

**Title:**

Are LARC users less likely to use condoms? An analysis of U.S. women initiating LARC in 2008-18

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1    **Are LARC users less likely to use condoms?**

2    **An analysis of U.S. women initiating LARC in 2008-18**

3  
4   **ABSTRACT**

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

11   **Methods:** With the 2011 to 2019 data files of the National Survey of Family Growth (NSFG),  
12 we examine the percent of sexually-active months with condom use in the year following LARC  
13 or moderately-effective method initiation for a nationally-representative sample of 2,018 women  
14 ages 15-44. Multinomial logistic models regressed condom use on method type and age group, as  
15 well as their interaction, while adjusting for key confounders.

16   **Results:** The unadjusted likelihood of *any* condom use is substantially lower among women who  
17 initiated LARC versus moderately-effective methods (12% versus 37%), and this difference is  
18 larger among younger versus older women. After accounting for differences in women’s  
19 reproductive and sociodemographic profiles, however, a statistically significant difference in  
20 condom use by method initiated remains only for those ages 20-34.

21   **Conclusions:** Crude estimates suggest that condom use is lower after initiating LARC versus  
22 moderately-effective methods, especially among young women. After accounting for the  
23 confounding effects of LARC users’ distinct profiles—particularly in terms of parity and teenage

24 childbearing—the difference is reduced overall, and no longer significant for adolescent women.  
25 Overall results indicate a need for new STI prevention strategies and policies that emphasize the  
26 importance of dual prevention for LARC users at risk of STIs.

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## INTRODUCTION

29 An estimated 45% of all U.S. pregnancies were unintended in 2011 (Finer & Zolna, 2016), a  
30 substantially higher level than other high-income countries (Sedgh et al., 2014). Highly-effective  
31 long-acting reversible contraceptives (LARC)—intrauterine devices (IUDs) and implants—  
32 attract attention from policymakers, medical professionals, and researchers alike because of their  
33 potential to reduce this high level of unintended pregnancy (ACOG, 2015; Parks & Peipert,  
34 2016). When offered as part of comprehensive sexual and reproductive health services, LARC  
35 could help women better achieve their reproductive goals, thus benefitting their reproductive  
36 autonomy (Eeckhaut, Rendall & Zvavitch, 2021). Use of LARC methods increased from about  
37 4% of U.S. contraceptive use in 2006–08 to 16% in 2017–19 (Daniels & Abma, 2020; Finer,  
38 Jerman & Kavanaugh, 2012).

39 Unlike barrier methods (e.g., condoms), which are less-effective for preventing pregnancy,  
40 LARCs confer no protection against sexually transmitted infections (STIs). Clinical guidelines  
41 recommend using a highly-effective contraceptive method in conjunction with a barrier method  
42 (typically, the male condom) for optimal pregnancy *and* STI prevention (ACOG, 2018; Gavin et  
43 al., 2014). This recommendation is critical for groups at high risk of STIs, including women ages  
44  $\leq 25$ , and women with a new male sex partner, multiple male sex partners, or a male sex partner

45 who has other concurrent partners (Gavin et al., 2014).<sup>1</sup> Yet combined use of male condoms with  
46 another contraceptive method is exceedingly low in the U.S. For example, Kavanaugh et al.  
47 (2021) estimated that only 10.3% of sexually-active contracepting women in 2015 used male  
48 condoms with another contraceptive method; Szucs et al. (2020) estimated that only 10.3% of  
49 sexually-active female high school students in 2019 used male condoms with a more effective  
50 contraceptive method. LARC users, in particular, have been found to be less likely to use male  
51 condoms (Eisenberg et al., 2012; Pazol et al., 2010; Steiner et al., 2016); a recent systematic  
52 review estimated LARC users to be 40-60% less likely to use male condoms than moderately-  
53 effective method users (i.e., users of pills, injectable, patch, or ring; Steiner et al., 2021). This has  
54 raised concern among public health professionals that the superior pregnancy protection offered  
55 by LARC could be reducing women's motivation to use condoms because they may view less of  
56 a need for supplemental pregnancy prevention (Potter & Soren, 2016; Raidoo et al., 2020).

57 Despite the concern, our understanding of whether and how LARC use impacts condom use  
58 is limited, in part because nationally-representative studies have typically considered condom use  
59 among current LARC users rather than among women *initiating* LARC (Eisenberg et al., 2012;  
60 Pazol et al., 2010; Steiner et al., 2016). Hence, these prior studies are likely affected by  
61 differential discontinuation of LARC versus other methods (Rosenstock et al., 2012), and  
62 typically do not consider women's initial condom use. Following prior clinical and intervention  
63 research (Bastow et al., 2018; Bernard et al., 2018; El Ayadi et al., 2017; McNicholas et al.,  
64 2017), we examine condom use among women *initiating* LARC during the period 2008-18—a  
65 period with rapidly increasing LARC use—and take account of women's initial condom use (i.e.,

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<sup>1</sup> 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 STI prevalence (Gavin et al., 2014).

66 prior to initiating LARC). We also consider the extent to which any differences in condom use  
67 between women initiating LARC versus other reversible methods could be attributed to the  
68 former group potentially being at lower risk for STIs. A recent systematic review found mixed  
69 evidence regarding the link between LARC use and having had direct exposure to multiple sex  
70 partners (Steiner et al., 2021); a key proximate cause of STI risk (Gavin et al. 2014; Falasinnu et  
71 al., 2015). But, LARC users tend to be more likely to be parous and to have a coresident partner  
72 (Kavanaugh & Jerman, 2018; Xu et al., 2011), characteristics that are associated with less  
73 indirect exposure to multiple sex partners (Finer et al., 1999). Hence the importance of  
74 considering the role of such potential confounders, including number of recent sexual partners,  
75 parity, and union status.

76 Young women have experienced particularly steep increases in LARC use since 2008  
77 (Kavanaugh & Jerman, 2018; Kavanaugh & Pliskin, 2020) and, compared to older women, they  
78 are at increased STI risk—the CDC estimate that those ages 15–24 years acquired over half of all  
79 new STIs in 2019 (CDC, 2021). Recent studies on adolescents and young women have  
80 confirmed that LARC users’ lower likelihood to use male condoms extends to these younger age  
81 groups (Kortsmitt et al., 2019; Steiner et al., 2016, 2021). Yet, it is unclear if the differences in  
82 condom use between women initiating LARC versus other reversible methods vary by age, and  
83 if any potential age variation could be explained by young LARC initiators being even more  
84 selective than their older counterparts in terms of characteristics such as parity (Eeckhaut,  
85 Sweeney, & Gipson, 2014). We aim to examine these questions by explicitly considering age  
86 variation in condom use among women initiating LARC versus other reversible methods, and by  
87 considering the potential role of young LARC initiators’ distinct reproductive and  
88 sociodemographic profile in explaining any potential age variation.

89 We draw on nationally-representative data for 2,018 non-sterilized, sexually-active women  
90 ages 15–44 who participated in the National Survey of Family Growth (NSFG) from 2011-2019.  
91 We compare condom use among LARC initiators and initiators of moderately-effective methods.  
92 LARC acts as an important alternative to moderately-effective methods—not only was the last  
93 method used by the majority of LARC users a moderately-effective method (Eeckhaut, 2021),  
94 increased LARC access has been associated with declines in pill use (Kelly, Lindo & Packham,  
95 2020). We address several specific research questions. First, are LARC initiators less likely to  
96 use condoms than women initiating moderately-effective methods, and do any observed  
97 differences in condom use by method vary by women’s age? Second, to what extent can  
98 differential condom use by method—and potential age variation in differential condom use—be  
99 explained by differences in the reproductive and sociodemographic profiles of LARC versus  
100 moderately-effective method initiators?

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## METHODS

### **Data Source**

104 Data for this study were drawn from the 2011–13, 2013–15, 2015–17 and 2017–19 public-use  
105 data files of the NSFG. Designed and administered by the National Center for Health Statistics  
106 (NCHS), the NSFG was conducted periodically from 1973 to 2002 before moving to a  
107 continuous survey design in 2006. NSFG data are representative of the U.S. non-institutionalized  
108 population ages 15–44 years<sup>2</sup> when properly weighted, and include oversamples of teenage,  
109 Black, and Hispanic participants. In-home interviews were conducted by trained female

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<sup>2</sup> The 2015-17 and 2017-19 NSFG data are representative of the U.S. non-institutionalized population ages 15-49, but we limited our analytic sample to respondents aged 15-44 for the current study.

110 interviewers using computer-assisted personal interviewing (CAPI). For the 2011–13, 2013–15,  
111 2015–17, and 2017–19 surveys, response rates were 73%, 71%, 67%, and 65%, respectively,  
112 resulting in a total of 5,601, 5,699, 5,554, and 6,141 women being interviewed (NCHS, 2020).  
113 The survey was approved by the NCHS Institutional Review Board (IRB; Groves, Mosher,  
114 Lepkowski, & Kirgis, 2009) and no additional IRB approval for this study was needed as the  
115 data files used are publicly available and include no identifiers, thus meeting the IRB criteria for  
116 exemption.

117 The analytic sample was limited to women ages 15–44 at interview, who initiated a LARC or  
118 moderately-effective method during the period covered by the survey’s contraceptive calendar.  
119 The NSFG contraceptive calendar measures monthly contraceptive use (up to 4 methods each  
120 month) for a period starting 3 calendar years prior to the survey year (in January) and ending in  
121 the month of survey interview. We included only women reporting LARC or moderately-  
122 effective method use continuously during the 12 months following the month of method  
123 initiation. We omitted women who reported initiating LARC/moderately-effective methods in  
124 the first month of the contraceptive calendar to enable inclusion of a measure for initial condom  
125 use. Women who reported zero months of sexual activity during the 12-month period following  
126 LARC or moderately-effective method initiation were also excluded, as were women who  
127 reported a female sterilization operation before the month of LARC/moderately-effective method  
128 initiation. Finally, 87 women were excluded because of missing information on the covariate  
129 ‘number of male sex partners in the 12 months prior to survey interview.’ The final analytic  
130 sample comprised 2,018 women, covering women initiating LARC or moderately-effective  
131 methods during the period 2008–18.

132

133 **Key Measures**

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

140 A key measure is age (13–19; 20–24; 25–29; 30–34; 35–44) at the time of initiating  
141 LARC/moderately-effective methods.<sup>3</sup> In addition, we considered several other reproductive and  
142 sociodemographic characteristics at the time of initiating LARC/moderately-effective methods,  
143 including parity (0; 1; 2; 3+), teenage childbearing (yes; no), educational attainment (less than  
144 high school; completed high school or GED; some college; completed college), union status and  
145 whether or not there has been a change in marital or cohabitation status in the 12 months  
146 following method initiation (married, no change; cohabiting, no change; married or cohabiting,  
147 change; single), and self-reported race/ethnicity (non-Hispanic White; Hispanic; non-Hispanic  
148 Black; non-Hispanic other or multiple race). We also considered whether the woman reported  
149 any condom use in the month before the method initiation month (yes; no), the number of  
150 months the woman reported being sexually active in the 12-month period following the method  
151 initiation month (1–5; 6–11; 12), and the period of method initiation (2008–10; 2011–13; 2014–  
152 15; 2016–18). We finally include a measure for the number of male sex partners in the 12

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<sup>3</sup> For the 2015-17 and 2017-19 NSFG 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 2015-19 data.



153 months prior to survey interview (0–1; 2; 3+) as a proxy for the woman’s number of sexual  
154 partners during the study period.

155

## 156 **Statistical Analysis**

157 We first considered the distribution of women’s characteristics, as well as the distribution of  
158 condom use, for LARC versus moderately-effective method initiators overall and by age group.  
159 Chi-squared tests were used to test for differences in these distributions by method initiated. We  
160 next relied on multinomial logistic regression to consider differences in condom use between  
161 LARC versus moderately-effective method initiators by age group, and the extent to which  
162 observed differences can be explained by women’s reproductive and sociodemographic  
163 characteristics. Model 1 regressed our 3-category condom use outcome on method initiated and  
164 age, including the method\*age interaction term to consider age variation in the association  
165 between condom use and method initiated. Model 2 additionally includes all reproductive and  
166 sociodemographic characteristics to examine if the association between condom use and method  
167 initiated—and any age variation in this association—could be explained by these potential  
168 confounders. To aid interpretation, we present results of these multinomial logistic regression  
169 models in terms of predicted probabilities, complemented with tests of average marginal effects.

170 We performed several sensitivity analyses to assess robustness. First, we considered the  
171 potential impact of certain hormonal methods (e.g., pills) requiring a backup contraceptive  
172 method during the first month of use. We constructed an alternative condom use measure  
173 omitting the first month after method initiation when calculating the percent of sexually-active  
174 months with condom use in the 12 months following LARC or moderately-effective method  
175 initiation. Second, we considered the potential impact of recall bias by limiting the sample to

176 women who started their LARC or moderately-effective method within 18 months prior to  
177 interview (i.e., we omitted 1,562 women who reported initiating LARC or moderately-effective  
178 methods 19+ months before the survey interview). Given that the main analyses are limited to  
179 women who reported LARC or moderately-effective method use continuously during the 12  
180 months following the month of method initiation (i.e., had 12 months of contraceptive calendar  
181 data available), all women considered for this sensitivity analysis initiated their method between  
182 12 and 18 months prior to survey interview. Finally, because the hormonal pill is the only  
183 moderately-effective method requiring daily action, which might increase the need for a backup  
184 method (e.g., male condoms), we considered whether results differed for moderately-effective  
185 method initiators who initiated pill use versus those who initiated injectable, patch, or ring use by  
186 re-estimating our multinomial logistic regression models with an alternative three-category  
187 “contraceptive method initiated” variable (LARC; injectable, patch, or ring; pills).

188 All statistical analyses were performed using Stata 14.2 (StataCorp) and relied on the *svy*  
189 suite of commands to adjust for the NSFG’s complex sampling design, which includes sampling  
190 weights, sampling strata, and clusters.

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## RESULTS

194 Table 1 presents key reproductive and sociodemographic characteristics of women who initiated  
195 LARC or moderately-effective methods during the 2008–18 period. Women who initiated LARC  
196 were more likely to be aged 25 or older than women who initiated moderately-effective methods  
197 (55%, compared to 37%). They were also more likely to be parous (72%, compared to 34% of  
198 moderately-effective method initiators), and to have had a teenage birth (20%, compared to 10%

199 of moderately-effective method initiators). These differences in the reproductive profiles tended  
200 to be larger among the younger versus older age groups. For example, among those under 20,  
201 LARC initiators were 36 percentage points more likely to be parous (43% versus 7%) and 32  
202 percentage points more likely to have had a teenage birth (39% versus 7%), as compared to  
203 moderately-effective method initiators, whereas among those aged 35-44, the corresponding  
204 differences were 7 percentage points (90% versus 83%) and -9 percentage points (11% versus  
205 20%), respectively.

206 Women initiating LARC were more likely to have at least some college education than were  
207 moderately-effective method initiators (62%, compared to 59%). This educational advantage  
208 appears related to age; in the younger age groups, the advantage was reversed, whereas in the  
209 older age groups, the education differences are not statistically significant. Finally, LARC  
210 initiators were less likely to be single at method initiation (36%, compared to 68% of  
211 moderately-effective method initiators), less likely to have used a condom in the month prior to  
212 method initiation (18%, compared to 23% of moderately-effective method initiators), and less  
213 likely to have initiated their method in the earlier 2008–13 period (46%, compared to 59% of  
214 moderately-effective method initiators). These differences manifest across age groups.

215 Table 2 considers condom use among women who initiated LARC or moderately-effective  
216 methods during the period 2008–18. Condom use is low overall, with 73% of women reporting  
217 not using condoms in any sexually-active months (category 0%) in the year after  
218 LARC/moderately-effective method initiation. Condom use is lower among LARC initiators as  
219 compared to moderately-effective method initiators; women who initiated LARC are 25  
220 percentage points more likely to report not using condoms in any sexually-active months  
221 following method initiation than are women who initiated moderately-effective methods (i.e.,

222 88% versus 63%). Among the oldest age group (i.e., those 35-44 years), LARC initiators are  
223 equally (i.e., 96% versus 96%) likely as moderately-effective method initiators to report not  
224 using condoms in any sexually-active months following method initiation. In contrast, among  
225 those 13-19 years, LARC initiators are 18 percentage points (i.e., 63% versus 45%) more likely  
226 as moderately-effective method initiators to report not using condoms in any sexually-active  
227 months following method initiation.

228 Multinomial logistic regression estimates confirm that the likelihood of condom use tends to  
229 be lower among LARC versus moderately-effective method initiators, and that this difference in  
230 condom use by method initiated varies by age group—the interaction between method and age is  
231 statistically significant ( $P<.05$ ) in both models with and without additional covariates (see  
232 Appendix Table A1 for the relative risk ratios and corresponding  $P$ -values). Figure 1 illustrates  
233 these differences in condom use with predicted probabilities for the outcome category ‘0%’ by  
234 method initiated for each age group, complemented with tests of average marginal effects. These  
235 estimates show, first, that without adjusting for differences in women’s reproductive and  
236 sociodemographic profiles, the likelihood of condom use is lower among LARC versus  
237 moderately-effective method initiators, and this difference is larger among younger versus older  
238 women (see Panel A of Figure 1). For example, among those aged 13-19, LARC initiators are 19  
239 percentage points (63% versus 44%) more likely to report not using a condom in any sexually-  
240 active months following method initiation than are moderately-effective method initiators,  
241 whereas there is no difference (96% versus 96%) among those ages 35-44.

242 Next, adjusting for women’s reproductive and sociodemographic characteristics reduces the  
243 difference in condom use by method initiated, particularly among younger women (see Panel B  
244 of Figure 1). For example, among those aged 13-19, the difference in condom use between

245 LARC versus moderately-effective method initiators is reduced from 19 percentage points in  
246 models that do not control for these characteristics (Panel A of Figure 1) to 7 percentage points  
247 in models that control for these characteristics (Panel B of Figure 1). In contrast, among those  
248 aged 30-34, the corresponding reduction is more modest, from 13 to 10 percentage points (the  
249 difference is stable at around zero among those aged 35-44).

250 This leads us to conclude that the observed age variation in the differences in condom use by  
251 method initiated (see Panel A of Figure 1 and Table A1) is largely explained by younger versus  
252 older LARC initiators' distinct profile—particularly in terms of parity and teenage childbearing.  
253 That is, while younger women had the largest observed differences in condom use by method  
254 initiated, they also showed the largest reduction in those differences when adjusting for  
255 reproductive and sociodemographic characteristics (see Figure 1). In fact, the difference in  
256 condom use by method initiated is no longer significant in the fully-adjusted model among those  
257 ages 13-19; for women ages 20-34, the difference remains statistically significant but is  
258 substantially reduced; and, for women ages 35+, there continues to be no statistical difference in  
259 condom use by method initiated. These main conclusions, as derived based on the main analyses,  
260 are confirmed by all three sensitivity analyses aimed at assessing robustness.

261

262

## DISCUSSION

263 Several key findings emerged from this research. First, the likelihood of using male condoms is  
264 lower in the year after initiating LARC versus moderately-effective methods, and this difference  
265 is larger among younger versus older women. That women initiating LARC are less likely to use  
266 condoms than women initiating moderately-effective methods supports findings from earlier  
267 nationally-representative studies examining LARC *users* (Eisenberg et al., 2012; Pazol et al.,

268 2010). It also corroborates results from clinical and intervention studies (Bastow et al., 2018;  
269 Bernard et al., 2018; El Ayadi et al., 2017; McNicholas et al., 2017), which have generally found  
270 lower condom use among U.S. women *initiating* LARC as compared to women initiating other  
271 reversible methods.

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

282 Our second key finding is that a substantial portion of the difference in condom use by  
283 method initiated can be attributed to the confounding effects of LARC users' distinct profiles,  
284 and this is particularly true for younger women. In other words, an important reason why  
285 younger women—particularly those ages <25—are characterized by a larger difference in  
286 condom use by method initiated is because those initiating LARC tend to have characteristics  
287 associated with lower STI risk. Most importantly, compared to their similarly-aged moderately-  
288 effective method initiators, younger LARC initiators are much more likely to be parous (and,  
289 relatedly, to have had a teenage birth; cf. Table 1), a characteristic that is associated with less  
290 indirect exposure to multiple sex partners (Finer et al., 1999). This finding is consistent with

291 prior research showing IUD use to be low (though increasing) among nulliparous women  
292 (Kavanaugh & Jerman, 2018; Kavanaugh & Pliskin, 2020) and women with an early birth to be  
293 overrepresented among young IUD users (Eckhaut, Sweeney & Gipson, 2014).

294 Overall, these findings suggest that LARC use is not, in and of itself, a cause of reduced  
295 condom use among adolescent women, at least not when compared to use of moderately-  
296 effective methods. Conversely, for women ages 20-34, a sizeable difference in condom use  
297 remained even after adjusting for differences between LARC and moderately-effective method  
298 initiators' reproductive and sociodemographic profiles, prior condom use, number of male sex  
299 partners, number of months sexually active, and period of method initiation. This latter result is  
300 in line with the idea that LARC's superior pregnancy protection reduces women's motivation to  
301 use condoms because they may view less of a need for supplemental pregnancy prevention. It  
302 also underscores the difficulty of balancing the dual risks of unplanned pregnancy and STIs in a  
303 context where no single method can offer maximum levels of both contraceptive effectiveness  
304 and disease prevention. Efforts to improve male condom use among women initiating other  
305 contraceptive methods should be considered, including provider counseling about condom use  
306 for STI prevention with all contraceptive users at risk of STIs, especially in light of the current  
307 historic highs in STI cases (CDC, 2021). More research is needed as to whether recent increases  
308 in LARC adoption relate to these increases in STIs.

309 In addition, new strategies and methods to communicate the dual risks of unplanned  
310 pregnancy and STIs should be explored. Such strategies should recognize that condom use in  
311 addition to using LARC may not be the best strategy for all women (see also O'Leary, 2011;  
312 Steiner et al., 2021) by, for example, adopting the term "dual prevention" rather than "dual use"  
313 to bring about behavior change required to achieve these two public health goals (Potter &

314 Soren, 2016; Steiner et al., 2018). Moreover, any strategy should ascertain that concerns  
315 regarding STI risk do not lead to the withholding of LARC, or any other method (see also Potter  
316 & Soren, 2016). After all, comprehensive sexual and reproductive health services—which should  
317 include access to the full range of contraceptive methods—are key to reproductive autonomy and  
318 have been shown to positively impact a range of health and other outcomes (Starrs et al., 2018).

319

### 320 **Strengths and Limitations**

321 The results of this study should be considered in light of its strengths and limitations. An  
322 important strength is the use of population-representative data, so results are generalizable to the  
323 15-44 year old population of U.S. women initiating LARC or moderately-effective methods  
324 during 2008 through 2018. One important limitation is that LARC versus moderately-effective  
325 method initiation was not randomized in our study, leaving open the possibility that the  
326 remaining difference in condom use between LARC versus moderately-effective method  
327 initiators could be explained by other, unobserved factors shown to affect condom use but  
328 unavailable in the data, such as relationship qualities and dynamics (Harvey et al., 2018) or  
329 attitudes about whether condoms reduce pleasure (Higgins & Wang, 2015). Our analyses  
330 accounted for prior condom use (though not for consistency in prior condom use) and for the  
331 number of male sex partners in the 12 months prior to survey interview. Future research should  
332 consider the role of other potential confounders in explaining any remaining differences in  
333 condom use.

334 A second limitation is that our condom use measure lacked information to assess with more  
335 detail the consistency of condom use. In addition, women’s monthly contraceptive use was  
336 retrospectively reported and therefore subject to recall bias. Our use of broad condom use



337 categories likely attenuated some recall issues, and sensitivity analyses limiting the sample to  
338 women who initiated LARC or moderately-effective methods in the 18 months prior to interview  
339 did not lead to substantively different conclusions. Still, future research could benefit from a  
340 prospective design that would allow for more detailed reporting of women's contraceptive use  
341 (including the consistency of condom use) and prevent recall bias—though such designs often  
342 lead to more selective and less generalizable samples.

343

#### 344 **Implications for Practice and Policy**

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

353 In recent decades, policies and programs have aimed to expand contraceptive access in  
354 general, and LARC adoption in particular, as a primary strategy to reduce the high rate of  
355 unintended pregnancy in the U.S. While efforts to expand contraceptive access should be  
356 applauded, when focused mainly or even exclusively on LARC they could lead to unintended  
357 consequences, including limiting reproductive autonomy as well as increasing STI risk by  
358 reducing condom use. To avoid such pitfalls, policy could instead focus on increasing access to  
359 comprehensive sexual and reproductive health services—including access to the full range of

360 contraceptive methods—as a way to enhance reproductive autonomy and reduce the risk of both  
361 unintended pregnancy *and* STIs.

362 Relatedly, clinicians should be mindful of the potential issues related to contraceptive  
363 counseling that is focused mainly on the risk of unintended pregnancy, such as tiered-  
364 effectiveness contraceptive counseling in which the most effective contraceptive methods (i.e.,  
365 LARC and sterilization) are presented first to emphasize their superior efficacy (Brandi &  
366 Fuentes, 2020). In addition to potentially impeding reproductive autonomy, approaches that  
367 prioritize pregnancy prevention fail to fully recognize and discuss the tradeoffs across  
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369 condom use for STI prevention among women initiating LARC (or another non-barrier method)  
370 at risk of STIs. The low use of condoms among LARC initiators, combined with the current  
371 historic highs in STI cases (CDC, 2021), point to the potential dangers of such an approach. A  
372 more promising approach would be for contraceptive counseling to center clients' needs,  
373 preferences, and concerns during method selection, in addition to providing comprehensive  
374 information about a method's side effects and risks (including risks and trade-offs related to  
375 STIs). In addition to benefitting reproductive autonomy, such best practices for contraceptive  
376 counseling may help achieve the public health goals of reducing unintended pregnancy and STIs  
377 as they have been shown to improve satisfaction and contraceptive use (Dehlendorf, Krajewski,  
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379

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**TABLE 1**—Characteristics of Women Who Initiated LARC or Moderately-effective Methods (MEM), by Women’s Age: U.S., 2008 to 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
<b>Age at method initiation</b>	<i>P</i> < 0.01											
<i>13-19</i>	16.0	40.2	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
<i>20-24</i>	29.3	22.9	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
<i>25-29</i>	26.3	19.1	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
<i>30-34</i>	16.3	11.5	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
<i>35-44</i>	12.1	6.3	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
<b>Parity at method initiation</b>	<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> = 0.79	
<i>0</i>	27.9	65.8	57.1	93.2	29.7	65.5	26.0	51.5	12.0	21.0	10.2	17.3
<i>1</i>	27.7	17.2	37.5	6.1	35.4	25.8	27.1	20.0	12.3	34.6	18.4	16.8
<i>2</i>	29.9	10.7	5.5	0.6	23.5	5.2	35.7	17.3	46.4	30.1	42.7	40.6
<i>3+</i>	14.6	6.2	0.0	0.0	11.4	3.5	11.2	11.3	29.4	14.2	28.7	25.3
<b>Teenage childbearing at method initiation</b>	<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> = 0.38		<i>P</i> = 0.80		<i>P</i> = 0.14	
<i>No teenage childbearing</i>	79.9	89.8	61.0	93.2	71.2	89.1	90.4	87.1	90.0	88.9	89.1	79.7
<i>Teenage childbearing</i>	20.2	10.2	39.1	6.8	28.8	10.9	9.6	12.9	10.0	11.1	10.9	20.3
<b>Union status at method initiation, and change after method initiation</b>	<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> = 0.69	
<i>Married, no change</i>	40.2	19.0	1.8	0.9	26.5	18.3	51.6	30.9	69.6	44.9	59.7	53.2
<i>Cohabiting, no change</i>	18.9	10.4	17.2	6.0	24.9	10.5	20.1	18.0	15.4	11.3	8.7	13.5
<i>Married or cohabiting, change</i>	5.2	3.1	6.9	1.1	8.8	3.8	2.8	4.9	3.2	4.9	2.2	5.3
<i>Single</i>	35.7	67.6	74.1	92.1	39.7	67.5	25.5	46.3	11.9	38.9	29.4	28.0
<b>Education at method initiation</b>	<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> = 0.37		<i>P</i> = 0.41		<i>P</i> = 0.41	

<i>Less than high school</i>	17.9	26.0	53.3	52.8	14.0	3.6	7.8	12.1	9.2	7.9	13.8	11.2
<i>High school or GED</i>	19.9	15.5	24.3	9.1	24.3	27.1	14.9	15.7	14.0	18.1	22.4	9.3
<i>Some college</i>	32.7	36.3	22.4	38.2	49.2	49.2	34.2	25.0	21.4	30.9	18.3	21.0
<i>Completed college</i>	29.5	22.2	0.0	0.0	12.4	20.1	43.1	47.1	55.4	43.1	45.6	58.5
<b>Race/ethnicity</b>	$P = 0.09$		$P = 0.76$		$P = 0.59$		$P = 0.48$		$P < 0.05$		$P < 0.01$	
<i>Non-Hispanic White</i>	59.0	58.9	57.4	63.1	53.8	51.8	60.8	60.2	62.4	66.8	65.4	39.1
<i>Hispanic</i>	23.4	18.6	23.3	18.8	26.3	22.5	19.3	15.4	23.6	13.8	25.0	22.4
<i>Non-Hispanic Black</i>	10.3	12.6	10.7	11.3	12.6	17.5	12.4	11.9	9.7	6.6	0.8	16.0
<i>Non-Hispanic other or multiple race</i>	7.3	9.9	8.5	6.9	7.4	8.1	7.6	12.5	4.3	12.8	8.9	22.5
<b>Condom use in month before</b>												
<b>method initiation</b>	$P < 0.05$		$P = 0.19$		$P = 0.09$		$P = 0.39$		$P < 0.05$		$P = 0.35$	
<i>No</i>	82.4	77.2	80.5	72.5	84.2	76.8	83.3	78.9	75.7	89.2	87.8	81.1
<i>Yes</i>	17.6	22.8	19.5	27.5	15.8	23.2	16.7	21.1	24.3	10.8	12.2	18.9
<b>Number of male sex partners in</b>												
<b>year before interview</b>	$P = 0.26$		$P < 0.05$		$P = 0.34$		$P < 0.05$		$P = 0.46$		$P = 0.21$	
<i>0-1</i>	78.5	75.7	48.2	62.7	70.3	78.7	91.9	83.6	91.8	92.4	91.1	92.4
<i>2</i>	10.7	14.2	20.6	21.3	17.2	11.4	4.2	12.4	2.3	4.1	7.3	3.6
<i>3+</i>	10.8	10.1	31.3	16.0	12.5	9.9	3.9	4.1	5.8	3.4	1.6	4.0
<b>Number of months sexually active</b>												
<b>in year after method initiation</b>	$P < 0.01$		$P = 0.56$		$P = 0.13$		$P = 0.19$		$P < 0.05$		$P = 0.11$	
<i>1-5 months</i>	8.4	15.4	18.9	24.4	10.0	10.0	4.9	9.6	5.6	11.2	2.5	3.7
<i>6-11 months</i>	17.4	27.1	38.0	32.3	19.3	30.7	9.6	12.6	9.8	24.1	13.1	29.7
<i>12 months</i>	74.2	57.5	43.1	43.3	70.7	59.3	85.5	77.8	84.7	64.8	84.5	66.6
<b>Period of method initiation</b>	$P < 0.01$		$P = 0.14$		$P = 0.17$		$P = 0.26$		$P = 0.42$		$P < 0.05$	
<i>2008-10</i>	15.7	20.4	14.2	19.2	15.1	23.8	15.9	21.6	15.9	16.1	18.4	19.4
<i>2011-13</i>	30.7	38.5	24.2	34.2	34.6	38.3	28.5	37.1	34.7	46.6	29.1	56.3
<i>2014-15</i>	29.8	24.2	35.0	29.4	28.8	20.1	32.1	24.8	22.0	18.1	30.6	15.1

<i>2016-18</i>	23.8	17.0	26.6	17.2	21.5	17.9	23.5	16.6	27.4	19.1	21.8	9.2
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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.

**TABLE 2**—Percent of Sexually-active Months During Which Condoms Were Used During the Year Following LARC or Moderately-effective Method (MEM) Initiation, by Women’s Age: U.S., 2008 to 2018.

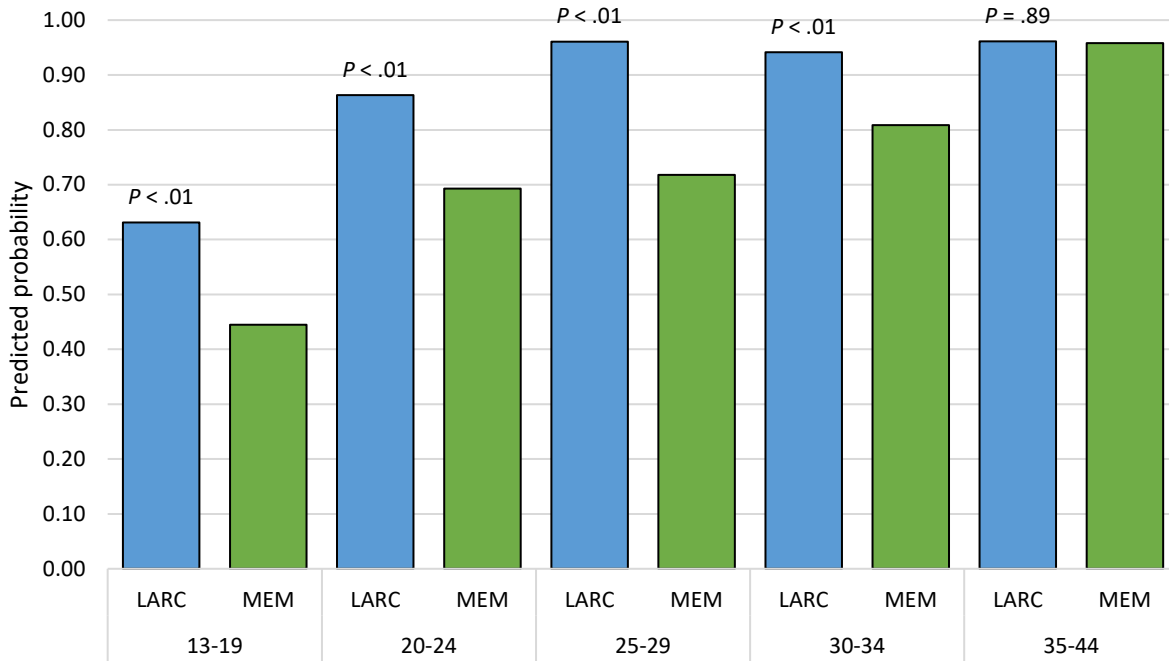
	All ages (N=2,018)			13-19 (N=586)		20-24 (N=556)		25-29 (N=447)		30-34 (N=273)		35-44 (N=156)	
	All (N=2,018)	LARC (N=824)	MEM (N=1194)	LARC (N=139)	MEM (N=447)	LARC (N=269)	MEM (N=287)	LARC (N=217)	MEM (N=230)	LARC (N=120)	MEM (N=153)	LARC (N=79)	MEM (N=77)
Percent of sexually-active months during which condoms were used at least once		<i>P</i> < 0.01		<i>P</i> < 0.05		<i>P</i> < 0.01		<i>P</i> < 0.01		<i>P</i> < 0.05		<i>P</i> = 0.17	
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

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

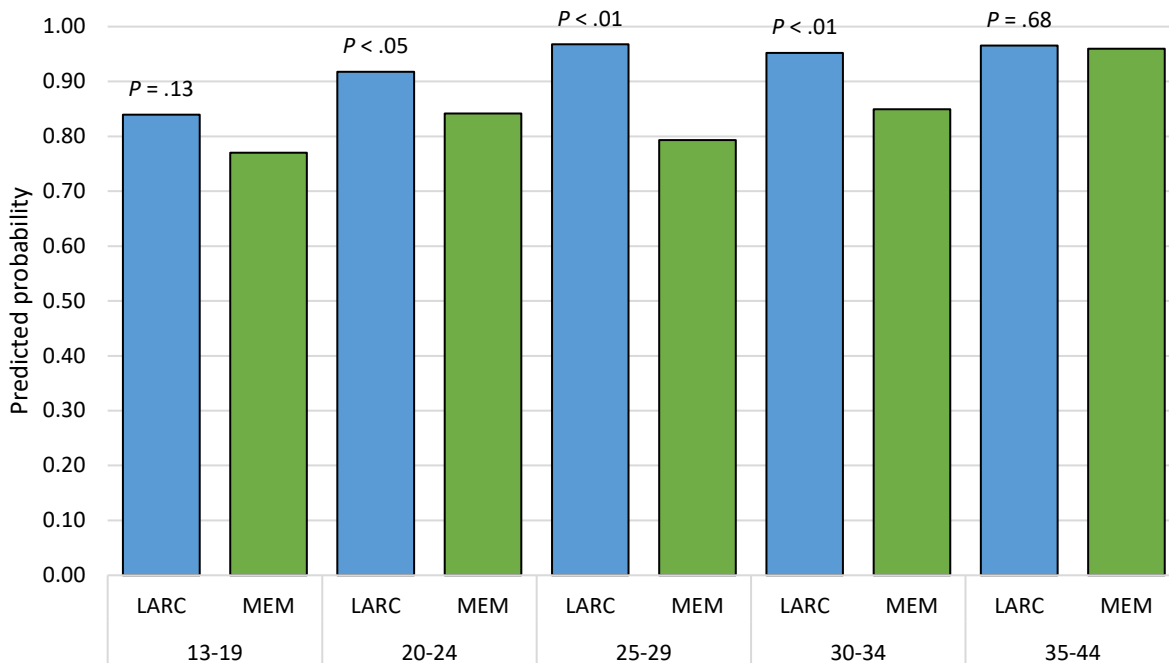
Note: *P*-values test for differences within each age group in the distribution by method initiated.

**FIGURE 1**—Predicted Probabilities<sup>a</sup> of Using Condoms During 0% of Sexually-active Months During the Year Following LARC Versus Moderately-effective Method (MEM) Initiation, by Women’s Age: U.S., 2008 to 2018.

**Panel A - Model 1, without covariates**



**Panel B - Model 2, with covariates**



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

Notes: Predicted probabilities are based on Appendix Table A.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 (ref.cat.: 1), teenage childbearing at method initiation (ref.cat.: No), educational attainment at method initiation (ref.cat.: High school), and union status at method initiation and union change (ref.cat.: Single), as well as self-reported race/ethnicity (ref.cat.: Non-Hispanic White), condom use in the month before method initiation (ref.cat.: No), number of male sex partners in year before interview (ref.cat.: 0-1), number of sexually-active months following method initiation (ref.cat.: 12), and period of method initiation (ref.cat.: 2011-13).

*P*-values test for difference between LARC versus MEM using Average Marginal Effects.

<sup>a</sup> Based on multinomial logistic regression analysis.

## Appendix

**TABLE A. 1**—Relative Risk Ratios<sup>a</sup> of Condom Use (Reference Outcome = 0% of Sexually-active Months with Condom Use) During the Year Following LARC or Moderately-effective Method Initiation: U.S., 2008 to 2018 (*N* = 2,018).

Covariate	Model 1 (Without covariates)		Model 2 (With covariates) <sup>b</sup>	
	1-99%	100%	1-99%	100%
<b>Contraceptive method initiated</b>	<i>P</i> < 0.01		<i>P</i> < 0.01	
<i>MEM</i>	1.00	1.00	1.00	1.00
<i>LARC</i>	0.12 <i>P</i> < 0.01	0.08 <i>P</i> < 0.01	0.15 <i>P</i> < 0.01	0.11 <i>P</i> < 0.01
<b>Age at method initiation</b>	<i>P</i> < 0.01		<i>P</i> < 0.01	
<i>13-19</i>	2.04 <i>P</i> < 0.05	4.62 <i>P</i> < 0.01	1.02 <i>P</i> = 0.96	1.29 <i>P</i> = 0.61
<i>20-24</i>	0.55 <i>P</i> = 0.14	1.87 <i>P</i> = 0.07	0.35 <i>P</i> < 0.05	1.16 <i>P</i> = 0.74
<i>25-29</i>	1.00	1.00	1.00	1.00
<i>30-34</i>	0.39 <i>P</i> = 0.06	0.87 <i>P</i> = 0.80	0.40 <i>P</i> = 0.08	1.02 <i>P</i> = 0.98
<i>35-44</i>	0.07 <i>P</i> < 0.01	0.17 <i>P</i> < 0.05	0.08 <i>P</i> < 0.01	0.25 <i>P</i> = 0.09
<b>Method * Age</b>	<i>P</i> < 0.05		<i>P</i> < 0.05	
<i>LARC * 13-19</i>	5.88 <i>P</i> < 0.01	4.02 <i>P</i> = 0.05	4.95 <i>P</i> < 0.01	5.22 <i>P</i> < 0.05
<i>LARC * 20-24</i>	6.72 <i>P</i> < 0.01	2.28 <i>P</i> = 0.23	7.49 <i>P</i> < 0.01	2.40 <i>P</i> = 0.24
<i>LARC * 30-34</i>	4.64 <i>P</i> = 0.14	1.07 <i>P</i> = 0.94	4.58 <i>P</i> = 0.09	0.97 <i>P</i> = 0.97
<i>LARC * 35-44</i>	19.11 <i>P</i> < 0.01	2.76 <i>P</i> = 0.45	15.94 <i>P</i> < 0.01	2.37 <i>P</i> = 0.53

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

<sup>a</sup> Based on multinomial logistic regression analysis.

<sup>b</sup> Model 2 includes the following covariates (results not shown): parity at method initiation (ref.cat.: 1), teenage childbearing at method initiation (ref.cat.: No), educational attainment at method initiation (ref.cat.: High school), and union status at method initiation and union change (ref.cat.: Single), as well as self-reported race/ethnicity (ref.cat.: Non-Hispanic White), condom use in the month before method initiation (ref.cat.: No), number of male sex partners in year before interview (ref.cat.: 0-1), number of sexually-active months following method initiation (ref.cat.: 12), and period of method initiation (ref.cat.: 2011-13).

Notes: *P*-values opposite the names of variables indicate results of Wald test of null hypothesis that full set of coefficients for that variable are jointly equal to one. *P*-values opposite the names of variable categories indicate results of *t*-test of null hypothesis that coefficient for that category is equal to one.