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## **Likelihood of repeat abortion in a Swedish cohort according to the choice of post-abortion contraception: a longitudinal study**

**Running title:** Post abortion contraception and odds of repeat abortion

Helena Kilander<sup>1,2</sup>, Siw Alehagen<sup>1</sup>, Linnea Svedlund<sup>1</sup>, Karin Westlund<sup>3</sup>, Johan Thor<sup>4</sup> & Jan Brynhildsen<sup>5</sup>

<sup>1</sup>Division of Nursing Science, Department of Medicine and Care, Faculty of Health Sciences, Linköping University, Linköping.

<sup>2</sup>Department of Obstetrics and Gynecology in Eksjö, County Council of Jönköping.

<sup>3</sup>Department of Obstetrics and Gynecology, Norrköping.

<sup>4</sup>Jönköping Academy for Improvement of Health and Welfare, Jönköping University, Jönköping.

<sup>5</sup>Department of Obstetrics and Gynecology and Department of Clinical and Experimental Medicine, Linköping University, Linköping, Sweden.

**Correspondence to:**

Helena Kilander

Kvinnokliniken Högländssjukhuset, 57581 Eksjö, Sweden

E-mail: [helena.kilander@rjl.se](mailto:helena.kilander@rjl.se)

**Conflicts of Interest statement**

Jan Brynhildsen has been reimbursed by Merck Sharpe & Dohme (MSD), Sweden, for running educational programs and giving lectures. JB has also been paid by Bayer AB, Sweden, and Actavis, for giving lectures. Other co-authors have no conflicts of interest to report.

1 **Abstract**

2 *Introduction:* Despite high access to contraceptive services, 42% of the women who seek an  
3 abortion in Sweden have a history of previous abortion(s). The reasons for this high repeat  
4 abortion rate remain obscure. The objective of this study was to study the choice of  
5 contraceptive method after abortion and related odds of repeat abortions within three to four  
6 years. *Material and methods:* This is a retrospective cohort study based on a medical record  
7 review at three hospitals in Sweden. We included 987 women who had an abortion during  
8 2009. We reviewed medical records from the date of the index abortion until the end of 2012  
9 to establish the choice of contraception following the index abortion and the occurrence of  
10 repeat abortions. We calculated odds ratios (OR) with 95 % confidence intervals (CI).  
11 *Results:* While 46 % of the women chose oral contraceptives, 34 % chose long-acting  
12 reversible contraceptives (LARC). LARC was chosen more commonly by women with a  
13 previous pregnancy, childbirth and/or abortion. During the follow-up period, 24 % of the  
14 study population requested one or more repeat abortion(s). Choosing LARC at the time of the  
15 index abortion was associated with fewer repeat abortions compared with choosing oral  
16 contraceptives (13% versus 26%, OR 0.36; 95% CI 0.24-0.52). Sub-dermal implant was as  
17 effective as intrauterine device in preventing repeat abortions beyond three years.  
18 *Conclusions:* Choosing LARC was associated with fewer repeat abortions over more than  
19 three years of follow-up.

20

21 **Keywords**

22 Long-acting reversible contraception, post-abortion contraception, repeat abortion, Subdermal  
23 implant, termination of pregnancy.

24

25 **Abbreviations**

26 OR odds ratio,  
27 CI confidence intervals,  
28 LARC long-acting reversible contraception,  
29 OC oral contraceptives,  
30 LNG-IUS levonorgestrel intrauterine systems,  
31 IUD intrauterine device.

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34 **Key message**

35 Choosing long-acting reversible contraception (LARC) post-abortion was associated with  
36 considerably fewer repeat abortions compared to choosing other contraceptive methods  
37 among women in Sweden.

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58 **Introduction**

59 Many unwanted pregnancies occur in spite of contraceptive use, probably due to inconsistent  
60 or incorrect use of the contraceptives (1-4). A French study reported that one-third of women  
61 undergoing an abortion chose to use the same contraceptive method after the abortion as  
62 before. Half of these women reported receiving a prescription for an oral contraceptive (OC)  
63 (4). Both prescribers and users may overestimate the effectiveness of OC (1, 3-5). Women  
64 undergoing an abortion seem, however, particularly willing to switch to more effective, non-  
65 user dependent, contraceptive methods such as long acting reversible contraception (LARC)  
66 (3-6).

67

68 Intrauterine contraception and sub-dermal implants (LARC), unlike OC, does not require the  
69 user to remember to take it each day or in conjunction with intercourse (7). Previous studies  
70 have found that use of LARC after an abortion leads to a greater reduction in the risk of  
71 further unintended pregnancies and repeat abortions compared with use of other contraceptive  
72 methods. Few studies have included choice and use of sub-dermal implants post abortion and  
73 studies with longer follow-up time are lacking (8-12). A high initial cost for levonorgestrel  
74 intrauterine systems (LNG-IUS) and sub-dermal implants is, however, a challenge affecting  
75 the choice of contraceptive method (13-14).

76

77 There are approximately 37000 induced abortions in Sweden every year, corresponding to a  
78 rate of almost 21 per 1000 women aged 15-49 years (15). In Sweden, 42 % of all women who  
79 undergo an abortion have had at least one previous abortion (15). Women are free to undergo  
80 an abortion until the 18th week of pregnancy. Thereafter, an abortion requires approval by the  
81 National Board of Health and Welfare. Medical abortions constitute 88% of all abortions.  
82 Women are offered a follow-up appointment three to four weeks after a medical abortion (15).  
83 Usually, initiation of LARC is arranged during this appointment, whereas women who  
84 undergo surgical abortion often have LARC inserted immediately. Contraceptive counselling  
85 is free for women of all ages and a number of hormonal contraceptives (including sub-dermal  
86 implants and LNG-IUS) are subsidized up to the age of 25 (16). In connection with an  
87 abortion, either a gynaecologist or a midwife carries out contraceptive counselling (17).

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91 In Sweden, approximately 25% of all fertile women use an intrauterine device (IUD), while 5-  
92 8% use implants (18). It is unclear why, despite these comparatively large proportions, 42 %  
93 of women who have had an abortion undergo repeat abortions (15). We therefore studied the  
94 choice of contraceptive method after abortion and the related odds of repeat abortions within  
95 three to four years.

96

## 97 **Material and methods**

98 This was a retrospective cohort study based on the review of medical records. The study was  
99 performed in departments of Obstetrics and Gynecology at one university hospital, one central  
100 hospital and one district hospital in southeast Sweden. We included all women with a Social  
101 Security Number (i.e. permanent residents of Sweden) who sought an abortion during 2009 at  
102 these hospitals and had a diagnosis of ‘unwanted pregnancy’ (z.64.0 in ICD-10). Women  
103 were excluded if the review showed that the diagnosis was incorrect at the index visit (e.g. the  
104 record indicated an spontaneous abortion), if the woman chose to continue the pregnancy, or  
105 if medical interventions preventing pregnancy, such as sterilization or hysterectomy, occurred  
106 during the follow-up period. Women were also excluded if the induced abortion occurred  
107 because of maternal disease or due to fetal malformations, since these women might wish to  
108 become pregnant soon again. The study was approved by the Regional Ethical Review Board  
109 in Linköping (#2013/145-31; date of approval: 24 April 2013.)

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111 The medical records were reviewed from the date of the index abortion during 2009 to the  
112 31st of December 2012. Data were manually extracted from the medical records using a  
113 standardized form. Local administrators de-identified all records before some of the authors  
114 reviewed them. The data abstraction procedure and form was pilot tested on 30 records,  
115 leading to a few adjustments. These 30 pilot medical records were then included in the study.  
116 Three authors collected data (HK, LS and KW) and a fourth author (JB) acted as an  
117 adjudicator in case of questions and disagreements.

118

119 From the index abortion records, we extracted data on women’s age, number of previous  
120 pregnancies (including all previous deliveries, abortions and miscarriages), current *Chlamydia*  
121 infection and use of an interpreter. The contraceptive method chosen was noted either if the  
122 women started the method immediately or the record noted that they planned to start later on.

123 Moreover, we collected data on any medical history that could constitute a contraindication  
124 for a specific contraceptive choice, on the method used for the index abortion and on any  
125 complications associated with the index abortion. We included information concerning the  
126 choice of contraceptive method up until four weeks after the index abortion.

127 If no contraception was chosen, it was recorded as “No chosen method”. LARC was defined  
128 as sub-dermal implants and IUDs, which included Copper-IUDs and LNG-IUS.

129

130 Each woman’s medical record was reviewed for repeat abortions at the same hospital from the  
131 time of the index abortion until the end of 2012. We were not able to trace women outside  
132 their local hospital, throughout Sweden, based on their Social Security Number since no  
133 individual based abortion register exists, and there are multiple different medical record  
134 systems across the country. The authors relied on the collaborating hospitals’ administrators  
135 to identify relevant records, and only received de-identified copies of records from them, to  
136 protect patient privacy.

137 A repeat abortion was defined as termination of one or more new pregnancies during the  
138 follow-up period. A total of 1574 women had the diagnosis z64.0. From this group, 1,395  
139 records were identified of women who actually had an abortion during 2009 at the study  
140 hospitals and met the inclusion criteria for review. Of these records, 408 were excluded  
141 because the patient had moved out of the area of each hospital (n=337) or had more than one  
142 contraceptive listed (n=26) or had no information regarding contraceptive choice in the record  
143 at the time of the index abortion (n=45). The remaining 987 records were included in this  
144 study.

145

146 For power calculation, we hypothesized that the choice of LARC after an index abortion  
147 would be associated with fewer repeat abortions within three to four years compared with  
148 other contraceptive options. Based on a previous study we expected 50% fewer repeat  
149 abortions among LARC users compared to users of other methods. We assumed that 30% of  
150 the women would choose LARC (8). To reach 80% power to identify this difference at a 0.05  
151 significance level, we needed to include 705 women (medical records). Since there was  
152 considerable uncertainty in this estimate, and assuming that a number of women would have  
153 no follow-up, we decided to double this number.

154

155 Statistical analyses were performed using IBM SPSS statistics version 20 (IBM Corp.,  
156 Armonk, NY, USA). In the statistical analysis, repeat abortion during follow-up was  
157 considered as both a continuous and a categorical variable. Using the Student's t-test we  
158 compared the characteristics of the women who chose LARC with those of the women who  
159 chose other contraceptive options. We used the Chi-squared test for calculating p-values and  
160 presented the results as odds ratios (OR) with 95% confidence intervals (CI) for the  
161 categorical variables contraceptive method, repeat abortion and abortion method. Using a  
162 logistic regression model we adjusted for the potential confounding factors age, previous  
163 pregnancy, childbirth and abortions. We used Kaplan Meier's survival test to estimate the  
164 proportions of women not having a repeat abortion according to their chosen contraceptive  
165 methods from the time of the index abortion until the first repeat abortion.  
166

## 167 **Results**

168 Thirty eight percent of the women (n=375) had undergone one or more previous abortion(s)  
169 before the index abortion. Twenty-seven women (2.7 %) were diagnosed with a *Chlamydia*  
170 infection. Few women (n=57) had a medical or family history noted in the records that could  
171 constitute a contraindication for use of a specific contraceptive method. Twenty-four women  
172 used an interpreter at the time of the index abortion, and in 17 additional cases, language  
173 difficulties were noted in the records when no interpreter had been present.  
174

175 In all, 239 women (24 %) returned for one or more repeat abortions at the same hospital as  
176 their index abortion during follow-up; 53 of them (5%) underwent two or more abortions. The  
177 median time until the first repeat abortion among the 239 women was 17 months.  
178

179 Women who chose LARC had a significantly higher number of previous pregnancies (2.6  
180 versus 1.7 on average), of children (1.5 versus 1.0) and of previous abortions ( 0.8 versus 0.6).  
181 Those who underwent a surgical abortion chose LARC more frequently than women who  
182 underwent a medical abortion (42% versus 32%,  $p < 0.03$ ) (Table 1).

183 Women were less likely to choose LARC than OC ( $P= 0.02$ , OR: 0.74 CI: 0.55-0.98). OC was  
184 prescribed to 46% of the women; 28% chose combined oral contraceptives and 18% chose  
185 progestin only pills. LARC was chosen by 34% of the women at the index abortion. Women

186 who chose progestin only pills, barrier methods or chose no method at all had similar rates of  
187 repeat abortions (33-34%, Table 2).

188  
189 A smaller proportion of women who chose LARC underwent repeat abortions than did  
190 women who chose other contraceptive methods (Tables 2, 3), or had no chosen method.  
191 Choice of sub-dermal implant yielded the same level of effectiveness as choice of IUD in  
192 preventing repeat abortions beyond three years (Table 2). In a logistic regression model  
193 including choice of LARC, previous pregnancies, childbirths, abortions and age, choice of  
194 LARC remained strongly associated with a decreased risk of repeated abortion (Table 3).  
195 Furthermore, analysing year by year after the index abortion, the choice of LARC was  
196 associated with fewer repeat abortions compared with all other choices (OR  $\leq$  0.36; 95% CI  
197 0.19-0.64).

198  
199 Choice of LARC was associated with fewer repeat abortions also when compared only with  
200 choice of OC (table 3). Over the follow-up period, 90 % of the women who chose LARC at  
201 the time of the index abortion avoided having any repeat abortion, while only 75 % of the  
202 women who chose OC did so – a proportion similar to that of women who chose no  
203 contraceptive method at all (Figure 1).

204  
205 Among women who chose to use an IUD at the index abortion (n=257), we found no  
206 difference in the odds of repeat abortion between those who underwent a surgical abortion  
207 and those who underwent a medical abortion.

208

## 209 **Discussion**

210 We found that 24% of the women returned for abortion(s) within three to four years following  
211 an index abortion. The odds of repeat abortion were significantly lower for women who chose  
212 LARC compared to all other options, thus confirming our hypothesis. The choice of sub-  
213 dermal implant was as effective as IUD in preventing repeat abortions over three to four  
214 years, corroborating the few previous studies following women beyond two years (11, 21).  
215 Previous studies (11, 20), while pointing in the same direction, included shorter follow-up  
216 periods than the present study. This study expands the body of evidence for the effectiveness  
217 and comparative advantage of LARC including implants, which have rarely been included to  
218 the same extent in previous studies, in preventing repeat abortion over 3-4 years compared to

219 other contraceptive methods.

220 Even though the proportion of women who chose LARC was comparatively high, at 34%,  
221 there is room for increasing use of LARC to further prevent repeat abortions. A Finnish  
222 register study had a long follow-up time after abortion (49 months) but only few women used  
223 an implant (8). We followed 987 women for more than three years. Moreover, the study  
224 reflects an “everyday situation” and confirms that the benefits of LARC found in (efficacy)  
225 intervention studies (8- 9, 11) are replicable in ordinary clinical settings.

226 As the vast majority of abortion care in Sweden is provided by public health care services, we  
227 likely included and followed the vast majority of the women who underwent abortion in the  
228 catchment areas of the hospitals. Furthermore, we included all women, whether they  
229 underwent surgical or medical abortion, which previous studies (8-9, 20) have not done. Only  
230 12 women were excluded due to abortion for medical reasons, and five women were excluded  
231 because they had a hysterectomy during the follow-up. Consequently, this could not be  
232 considered a source of bias that affects the results.

233 We have only evaluated the post-abortion *choices* of contraceptives (as documented in the  
234 medical record) rather than actual *use* of contraception, since such data are much more  
235 difficult to acquire; there, the medical record does not suffice as a data source. It is likely  
236 some women did not use the method they had chosen (according to the medical record) and  
237 others discontinued its use. We actually do not know how many subsequently discontinued  
238 the method during our follow-up period. Not starting use or discontinuing use are probably  
239 the major causes of pregnancy and repeat abortion among the women who chose LARC  
240 (according to their record) rather than becoming pregnant when actually using LARC.

241 As in previous studies (3, 19) OC showed to be less effective, but the most frequently selected  
242 contraceptive method, following an abortion in our study population. LARC offered better  
243 protection against repeat abortion than other options, yet was chosen by a minority of women  
244 at the time of their index abortion. There are many possible explanations for why women did  
245 not choose the more effective LARC over OC. After a medical abortion, use of LARC  
246 requires an additional visit to initiate the method, whereas it can be introduced concomitantly  
247 with surgical abortion (20). Therefore, as might be expected, a greater proportion of women in  
248 our study who had a surgical abortion chose to use LARC. Simplifying initiation and use of  
249 LARC post-abortion is an important issue. Sääw and co-workers showed that an IUD could be  
250 safely inserted five to ten days after a medical abortion (22) and recently it has been described

251 that sub-dermal implants can be inserted at the time of mifepristone intake during a medical  
252 abortion (23).

253 Lack of knowledge and inadequate clinical training of health care professionals may hinder  
254 women from using LARC (14, 24-26). While midwives and gynaecologists who provide  
255 contraceptive counselling in Sweden are expected to have these skills, it is unclear to what  
256 extent they actually do support LARC during such counselling.

257 Poor bleeding control is a well-known reason for discontinuation of contraceptive use. This  
258 may explain why the women in our study more frequently chose combined hormonal  
259 contraceptives than LARC (26). Some prescribers may not recommend LARC to nulliparous  
260 women due to a common misconception that these women prefer to use OC (27, 28). By  
261 contrast, however, adolescents might benefit the most from using LARC instead of OC (10).  
262 In our study, LARC was chosen more often by women with a previous pregnancy, childbirth  
263 and /or abortion, perhaps due to the increased motivation by the women and their counsellors  
264 to change to a more effective, non-user-dependent, method. Here, too, we see room for  
265 increased use of LARC, also among nulliparous women.

266 Financial factors may have influenced the women's choice of contraception in this study and  
267 in previous studies (8, 20). Implants and LNG-IUS are associated with a high initial cost (14,  
268 24). In an American study where all methods were offered for free for three years, 70% of  
269 women who were given structured contraceptive counselling chose LARC (29). More  
270 broadly, previous studies have shown a relationship between repeat abortion and  
271 socioeconomic factors (1, 4, 30). While we were not able to address this important issue here,  
272 since data on patients' socioeconomic status were not consistently available in the medical  
273 records, we note the potential relationship between the cost of different contraceptive methods  
274 and the socioeconomic gradient in the risk of unwanted pregnancy. Good access to LARC for  
275 all women, regardless of socioeconomic status, could prevent unwanted pregnancies and  
276 improve sexual and reproductive health (10).

277 In conclusion, this study shows that more women chose OC than LARC even though LARC  
278 was associated with considerably fewer repeat abortions over 3-4 years compared to choice of  
279 other contraceptive options. Sub-dermal implant was as effective as IUD in preventing repeat  
280 abortions. These findings highlight the importance, not least at the time of an abortion, of  
281 providing evidence based information to women who might not know the large differences in  
282 effectiveness of the different methods. More research regarding experiences and perceptions

283 among both healthcare professionals and women could reveal possible obstacles to more  
284 effective contraceptive counselling. Interventional studies could test the feasibility of  
285 promoting LARC to prevent repeat abortions.

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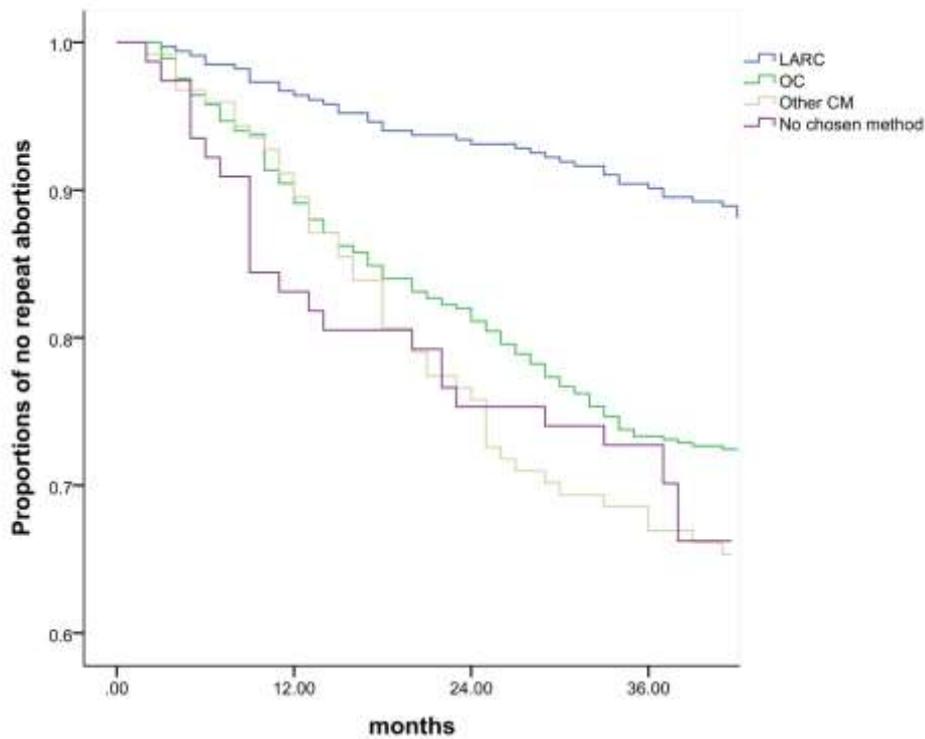
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382 **Figure 1.** Probability of not having a repeat abortion according to chosen contraceptive  
 383 method. Calculated from the date of the index abortion until the first repeat abortion.

384 LARC, long-acting reversible contraception; OC, oral contraceptives; CM, contraceptive  
 385 methods.

386

387

388

389 Table 1. Characteristics of the study population divided by choice of Long Acting Reversible  
 390 Contraception (LARC) or no LARC at the index abortion.

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<b>Characteristics</b>	<b>Study-population</b> n=987	<b>No LARC <sup>a</sup></b> n=653	<b>LARC <sup>b</sup></b> n=334	<b>P-value</b>
<b>Age</b> Mean (SD)	27.7 (7.9)	26.9 (7.7)	29.3 (8.1)	0.09 <sup>c</sup>
<b>Previous pregnancies</b> Mean (SD)	2.0(2.1)	1.7 (2.0)	2.6 (2.2)	0.01 <sup>c</sup>
<b>Previous childbirth</b> Mean (SD)	1.1 (1.2)	1.0 (1.2)	1.5(1.3)	0.01 <sup>c</sup>
<b>Previous abortions</b> Mean (SD)	0.6 (1.0)	0.6(0.9)	0.8(1.1)	0.003 <sup>c</sup>
<b>Medical abortion/ Surgical abortion</b> n (%)	803 (81) 184 (19)	546 (68) 107 (58)	257 (32) 77 (42)	0.030 <sup>d</sup>

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394 <sup>a</sup> No LARC: Combined oral contraceptives; Progestin only pills; Injections; The vaginal contraceptive ring; The  
 395 transdermal contraceptive patch; Barrier method; Choice of no contraceptive method in the record.

396 <sup>b</sup> LARC: Copper intrauterine device ; Levonorgestrel intrauterine system; Sub-dermal implants. <sup>c</sup> Students t-test.

397 <sup>d</sup> Chi-square test - choice of LARC after medical versus surgical abortion. Missing values: No missing values in  
 398 the variable age. Min/max 42-97 missing values in the other variables.

399 Table 2. Choice of contraceptive method at the time of the index abortion, and number of  
 400 repeat abortions during the follow-up period.

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Contraceptive method	Number of women n (%)	Number of women undergoing one or more repeat abortions during the follow-up period		
		any (%)	1 n (%)	>1 n (%)
<b>No LARC</b>	653 (66)	197 (30)	155 (24)	42 (6)
Combined oral contraceptives	277 (28)	72 (26)	54 (19)	18 (7)
Progestin only pill	174 (18)	56 (32)	48 (27)	8 (5)
Ring/ Patch <sup>a</sup>	52 (5)	20 (38)	15 (29)	5 (9)
Barrier method	42 (4)	14 (33)	10 (24)	4 (9)
Injection	30 (3)	9 (30)	9 (30)	0
No chosen method <sup>b</sup>	78 (8)	26 (33)	19 (24)	7 (9)
<b>LARC <sup>c</sup></b>	334 (34)	42 (13)	31 (9)	11 (4)
Copper intrauterine device	159 (16)	19 (12)	13 (8)	6 (4)
Levonorgestrel intrauterine system	98 (10)	12 (12)	11 (11)	1 (1)
Sub-dermal Implant	77 (8)	11 (14)	7 (9)	4 (5)
<b>Total</b>	987 (100%)	239 (24%)	186 (19)	53 (5)

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<sup>a</sup> Ring/Patch= the vaginal contraceptive ring/ the transdermal contraceptive patch. <sup>b</sup> No chosen method= Choice of no contraceptive method in the record <sup>c</sup> LARC=Long Acting Reversible Contraception

412 Table 3. Choice of contraceptive method and odds of repeat abortion(s).

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<b>Contraceptive methods</b>	<b>Women</b>	<b>Odds of repeat abortion(s)<sup>b</sup></b>	<b>Adjustments for potential confounding factors<sup>c</sup></b>
Comparing groups	(n)	(OR/ CI)	(OR/CI)
LARC/ no LARC	987	0.33( 0.23-0.47)	0.29 (0.19-0.44)
LARC/OC <sup>a</sup>	785	0.36( 0.24-0.52)	0.26 ( 0.15-0.42)

414 <sup>a</sup> OC= Oral contraceptives, which includes combined oral contraceptives, and progestin-only pills.

415 <sup>b</sup> The Chi-square test was used for calculating p-values and presented as Odds Ratios (OR) and 95% confidence  
416 intervals (CI).

417 <sup>c</sup> A logistic regression model was used to adjust for age, previous pregnancies, childbirths and abortions.

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