG's contraceptive calendar, we estimated the percent of sexually active months in which condom use was also reported for the 12 months after the month of LARC or moderately effective method initiation. Given the relative sparseness of responses other than 0% and 100% (Table 2), we focus on three broad categories of condom use: used condoms in none (0%), some (1%–99%), or all (100%) sexually active months in the 12 months after LARC or moderately effective method initiation.

A key measure is age (13–19; 20–24; 25–29; 30–34; 35–44) at the time of initiating LARC or moderately effective methods.³ In addition, we considered several other reproductive and sociodemographic characteristics at the time of initiating LARC or moderately effective methods, including parity (0, 1, 2, ≥ 3), teenage childbearing (yes, no), educational attainment (less than high school, completed high school or GED, some college, completed college), union status, and whether or not there has been a change in marital or cohabitation status in the 12 months after method initiation (married, no change; cohabiting, no change; married or cohabiting, change; single), and self-reported race/ethnicity (non-Hispanic White, Hispanic, non-Hispanic Black, non-Hispanic other or multiple race). We also considered whether the woman reported any condom use in the month before the method initiation month (yes, no), the number of months the woman reported being sexually active in the 12-month period after the method initiation month (1–5, 6–11, 12), and the period of method initiation (2008–2010, 2011–2013, 2014–2015, 2016–2018). We finally include a measure for the number of male sex partners in the 12 months before survey interview (0–1, 2, ≥ 3) as a proxy for the woman's number of sexual partners during the study period.

Statistical Analyses

We first considered the distribution of women's characteristics, as well as the distribution of condom use, for LARC versus

moderately effective method initiators overall and by age group. We used χ^2 tests to test for differences in these distributions by method initiated. We next relied on multinomial logistic regression to consider differences in condom use between LARC versus moderately effective method initiators by age group, and the extent to which observed differences can be explained by women's reproductive and sociodemographic characteristics. Model 1 regressed our three-category condom use outcome on method initiated and age, including the method*age interaction term to consider age variation in the association between condom use, and method initiated. Model 2 additionally includes all reproductive and sociodemographic characteristics to examine whether the association between condom use and method initiated—and any age variation in this association—could be explained by these potential confounders. To aid interpretation, we present results of these multinomial logistic regression models in terms of predicted probabilities, complemented with tests of average marginal effects.

We performed several sensitivity analyses to assess robustness. First, we considered the potential impact of certain hormonal methods (e.g., pills) requiring a backup contraceptive method during the first month of use. We constructed an alternative condom use measure omitting the first month after method initiation when calculating the percent of sexually active months with condom use in the 12 months after LARC or moderately effective method initiation. Second, we considered the potential impact of recall bias by limiting the sample to women who started their LARC or moderately effective method within 18 months before interview (i.e., we omitted 1,562 women who reported initiating LARC or moderately effective methods ≥ 19 months before the survey interview). Given that the main analyses are limited to women who reported LARC or moderately effective method use continuously during the 12 months after the month of method initiation (i.e., had 12 months of contraceptive calendar data available), all women considered for this sensitivity analysis initiated their method between 12 and 18 months before the survey interview. Finally, because the hormonal pill is the only moderately effective method requiring daily action, which might increase the need for a backup method (e.g., male condoms), we considered whether results differed for moderately effective method initiators who initiated pill use versus those who initiated injectable, patch, or ring use by re-estimating our multinomial logistic regression models with an alternative three-category contraceptive method initiated variable (LARC; injectable, patch, or ring; pills).

All statistical analyses were performed using Stata 14.2 (StataCorp, College Station, TX) and relied on the svy suite of commands to adjust for the NSFG's complex sampling design, which includes sampling weights, sampling strata, and clusters.

Results

Table 1 presents key reproductive and sociodemographic characteristics of women who initiated LARC or moderately effective methods during the 2008–2018 period. Women who initiated LARC were more likely to be aged 25 or older than women who initiated moderately effective methods (55% compared with 37%). They were also more likely to be parous (72%, compared with 34% of moderately effective method initiators), and to have had a teenage birth (20% compared with 10% of moderately effective method initiators). These differences in the reproductive profiles tended to be greater among the younger versus older age groups. For example, among those

³ For the 2015–2017 and 2017–2019 National Survey of Family Growth data, to ensure confidentiality of respondents, the public use dataset restricted timing information to the calendar year, rather than the calendar year and month, for many key life events including the woman's date of birth, high school and college graduation, her marriage(s)/cohabitation(s) and divorce(s)/separation(s), and her birth(s). Given these restrictions, we estimated the woman's age and other select sociodemographic and reproductive characteristics at the time of initiating LARC/moderately effective methods based on the calendar year of key life events for the 2015–2019 data.

Table 1
 Characteristics of Women Who Initiated LARC or MEM, by Women's Age: United States, 2008–2018

Characteristic	All Ages		13–19		20–24		25–29		30–34		35–44	
	LARC	MEM	LARC	MEM	LARC	MEM	LARC	MEM	LARC	MEM	LARC	MEM
Age at method initiation	<i>p</i> < .01											
13–19	16.0	40.2	NA	NA								
20–24	29.3	22.9	NA	NA								
25–29	26.3	19.1	NA	NA								
30–34	16.3	11.5	NA	NA								
35–44	12.1	6.3	NA	NA								
Parity at method initiation	<i>p</i> < .01											
0	27.9	65.8	57.1	93.2	29.7	65.5	26.0	51.5	12.0	21.0	10.2	17.3
1	27.7	17.2	37.5	6.1	35.4	25.8	27.1	20.0	12.3	34.6	18.4	16.8
2	29.9	10.7	5.5	0.6	23.5	5.2	35.7	17.3	46.4	30.1	42.7	40.6
≥3	14.6	6.2	0.0	0.0	11.4	3.5	11.2	11.3	29.4	14.2	28.7	25.3
Teenage childbearing at method initiation	<i>p</i> < .01											
No teenage childbearing	79.9	89.8	61.0	93.2	71.2	89.1	90.4	87.1	90.0	88.9	89.1	79.7
Teenage childbearing	20.2	10.2	39.1	6.8	28.8	10.9	9.6	12.9	10.0	11.1	10.9	20.3
Union status at method initiation, and change after method initiation	<i>p</i> < .01											
Married, no change	40.2	19.0	1.8	0.9	26.5	18.3	51.6	30.9	69.6	44.9	59.7	53.2
Cohabiting, no change	18.9	10.4	17.2	6.0	24.9	10.5	20.1	18.0	15.4	11.3	8.7	13.5
Married or cohabiting, change	5.2	3.1	6.9	1.1	8.8	3.8	2.8	4.9	3.2	4.9	2.2	5.3
Single	35.7	67.6	74.1	92.1	39.7	67.5	25.5	46.3	11.9	38.9	29.4	28.0
Education at method initiation	<i>p</i> < .01											
Less than high school	17.9	26.0	53.3	52.8	14.0	3.6	7.8	12.1	9.2	7.9	13.8	11.2
High school or GED	19.9	15.5	24.3	9.1	24.3	27.1	14.9	15.7	14.0	18.1	22.4	9.3
Some college	32.7	36.3	22.4	38.2	49.2	49.2	34.2	25.0	21.4	30.9	18.3	21.0
Completed college	29.5	22.2	0.0	0.0	12.4	20.1	43.1	47.1	55.4	43.1	45.6	58.5
Race/ethnicity	<i>p</i> = .09											
Non-Hispanic White	59.0	58.9	57.4	63.1	53.8	51.8	60.8	60.2	62.4	66.8	65.4	39.1
Hispanic	23.4	18.6	23.3	18.8	26.3	22.5	19.3	15.4	23.6	13.8	25.0	22.4
Non-Hispanic Black	10.3	12.6	10.7	11.3	12.6	17.5	12.4	11.9	9.7	6.6	0.8	16.0
Non-Hispanic other or multiple race	7.3	9.9	8.5	6.9	7.4	8.1	7.6	12.5	4.3	12.8	8.9	22.5
Condom use in month before method initiation	<i>p</i> < .05											
No	82.4	77.2	80.5	72.5	84.2	76.8	83.3	78.9	75.7	89.2	87.8	81.1
Yes	17.6	22.8	19.5	27.5	15.8	23.2	16.7	21.1	24.3	10.8	12.2	18.9
Number of male sex partners in year before interview	<i>p</i> = .26											
0–1	78.5	75.7	48.2	62.7	70.3	78.7	91.9	83.6	91.8	92.4	91.1	92.4
2	10.7	14.2	20.6	21.3	17.2	11.4	4.2	12.4	2.3	4.1	7.3	3.6
≥3	10.8	10.1	31.3	16.0	12.5	9.9	3.9	4.1	5.8	3.4	1.6	4.0
No. of months sexually active in year after method initiation	<i>p</i> < .01											
1–5	8.4	15.4	18.9	24.4	10.0	10.0	4.9	9.6	5.6	11.2	2.5	3.7
6–11	17.4	27.1	38.0	32.3	19.3	30.7	9.6	12.6	9.8	24.1	13.1	29.7
12	74.2	57.5	43.1	43.3	70.7	59.3	85.5	77.8	84.7	64.8	84.5	66.6
Period of method initiation	<i>p</i> < .01											
2008–2010	15.7	20.4	14.2	19.2	15.1	23.8	15.9	21.6	15.9	16.1	18.4	19.4
2011–2013	30.7	38.5	24.2	34.2	34.6	38.3	28.5	37.1	34.7	46.6	29.1	56.3
2014–2015	29.8	24.2	35.0	29.4	28.8	20.1	32.1	24.8	22.0	18.1	30.6	15.1
2016–2018	23.8	17.0	26.6	17.2	21.5	17.9	23.5	16.6	27.4	19.1	21.8	9.2

Abbreviations: LARC, long-acting reversible contraceptives; MEM, moderately effective method.

Note: *p* values test for differences within each age group in the distribution by method initiated.

under 20 years of age, LARC initiators were 36 percentage points more likely to be parous (43% vs. 7%) and 32 percentage points more likely to have had a teenage birth (39% vs. 7%), as compared with moderately effective method initiators, whereas among those aged 35 to 44, the corresponding differences were 7 percentage points (90% vs. 83%) and –9 percentage points (11% vs. 20%), respectively.

Women initiating LARC were more likely to have at least some college education than were moderately effective method initiators (62% compared with 59%). This educational advantage seems to be related to age; in the younger age groups, the advantage was reversed, whereas in the older age groups, the education differences are not statistically significant. Finally, LARC initiators were less likely to be single at method initiation (36% compared with 68% of moderately effective method initiators), less likely to have used a condom in the month before method initiation (18% compared with 23% of moderately effective method initiators), and less likely to have initiated their method in the earlier 2008–2013 period (46% compared with 59% of moderately effective method initiators). These differences manifest across age groups.

Table 2 considers condom use among women who initiated LARC or moderately effective methods during the period from 2008 to 2018. Condom use is low overall, with 73% of women reporting not using condoms in any sexually active months (category 0%) in the year after LARC or moderately effective method initiation. Condom use is lower among LARC initiators as compared with moderately effective method initiators; women who initiated LARC are 25 percentage points more likely to report not using condoms in any sexually active months after method initiation than are women who initiated moderately effective methods (i.e., 88% vs. 63%). Among the oldest age group (i.e., those aged 35–44 years), LARC initiators are equally likely (i.e., 96% vs. 96%) as moderately effective method initiators to report not using condoms in any sexually active months following method initiation. In contrast, among those aged 13–19 years, LARC initiators are 18 percentage points (i.e., 63% vs. 45%) more likely than moderately effective method initiators to report not using condoms in any sexually active months after method initiation.

Multinomial logistic regression estimates confirm that the likelihood of condom use tends to be lower among LARC versus moderately effective method initiators, and that this difference in condom use by method initiated varies by age group—the interaction between method and age is statistically significant ($p < .05$) in both models with and without additional covariates (see Appendix Table 1 for the relative risk ratios and corresponding p values). Figure 1 illustrates these differences in condom use with predicted probabilities for the outcome category “0%” by method initiated for each age group, complemented with tests of average marginal effects. These estimates show, first, that without adjusting for differences in women’s reproductive and sociodemographic profiles, the likelihood of condom use is lower among LARC versus moderately effective method initiators, and this difference is larger among younger versus older women (Figure 1A). For example, among those aged 13–19 years, LARC initiators are 19 percentage points (63% vs. 44%) more likely to report not using a condom in any sexually active months after method initiation than are moderately effective method initiators, whereas there is no difference (96% vs. 96%) among those aged 35–44 years.

Next, adjusting for women’s reproductive and sociodemographic characteristics reduces the difference in condom use

Table 2 Percent of Sexually Active Months During which Condoms Were Used During the Year After LARC or MEM Initiation, by Women’s Age: United States, 2008–2018

Measure	All Ages (N = 2,018)		13–19 (n = 586)		20–24 (n = 556)		25–29 (n = 447)		30–34 (n = 273)		35–44 (n = 156)		
	All (N = 2,018)	LARC (n = 824)	MEM (n = 1194)	LARC (n = 139)	MEM (n = 447)	LARC (n = 269)	MEM (n = 287)	LARC (n = 217)	MEM (n = 230)	LARC (n = 120)	MEM (n = 153)	LARC (n = 79)	MEM (n = 77)
Percent of sexually active months during which condoms were used at least once													
0%	72.6	87.7	62.8	63.1	44.5	86.3	69.3	96.1	71.8	94.1	80.9	96.1	95.8
1–99%	11.4	7.6	13.9	20.3	20.0	8.5	8.3	2.6	15.8	4.6	7.0	3.2	1.4
100%	16.1	4.8	23.4	16.6	35.5	5.2	22.4	1.4	12.4	1.2	12.1	0.6	2.8
		$p < .01$		$p < .05$		$p < .01$		$p < .01$		$p < .05$		$p = .17$	

Abbreviations: LARC, long-acting reversible contraceptives; MEM, moderately effective method. Note: p values test for differences within each age group in the distribution by method initiated.

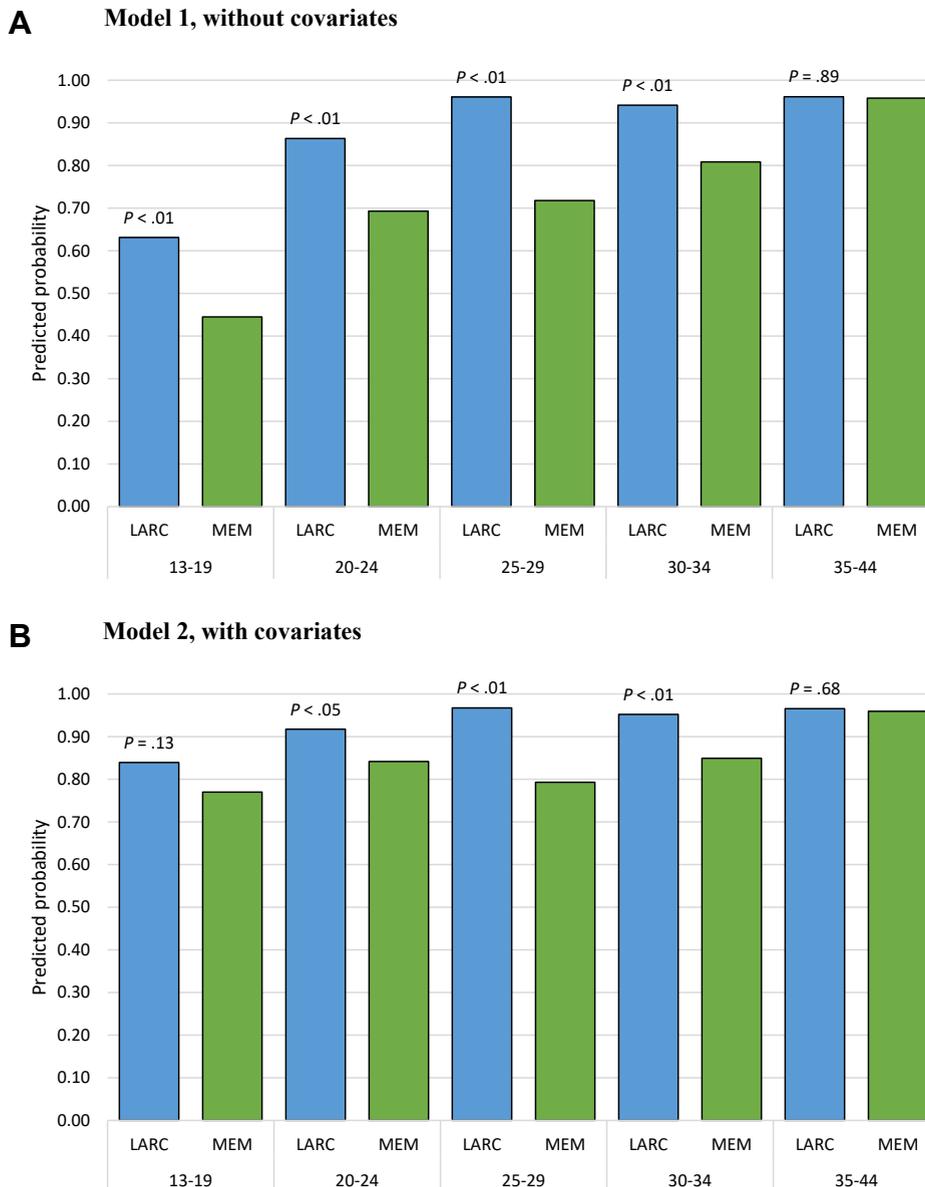


Figure 1. Predicted probabilities* of using condoms during 0% of sexually active months during the year after LARC versus MEM initiation, by women's age: United States, 2008–2018. **(A)** Model 1, without covariates. **(B)** Model 2, with covariates. *Abbreviations:* LARC, long-acting reversible contraceptives; MEM, moderately effective method. Notes: Predicted probabilities are based on Appendix Table 1, Models 1 and 2. For Model 2, predicted probabilities are calculated while holding all other covariates at their reference category values: parity at method initiation (reference category: 1), teenage childbearing at method initiation (reference category: no), educational attainment at method initiation (reference category: high school), and union status at method initiation and union change (reference category: single), as well as self-reported race/ethnicity (reference category: Non-Hispanic White), condom use in the month before method initiation (reference category: no), number of male sex partners in year before interview (reference category: 0–1), number of sexually active months following method initiation (reference category: 12), and period of method initiation (reference category: 2011–13). The *p* values test for difference between LARC versus MEM using average marginal effects. *Based on multinomial logistic regression analysis.

by method initiated, particularly among younger women (Figure 1B). For example, among those aged 13–19 years, the difference in condom use between LARC versus moderately effective method initiators is decreased from 19 percentage points in models that do not control for these characteristics (Figure 1A) to 7 percentage points in models that control for these characteristics (Figure 1B). In contrast, among those aged 30–34 years, the corresponding reduction is more modest, from 13 to 10 percentage points (the difference is stable at around zero among those aged 35–44 years).

This finding leads us to conclude that the observed age variation in the differences in condom use by method initiated (Figure 1A and Appendix Table 1) is largely explained by younger versus older LARC initiators' distinct profiles—particularly in terms of parity and teenage childbearing. That is, whereas younger women had the greatest observed differences in condom use by method initiated, they also showed the largest reduction in those differences when adjusting for reproductive and socio-demographic characteristics (Figure 1). In fact, the difference in condom use by method initiated is no longer significant in the

fully adjusted model among those aged 13–19 years; for women aged 20–34 years, the difference remains statistically significant but is substantially decreased; and, for women aged 35 years and older, there continues to be no statistical difference in condom use by method initiated. These main conclusions, as derived based on the main analyses, are confirmed by all three sensitivity analyses aimed at assessing robustness.

Discussion

Several key findings emerged from this research. First, the likelihood of using male condoms is lower in the year after initiating LARC versus moderately effective methods, and this difference is greater among younger versus older women. That women initiating LARC are less likely to use condoms than women initiating moderately effective methods supports findings from earlier nationally representative studies examining LARC users (Eisenberg et al., 2012; Pazol et al., 2010). It also corroborates results from clinical and intervention studies (Barstow et al., 2018; Bernard et al., 2018; El Ayadi et al., 2017; McNicholas et al., 2017), which have generally found lower condom use among U.S. women initiating LARC as compared with women initiating other reversible methods.

We furthered existing knowledge by establishing that the difference in condom use between LARC and moderately effective method initiators tends to be greater among younger women—a group considered to be at high risk of STIs. Previous studies have either focused exclusively on young women (Barstow et al., 2018; El Ayadi et al., 2017; Steiner et al., 2016) or have included age as a covariate (Bernard et al., 2018; Eisenberg et al., 2012; Pazol et al., 2010). These approaches leave open the question of whether the difference in condom use between women initiating LARC versus moderately effective methods is greater among young women. Our approach speaks directly to this question; we explicitly considered age variation in the difference in condom use by method initiated among a nationally representative sample of U.S. women aged 15–44 years.

Our second key finding is that a substantial portion of the difference in condom use by method initiated can be attributed to the confounding effects of LARC users' distinct profiles, and this is particularly true for younger women. In other words, an important reason why younger women—particularly those aged less than 25 years—are characterized by a greater difference in condom use by method initiated is because those initiating LARC tend to have characteristics associated with lower STI risk. Most importantly, compared with their similarly aged moderately effective method initiators, younger LARC initiators are much more likely to be parous (and, relatedly, to have had a teenage birth) (Table 1), a characteristic that is associated with less indirect exposure to multiple sex partners (Finer et al., 1999). This finding is consistent with prior research showing intrauterine device use to be low (although increasing) among nulliparous women (Kavanaugh & Jerman, 2018; Kavanaugh & Pliskin, 2020) and women with an early birth to be overrepresented among young intrauterine device users (Eeckhaut et al., 2014).

Overall, these findings suggest that LARC use is not, in and of itself, a cause of decreased condom use among adolescent women, at least not when compared with use of moderately effective methods. Conversely, for women aged 20–34 years, a sizeable difference in condom use remained even after adjusting for differences between LARC and moderately effective method initiators' reproductive and sociodemographic profiles, prior condom use, number of male sex partners, number of

months sexually active, and period of method initiation. This latter result is in line with the idea that LARC's superior pregnancy protection decreases women's motivation to use condoms because they may view less of a need for supplemental pregnancy prevention. It also underscores the difficulty of balancing the dual risks of unplanned pregnancy and STIs in a context where no single method can offer maximum levels of both contraceptive effectiveness and disease prevention. Efforts to improve male condom use among women initiating other contraceptive methods should be considered, including provider counseling about condom use for STI prevention with all contraceptive users at risk of STIs, especially in light of the current historic highs in STI cases (CDC, 2021). More research is needed as to whether recent increases in LARC adoption relate to these increases in STIs.

In addition, new strategies and methods to communicate the dual risks of unplanned pregnancy and STIs should be explored. Such strategies should recognize that condom use in addition to using LARC may not be the best strategy for all women (see also O'Leary, 2011; Steiner et al., 2021) by, for example, adopting the term “dual prevention” rather than “dual use” to bring about behavior change required to achieve these two public health goals (Potter & Soren, 2016; Steiner, Liddon, Swartzendruber, Pazol, & Sales, 2018). Moreover, any strategy should ascertain that concerns regarding STI risk do not lead to the withholding of LARC or any other method (see also Potter & Soren, 2016). After all, comprehensive sexual and reproductive health services—which should include access to the full range of contraceptive methods—are key to reproductive autonomy and have been shown to positively impact a range of health and other outcomes (Starrs et al., 2018).

Strengths and Limitations

The results of this study should be considered in light of its strengths and limitations. An important strength is the use of population-representative data, so results are generalizable to the 15- to 44-year-old population of U.S. women initiating LARC or moderately effective methods during 2008 through 2018. One important limitation is that LARC versus moderately effective method initiation was not randomized in our study, leaving open the possibility that the remaining difference in condom use between LARC versus moderately effective method initiators could be explained by other, unobserved factors shown to affect condom use but unavailable in the data, such as relationship qualities and dynamics (Harvey, Oakley, Washburn, & Agnew, 2018) or attitudes about whether condoms reduce pleasure (Higgins & Wang, 2015). Our analyses accounted for prior condom use (although not for consistency in prior condom use) and for the number of male sex partners in the 12 months before the survey interview. Future research should consider the role of other potential confounders in explaining any remaining differences in condom use.

A second limitation is that our condom use measure lacked information to assess with greater detail the consistency of condom use. In addition, women's monthly contraceptive use was reported retrospectively and, therefore, subject to recall bias. Our use of broad condom use categories likely attenuated some recall issues, and sensitivity analyses limiting the sample to women who initiated LARC or moderately effective methods in the 18 months before interview did not lead to substantively different conclusions. Still, future research could benefit from a prospective design that would allow for more detailed reporting

of women's contraceptive use (including the consistency of condom use) and prevent recall bias—although such designs often lead to more selective and less generalizable samples.

Implications for Practice and/or Policy

Overall, we corroborate and build on prior work to demonstrate that condom use is lower in the year after initiating LARC versus moderately effective methods. Although the difference in condom use is greater among younger women, this age variation is largely accounted for by women's reproductive and socio-demographic profiles, prior condom use, number of male sex partners, number of months sexually active, and period of method initiation. Hence we find that, across all ages, low condom use among LARC initiators may be putting individuals at increased risk for STIs and the associated reproductive health problems, including pelvic inflammatory disease, infertility, and adverse birth outcomes.

In recent decades, policies and programs have aimed to expand contraceptive access in general, and LARC adoption in particular, as a primary strategy to decrease the high rate of unintended pregnancy in the United States. Although efforts to expand contraceptive access should be applauded, when focused mainly or even exclusively on LARC, they could lead to unintended consequences, including limiting reproductive autonomy as well as increasing STI risk by decreasing condom use. To avoid such pitfalls, policy could instead focus on increasing access to comprehensive sexual and reproductive health services—including access to the full range of contraceptive methods—as a way to enhance reproductive autonomy and decrease the risk of both unintended pregnancy and STIs.

Relatedly, clinicians should be mindful of the potential issues related to contraceptive counseling that is focused mainly on the risk of unintended pregnancy, such as tiered-effectiveness contraceptive counseling in which the most effective contraceptive methods (i.e., LARC and sterilization) are presented first to emphasize their superior efficacy (Brandi & Fuentes, 2020). In addition to potentially impeding reproductive autonomy, approaches that prioritize pregnancy prevention fail to fully recognize and discuss the tradeoffs across contraceptive methods between pregnancy prevention and STI risk, as well as the need for condom use for STI prevention among women initiating LARC (or another nonbarrier method) at risk of STIs. The low use of condoms among LARC initiators, combined with the current historic highs in STI cases (CDC, 2021), point to the potential dangers of such an approach. A more promising approach would be for contraceptive counseling to center clients' needs, preferences, and concerns during method selection, in addition to providing comprehensive information about a method's side effects and risks (including risks and trade-offs related to STIs). In addition to benefitting reproductive autonomy, such best practices for contraceptive counseling may help to achieve the public health goals of decreasing unintended pregnancy and STIs as they have been shown to improve satisfaction and contraceptive use (Dehlendorf, Krajewski, & Borrero, 2014).

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Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.whi.2022.05.002>.

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