

<https://helda.helsinki.fi>

Early provision of intrauterine contraception as part of abortion care-5-year results of a randomised controlled trial

Pohjoranta, Elina

2020-04

Pohjoranta , E , Suhonen , S , Gissler , M , Ikonen , P , Mentula , M & Heikinheimo , O 2020 , ' Early provision of intrauterine contraception as part of abortion care-5-year results of a randomised controlled trial ' , Human Reproduction , vol. 35 , no. 4 , pp. 796-804 . <https://doi.org/10.1093/humrep/de>

<http://hdl.handle.net/10138/328822>

<https://doi.org/10.1093/humrep/deaa031>

acceptedVersion

Downloaded from Helda, University of Helsinki institutional repository.

This is an electronic reprint of the original article.

This reprint may differ from the original in pagination and typographic detail.

Please cite the original version.



Draft Manuscript For Review. Reviewers should submit their review at
<http://mc.manuscriptcentral.com/humrep>

**Early provision of intrauterine contraception as part of
 abortion care – 5-year results of a randomised controlled
 trial**

Journal:	<i>Human Reproduction</i>
Manuscript ID	HUMREP-19-1487.R1
Manuscript Type:	Original Article
Date Submitted by the Author:	n/a
Complete List of Authors:	Pohjoranta, Elina; Helsingin Yliopisto Laaketieteellinen tiedekunta, Obstetrics and Gynecology Suhonen, Satu; City of Helsinki Health Centre, 4. Sexual Health and Family Planning Clinic Gissler, Mika; Finnish Institute for Health and Welfare; Karolinska Institutet Department of Neurobiology Care Sciences and Society Ikonen, Pirjo; Helsinki University Hospital Obstetrics and Gynecology Mentula, Maarit; Helsinki University Hospital, Obt &Gyn Heikinheimo, Oskari; Helsinki University Central Hospital, Ob & Gyn
Keywords:	ABORTION, CONTRACEPTION, PREGNANCY TERMINATION, RANDOMISED CONTROLLED TRIALS
Subject Section:	Fertility Control

SCHOLARONE™
 Manuscripts

1 **Early provision of intrauterine contraception as part of** 2 **abortion care – 5-year results of a randomised controlled trial**

3 Running title: Early provision of IUD as part of abortion care

4

5 Elina Pohjoranta¹ MD; Satu Suhonen³ PhD; Prof Mika Gissler², PhD; Pirjo Ikonen¹ RN; Maarit

6 Mentula¹ PhD; Prof Oskari Heikinheimo^{1*}, PhD

7

8

9 1. Department of Obstetrics and Gynaecology, University of Helsinki and Helsinki

10 University Hospital

11 2. Finnish Institute for Health and Welfare, Helsinki, Finland and Karolinska Institute,

12 Department of Neurobiology, Care Sciences and Society, Stockholm, Sweden

13 3. Centralized Family Planning, Department of Social Services and Health Care, City of

14 Helsinki, Helsinki, Finland

15

16 * Correspondence: O Heikinheimo, Department of Obstetrics and Gynaecology, Helsinki University

17 Hospital, PO Box 140, 00029-HUS, Helsinki, Finland.

18 E-mail: oskari.heikinheimo@helsinki.fi

19

20

21

22 **Abstract**

23 **Study question:** Can the incidence of subsequent termination of pregnancy (TOP) be diminished
24 by providing intrauterine contraception as part of abortion services?

25 **Summary answer:** Provision of IUD as part of TOP services reduced the need for subsequent TOP
26 during 5-year follow-up, ~~but~~ the effect was limited to the first three years.

27 **What is known already:** IUD is highly effective in preventing subsequent TOP. Prompt initiation
28 of IUD leads to higher usage rate during follow-up, as compliance with post-TOP IUD insertion
29 visits is low.

30 **Study design, size, duration:** The objective of this randomised controlled trial was to assess the
31 effect of early comprehensive provision of intrauterine contraception after TOP on the incidence
32 of subsequent TOP during five years of follow-up.

33 This study was conducted at Helsinki University Hospital between October 18th 2010 and January
34 21st 2013. Altogether 748 women undergoing a first trimester TOP were recruited and randomised
35 into two groups. The intervention group (n=375) was provided with an IUD during surgical TOP or
36 1–4 weeks following medical TOP at the hospital providing the abortion care. Women in the
37 control group (n=373) were advised to contact primary health care for follow-up and IUD
38 insertion. Subsequent TOPs during the 5-year follow-up were identified from the Finnish Register
39 on induced abortions.

40 **Participants, setting, methods:** The inclusion criteria were age ≥ 18 years, duration of gestation
41 ≤ 12 weeks, residence in Helsinki and accepting intrauterine contraception. Women with
42 contraindications to IUD were excluded.

43 **Main results and the role of chance:** The overall numbers of subsequent TOPs were 50 in the
44 intervention and 72 in the control group (26.7 vs. 38.6/1000 years of follow-up, $p=0.027$) and

45 those of requested TOPs including TOPs and early pregnancy failures 58 and 76 (30.9 vs.
46 40.8/1000, $p=0.080$). Altogether 40 (10.7%) women in the intervention and 63 (16.9%) in the
47 control group underwent one or several subsequent TOPs (HR 1.67 [CI 95% 1.13 to 2.49],
48 $p=0.011$). The number of TOPs was reduced by the intervention during years 0–3 (22.2 vs.
49 46.5/1000, $p=0.035$), but not during years 4–5 (33.3 vs. 26.8/1000, $p=0.631$).

50 **Limitations, reasons for caution:** Both medical and surgical TOP were used. This may be seen as
51 a limitation, but it also reflects the contemporary praxis of abortion care. The immediate post-TOP
52 care were provided by two different organizations allowing us to compare two different ways of
53 contraceptive service provision following TOP.

54 **Wider implications of the findings:** Providing TOP and IUD insertion comprehensively in a same
55 health care unit leads to significantly higher rates of attendance, IUD use and significantly lower
56 risk of subsequent TOP (HR 1.67 [CI 95% 1.13 to 2.49], $p=0.011$).

57 **Study funding/competing interest(s):** This study was supported by Helsinki University Central
58 Hospital Research funds and by research grants provided by the Jenny and Antti Wihuri
59 Foundation, the Yrjö Jahnsson Foundation, and Finska Läkaresällskapet. EP has received a personal
60 research grant from the Finnish Medical Society. The City of Helsinki supported the study by
61 providing the IUDs. The funding organisations had no role in planning or execution of the study, or
62 in analysing the study results.

63 **Trial registration number:** The trial was registered at clinicaltrials.gov (NCT01223521).

64 **Trial registration date:** 18th October 2010.

65 **Date of first patient's enrolment:** 18th October 2010.

66 **Keywords:** Abortion/termination of pregnancy, IUD/intrauterine contraception, subsequent TOP

67

68 Ethics approval

69 We received approvals from the Ethics Committee of the Hospital District of Helsinki and Uusimaa
70 (HUS 260/13/03/03/2009), the Ethics Committee of the City of Helsinki (10-1138/054). Approval to
71 carry out the study was granted by the Hospital District of Helsinki and Uusimaa (§12/30.03.2010).
72 The Finnish Institute for Health and Welfare (THL) granted an approval to use personal-level data,
73 which is required for registry-based studies in Finland (THL/1479/5.05.00/2013). All personal-level
74 data that could be used to identify individuals was removed before the analyses.

75 Transparency statement

76 The lead author* affirms that this manuscript is an honest, accurate, and transparent account of
77 the study being reported; that no important aspects of the study have been omitted; and that any
78 discrepancies from the study as planned (and, if relevant, registered) have been explained.

79 Patient and public information statement

80 The study was initiated in 2009, and at the time it was not customary to involve patients and/or
81 public in planning of a scientific study.

82 Dissemination declaration

83 The study results will be disseminated to the health care providers and organizations involved in
84 the study as well as to the public once the study has been published.

85

86

87

88 **Introduction**

89 The efficacy of long-acting reversible contraceptives (LARCs) and, especially, that of intrauterine
90 devices (IUD) in preventing unwanted pregnancy is well established (Peipert *et al.*, 2012; Winner
91 *et al.*, 2012; Blumenthal *et al.*, 2011; Secura *et al.*, 2014). According to several recent guidelines,
92 LARCs have become the recommended method of contraception for women in all age groups
93 (WHO, 2015; RCOG, 2018).

94 Previous cohort studies have shown that young age, parity, and history of termination of
95 pregnancy (TOP) are associated with increased risk of subsequent TOP (Heikinheimo *et al.*, 2008).
96 In addition, contraceptive choices affect the risk of subsequent unwanted pregnancy. In cohort
97 studies, post-abortal use of IUD has been associated with a 60–70% reduction in the need of
98 subsequent TOP (Okusanya *et al.*, 2014; Rose *et al.*, 2012).

99 Regardless of the method of TOP, the resumption of ovarian function occurs rapidly; 80% of
100 women ovulate within 6 weeks after TOP (Schreiber *et al.*, 2011). In addition, 50% of women
101 resume sexual activity in two weeks following TOP (Boesen *et al.*, 2004). Thus, in order to prevent
102 subsequent unwanted pregnancy, immediate initiation of effective contraception is important. In
103 Finland, contraceptive counselling and planning are routinely included in the TOP process, and
104 women are advised to initiate contraceptive use immediately. Yet, more than one in three women
105 undergoing a TOP have a history of one or several previous TOPs. Similar to several other
106 countries, this rate has been increasing during the past decade in Finland (THL, 2018;
107 Socialstyrelsen, 2018; INED, 2012; GOV.UK, 2018).

108 The insertion of IUD at the time of surgical TOP is effective and safe, and results in higher IUD use
109 during follow-up (Okusanya *et al.*, 2014; WHO, 2012; Sääv *et al.*, 2012; Bednarek *et al.*, 2011).

110 However, medical abortion has become the dominant method in several countries during the last
111 decades (THL, 2018; Socialstyrelsen, 2018; INED, 2012; GOV.UK, 2018). Medical abortion poses
112 challenges concerning IUD provision since compliance with post-abortion care in the service-
113 delivery systems assessed is often poor (Betstadt *et al.*, 2011; Pohjoranta *et al.*, 2018). Immediate
114 insertion of an IUD after medical TOP (MTOP) is safe, although it is associated with a higher risk of
115 partial expulsion (Korjamo *et al.*, 2017). In contrast, IUD provision at approximately one week after
116 MTOP does not significantly increase the risk of expulsion (Sääv *et al.*, 2012; Shimoni *et al.*, 2011;
117 Betstadt *et al.*, 2011). As with surgical abortion, the prompt provision of IUD leads to a higher rate
118 of use and subject satisfaction following MTOP (Sääv *et al.*, 2012).

119 In the present study, we studied the efficacy of routine provision of IUD as part of abortion care in
120 comparison to the current praxis of prescribing oral contraceptives as a bridging method and
121 directing women to primary health care (PHC) for IUD insertion. Our primary outcome measure
122 was the number of subsequent TOPs performed during the 5-year follow-up after the index
123 abortion. The secondary outcomes were the number of all requested TOPs during the follow-up
124 (including cases of miscarriage, blighted ovum or ectopic pregnancy) and the timing of subsequent
125 TOP. Previously, we published the 1-year follow-up results concerning the need for subsequent
126 TOP, success of early IUD insertion, rates of attendance and IUD use, as well as mental and sexual
127 well-being (Pohjoranta *et al.*, 2015; Pohjoranta *et al.*, 2017; Pohjoranta *et al.*, 2018; Toffol *et al.*,
128 2016). In the present study, we report the final 5-year results on the need for subsequent TOP.

129

130 **Methods**

131 **Study design and participants**

132 This study design has been described in detail previously (Pohjoranta *et al.*, 2015). The study was
133 conducted in collaboration with the Helsinki University Hospital and the City of Helsinki.

134 The inclusion criteria were age ≥ 18 years, residence in Helsinki, duration of gestation $\leq 12^{+0}$ weeks,
135 having a non-foetal indication for the abortion and signing an informed consent form. Women
136 with uterine anomaly, cervical screening result requiring surgical intervention, or inadequate
137 language skills in Finnish or Swedish were excluded. Acute liver disease and breast cancer were
138 contraindications for the levonorgestrel-releasing intrauterine system (LNG-IUS), and copper
139 allergy, iron deficiency anaemia, and Wilson's disease for copper intrauterine device (Cu-IUD). The
140 characteristics of the study participants are presented in Table 1.

141

142 Altogether 751 women were randomised into two groups (Figure 1). Women in the intervention
143 group (n=375) were provided with an IUD (either the 52mg levonorgestrel-releasing intrauterine
144 system, LNG-IUS, Mirena® or a Cu-IUD, Nova-T®, both manufactured by Bayer Ag [Turku, Finland]
145 and hereafter referred as IUD) at the hospital responsible for the abortion care. The IUD was
146 planned to be inserted at the time of surgical abortion (n=70), or at a follow-up visit performed 1–
147 4 weeks after MTOP (n=305). Women in the control group (n=373 [71 cases of surgical and 302
148 medical abortion]) were prescribed oral contraceptives and advised to contact their PHC unit for
149 follow-up and contraceptive services including IUD insertion, according to the current national
150 guideline on induced abortion (Duodecim, 2013). The subsequent TOPs were analysed on an
151 intention-to-treat analysis (ITT) to assess the efficacy of the intended intervention.

152 **Procedures**

153 All abortions were performed according to the national guideline (Duodecim, 2013). All the index
154 abortions in this study were performed due to a social indication, or based on the woman's age of
155 at least 40 years or having given birth to four or more children, both indications for abortion given
156 in the Finnish legislation. The participants were advised to contact the hospital in case of
157 suspected abortion-related adverse events or complications.

158 According to local guideline of the time, all women were invited for a follow-up at three months
159 after IUD insertion. For the intervention group, this was performed by study nurse. All women
160 were provided a follow-up visit by a specialist in obstetrics and gynaecology (SS) at one and five
161 years at the PHC family planning clinic of the City of Helsinki.

162 Data on subsequent induced abortions during five years after the index abortion were obtained
163 from the Finnish Register of Induced Abortions kept by the Finnish Institute for Health and Welfare
164 (THL). In Finland, reporting all TOPs to THL is mandatory by the law, and thus the coverage of the
165 register is very high (Heino *et al.*, 2018). These data were complemented with data from the
166 electronic patient files of the Hospital District of Helsinki and Uusimaa, where also the requested
167 TOPs later diagnosed as ectopic pregnancies or miscarriages were identified. All cases were
168 reviewed by two members of the study team. In case of a disagreement, a third review was
169 performed. IUD insertion and usage in the control group was followed up to one year using the
170 electronic patient files of the PHC of the City of Helsinki.

171 **Outcomes**

172 The primary outcome of the study was the number of subsequent TOP during five years of follow-
173 up. As a secondary outcome, we analysed all requested TOPs, including cases of miscarriage,
174 ectopic pregnancy or blighted ovum, diagnosed at the time of assessment for TOP.

175 **Randomisation and masking**

176 Randomisation was performed by using computer-assisted permuted-block method with random
177 block sizes of four to six. The investigators did not participate in randomisation, which was done
178 before commencing the study. The group assignments were kept in sealed envelopes, which the
179 study nurse opened after informing and recruiting the women.

180 **Statistical analysis**

181 Based on previous studies, a 15% incidence for subsequent abortion during five years was
182 assumed (Heikinheimo *et al.*, 2008). The power calculation was performed with an assumption
183 that the intervention would cause a 50% decrease in the incidence of subsequent abortion. By
184 using the log-rank test, for a power of 80% and a 5% significance level, a total of 350 participants
185 were needed for each group. To cover for the possible loss-to follow-up, 751 women were
186 randomised, and finally 748 women were included in the study. (Figure 1)

187 The outcomes were calculated by one thousand follow-up years. The Cox proportional hazards
188 model was used for calculating hazard ratios (HR). Cumulative subsequent TOPs or requests for
189 TOP were analysed by using the Kaplan-Meier method with the log-rank test. The Chi-square test
190 was used as appropriate for categorical variables. To compare distributions between continuous
191 variables, the Mann-Whitney U-test was used. Statistical analyses were performed with IBM SPSS
192 Statistics software, version 24 (IBM Corp., Armonk, NY). Statistical significance was defined as
193 $p < 0.05$.

194 **Role of the funding source**

195 The funders of the study had no role in study design, data collection, data analysis, data interpretation, or
196 writing of the report. The corresponding author had full access to all the data in the study and had final
197 responsibility for the decision to submit for publication.

198 **Results**

199 Of the 2305 eligible women undergoing a first trimester TOP at Kätilöopisto hospital, Department
200 of Obstetrics and Gynaecology, Helsinki University Hospital, 1139 were interested in intrauterine
201 contraception, 751 of whom were recruited and randomised between October 18th2010 and
202 January 21st2013. After randomisation, three women decided to continue with the pregnancy, and
203 were excluded from the study. Of all the abortions 141 (18.9%) were surgical and 607 (81.1%)
204 medical.

205 In the intervention group, 301 (80.3%) women received the IUD within four weeks after the
206 abortion as planned. By three months, 347 (92.5%) women had an IUD inserted. The remaining 28
207 (7.5%) women did not receive an IUD; 20 (5.3%) women did not attend the follow-up and 8 (2.1%)
208 declined IUD insertion.

209 In the control group, 76 (20.4%) women received an IUD at the PHC within three months.
210 Additionally, 19 (5.1%) women received an IUD at the hospital within three months, either at the
211 time of surgical abortion or at an additional visit, contrary to the study plan. By one year, a total of
212 166 (44.5%) women in the control group had an IUD inserted.

213 The cumulative proportion of women without a subsequent TOP during five years was 89.3% in
214 the intervention and 83.1% in the control group ($p=0.010$). The cumulative proportions of women
215 without a request for subsequent TOP were 87.7% and 82.3% ($p=0.028$), respectively (Figure 2).

216 During the 5-year follow-up, 40 (10.7%) women in the intervention and 63 (16.9%) in the control
217 group underwent at least one subsequent induced abortion (HR 1.67 [CI 95% 1.13 to 2.49],

218 $p=0.011$) (Table 2). Altogether 16 (2.1%) women (9 in the intervention and 7 in the control group)
219 had more than one subsequent TOP during the 5-year follow-up. The overall numbers of
220 subsequent induced abortions were 50 in the intervention and 72 in the control group, resulting in
221 an incidence of 26.7 vs. 38.6/1000 years of follow-up ($p=0.027$).

222 In the intervention group, 36 (11.8%) of the women undergoing a subsequent TOP had a medical
223 and 4 (5.8%) a surgical index TOP, whereas in the control group the numbers were 49 (16.4%) and
224 14 (18.9%), respectively. The method of abortion did not explain the risk for subsequent TOP in
225 either group (intervention group: HR 0.46 [CI 95% 0.16 to 1.34], $p=0.156$; control group: HR 1.19
226 [CI 95% 0.62 to 2.30], $p=0.603$).

227 The total number of women requesting termination of a subsequent unwanted pregnancy
228 (including cases of miscarriage, ectopic pregnancy and blighted ovum diagnosed at the time of
229 assessment for TOP) was 46 (12.3%) in the intervention and 66 (17.7%) in the control group (HR
230 1.52 [CI 95% 1.04 to 2.22], $p=0.029$). There were 58 requests for TOP in the intervention and 76 in
231 the control group (30.9 vs. 40.8/1000 years of follow-up, $p=0.080$).

232 The median time interval between the index TOP and the first subsequent TOP was 792 days (2.17
233 years [IQR 604–1439 days/1.65–3.94 years]) in the intervention, and 645 days (1.77 years [IQR
234 337–1076 days/0.92–2.94 years]) in the control group ($p=0.013$).

235 When looking at subsequent TOPs during the first three years, a significant difference between the
236 groups was seen; the number of women undergoing one or several TOP(s) was 23 (6.1%) in the
237 intervention and 48 (12.9%) in the control group (HR 1.71 [CI 95% 1.04 to 2.81], $p=0.035$). During
238 fourth and fifth year, 17 (4.5%) women in the intervention and 15 (4.0%) in the control group had
239 their first subsequent TOP (HR 1.19 [CI 95% 0.58 to 2.43], $p=0.631$).

240 The number of women requesting a subsequent TOP during the first three years was 27 (7.2%) in
241 the intervention and 52 (13.9%) in the control group (HR 2.02 [CI 95% 1.27 to 3.22], $p=0.003$), and

242 during the fourth and fifth year, 19 (5.1%) and 14 (3.8%), respectively (HR 0.80 [CI95% 0.40 to
243 1.59], $p=0.523$). Altogether 25 TOPs were performed in the intervention group and 52 in the
244 control group ($p=0.001$) during the first three years resulting in an incidence of 22.2 vs. 46.5/1000
245 years of follow-up. However, during the 4th and 5th year there were slightly more TOPs in the
246 intervention (25) than in the control group (20) (33.3 vs. 26.8/1000, $p=0.453$). Similarly, the
247 number of all requested TOPs was 30 vs. 56 (24.0 vs. 46.5/1000, $p=0.003$) during the first three
248 years, and 28 vs. 20 (25.3 vs. 18.8/1000, $p=0.240$) during the 4th and 5th year.

249 There were no cases of pregnancy during IUD use. Two women in the intervention group had an
250 unwanted pregnancy due to an unnoticed expulsion of the LNG-IUS; one attended the follow-up
251 visits at three months and one year, when the IUD was found to be *in situ*. The other one reported
252 IUD use at one year but did not attend the 1-year visit.

253 Based on self-reporting, information collected at the follow-up visits or based on the PHC database
254 of the City of Helsinki, 228 (60.8%) women in the intervention group and 100 (26.8%) women in
255 the control group were known to be currently using IUD at one year. Data on the contraceptive
256 method used at one year were unavailable for 118 (31.5%) women in the intervention and 192
257 (51.5%) in the control group. Based on these data, the 1-year continuation rate of IUD use in the
258 intervention group was at least 65.7%, but considering the missing data, possibly considerably
259 higher. In the intervention group, 225 (60.0%) women attended the 1-year follow-up, and 202
260 (89.8%) of them were using IUD at that time. In the control group, the corresponding figures were
261 significantly lower, i.e. 152 (41.4%, $p<0.001$) and 89 (58.6%, $p<0.001$).

262 The risk for subsequent TOP could not be predicted by smoking (HR 1.29 [0.85 to 1.96], $p=0.225$),
263 parity (1.16 [0.77 to 1.74], $p=0.488$), or history of TOP (0.96 [0.64 to 1.42], $p=0.827$).

264

265 **Discussion**

266 We find that provision of intrauterine contraception as part of abortion service was effective in
267 reducing both the number of women requesting subsequent TOP as well as the overall number of
268 TOPs. The efficacy of IUD in reducing the need of abortion was limited to the first three years after
269 the index TOP.

270 The overall rate of subsequent TOP was 14%, which is in line with previous studies as well as the
271 estimates on which the power calculations of the study were based. The total number of
272 subsequent TOPs was reduced by approximately one third during the 5-year follow-up due to the
273 intervention. This is slightly less than the presumed 50% reduction used in the power calculations.
274 However, these figures were derived from studies comparing IUD vs. non-IUD contraception
275 (Heikinheimo *et al.*, 2008). We found no predictive background factors for the risk of subsequent
276 TOP. Thus, the difference in the rate of subsequent abortion between the two study groups is
277 most likely due to their different rate of IUD use. For example, 93% of the intervention but only
278 26% of the control group had received the IUD by three months after the abortion (Pohjoranta *et*
279 *al.*, 2018). The reasons for this are likely to involve factors related both to the individuals as well as
280 to the service provision system separating abortion care from pre- and post-abortion
281 contraceptive care (Duodecim, 2013). Nevertheless, it is noteworthy that even among women who
282 are highly motivated for intrauterine contraception, providing the service as part of abortion care
283 makes a significant difference in IUD uptake and the need for future abortion.

284 The randomised study setting with a relatively large sample is a strength. The data on subsequent
285 TOPs was obtained from the national abortion register, which is of exceptionally high quality and
286 coverage. In 2011, the coverage of the register was 97% (Heino *et al.*, 2018). In our study data,
287 only one recurrent TOP identified in the hospital database was missing from the register data.

288 Both medical and surgical abortions, with different time points of IUD provision, were included.
289 This may be considered a weakness. However, use of both methods of abortion also reflects the
290 contemporary practice of TOP. Moreover, significant reduction in the need of subsequent TOP was
291 seen following both medical and surgical – and thus different means of IUD provision – index
292 abortion. In addition, due to poor attendance at follow-up and low response rates to the
293 questionnaires, especially in the control group, reliable information about IUD usage during the 5-
294 year follow-up was unavailable.

295 The study participants were residents of the City of Helsinki, which may limit the generalizability of
296 the results. Also, the study population represents women often in an evolving phase of life, and
297 during the follow-up some of the participants have moved inside Finland or even abroad. Thus, we
298 were unable to receive comprehensive information concerning the contraceptive methods used
299 during the follow-up. However, the data derived from the national abortion register cover all TOPs
300 performed in Finland. Unfortunately, we had no possibility to obtain data on possible subsequent
301 TOPs performed abroad.

302 It is noteworthy that the effect of intervention was significant during the first 3 years after the
303 index TOP. However, both the number of women requesting subsequent TOP and the overall
304 number of TOPs were approximately similar in both groups during the 4th and 5th year after the
305 index abortion. This is likely explained by discontinuation of IUD use before the follow-up was
306 complete.

307 The average age at first delivery in Finland is 29.2 years, whereas the median age of the study
308 participants at baseline was 27 years (THL, 2017). Thus, it is likely that many of the participants
309 had planned pregnancies during the five-year follow-up period. Our previous study also supports
310 this; the mean time from abortion to next pregnancy resulting in delivery was three years
311 (Heikinheimo *et al.*, 2009). Thus, the effect of the intervention in reducing requested TOPs

312 dissolved three years after the index abortion. The cost-effectiveness of this intervention is yet to
313 be shown, however in large populations, the provision of IUD post abortion has shown to be cost
314 effective in lowering the number of induced abortions (Ames *et al.*, 2012).

315 A key finding of the study is that the higher incidence of subsequent TOP in the control group was
316 associated with lower uptake of IUD. Besides the randomisation group, few risk factors for not
317 having the IUD inserted could be identified in our previous analysis (Pohjoranta *et al.* 2018). Thus,
318 in abortion care, in order to optimize the high efficacy of IUD in post-abortion contraception,
319 integration of counselling, easy-access service, and early and effective IUD provision is important.

320

321 **Data sharing**

322 • Deidentified participant data, study protocol, statistical analysis plan and study protocol will be
323 made available.

324 • These data will be available 6–36 months after publication for investigators whose proposed use
325 of the data has been approved by an independent review committee (“learned intermediary”)
326 identified for this purpose.

327 • Proposals should be directed to oskari.heikinheimo@helsinki.fi.

328

329 **Patient and Public Involvement**

330

331 This research was done without patient involvement. Patients were not invited to comment on
332 the study design and were not consulted to develop patient relevant outcomes or interpret the
333 results. Patients were not invited to contribute to the writing or editing of this document for
334 readability or accuracy.

335

336 **Acknowledgements**

337 The funders of this study, the Yrjö Jahnsson foundation, the Jenny and Antti Wihuri foundation,
338 Finska Läkaresällskapet and the Helsinki University Central Hospital Research funds are thanked
339 for supporting our research.

340 We wish to thank adjunct Professor Pasi Korhonen of EPID Research for his advice and help with
341 the power analysis and Helena Schmidt for her contribution with graphic designing. The authors
342 wish also to thank the City of Helsinki for providing the LNG-IUSs and Cu-IUDs used in the present
343 study.

344

345 **Declaration of interest**

346 OH has served on advisory boards for Bayer Healthcare AG, Gedeon-Richter, Sandoz AG, HRA-
347 Pharma and Vifor Pharma, and designed and lectured at educational events of these companies.
348 SS has served as an advisor for Exeltis, Sandoz AG and Gedeon Richter and lectured at educational
349 events of Bayer Healthcare AG. The other authors have no conflicts of interests to declare.

350

351 **Contributors**

352 All authors have contributed to planning the study protocol. EP, SS, PI, MM and OH were
353 responsible for the clinical visits. MG has provided the data from the national health registers. PI
354 has recruited and interviewed the participants and arranged the appointments. EP has performed
355 the statistical analysis and written the first draft of the report with input from SS and OH. SS and
356 OH were responsible for the overall study and obtained funding.

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371 **References**

372 Ames CM, Norman WV. Preventing repeat abortion in Canada: is the immediate insertion of

373 intrauterine devices postabortion a cost-effective option associated with fewer repeat abortions?

374 *Contraception* 2012;**85**(1):51-5.

375

376 Bednarek PH, Creinin MD, Reeves MF, et al. Immediate versus delayed IUD insertion after uterine

377 aspiration. *N Engl J Med* 2011;**364**(23):2208-17.

378

379 Betstadt SJ, Turok DK, Kapp N, Feng KT, Borgatta L. Intrauterine device insertion after medical

380 abortion. *Contraception* 2011;**83**(6):517-21.

381

- 382 Blumenthal PD, Voedisch A, Gemzell-Danielsson K. Strategies to prevent unintended pregnancy:
383 increasing use of long-acting reversible contraception. *Hum Reprod Update* 2011;**17**(1):121-37.
384
- 385 Boesen HC, Rorbye C, Norgaard M, Nilas L. Sexual behavior during the first eight weeks after legal
386 termination of pregnancy. *Acta Obstet Gynecol Scand* 2004;**83**(12):1189-92.
387
- 388 Duodecim (Working group set up by the Finnish Medical Society Duodecim and The Finnish Society
389 of Obstetrics and Gynaecology). Current Care Guideline. Induced abortion. 2013; Available from:
390 <http://www.kaypahoito.fi/web/kh/suosituksset/suositus?id=hoi27050#NaN>. 15 January 2019, date
391 last accessed.
392
- 393 GOV.UK. Abortion statistics for England and Wales: 2017. 2018; Available from:
394 <https://www.gov.uk/government/statistics/abortion-statistics-for-england-and-wales-2017>. 14
395 November 2018, date last accessed.
396
- 397 Heikinheimo O, Gissler M, Suhonen S. Age, parity, history of abortion and contraceptive choices
398 affect the risk of repeat abortion. *Contraception* 2008;**78**(2):149-54.
399
- 400 Heikinheimo O, Gissler M, Suhonen S. Can the outcome of the next pregnancy be predicted at the
401 time of induced abortion? *Hum Reprod* 2009;**24**(4):820-6.
402
- 403 Heino A, Niinimaki M, Mentula M, Gissler M. How reliable are health registers? Registration of
404 induced abortions and sterilizations in Finland. *Inform Health Soc Care* 2018;**43**(3):310-19.

405 INED (Institut National d'Etudes Demographiques). 2012; Available from: [https://ivg-](https://ivg-statistiques.site.ined.fr/en/)
406 [statistiques.site.ined.fr/en/](https://ivg-statistiques.site.ined.fr/en/). 14 November 2018, date last accessed.

407

408 Korjamo R, Mentula M, Heikinheimo O. Fast-track vs. delayed insertion of the levonorgestrel-
409 releasing intrauterine system after early medical abortion - a randomized trial. *Contraception*
410 2017;**96**(5):344-51.

411

412 Okusanya BO, Oduwole O, Effa EE. Immediate postabortal insertion of intrauterine devices.
413 *Cochrane Database Syst Rev* 2014(7):CD001777.

414

415 Peipert JF, Madden T, Allsworth JE, Secura GM. Preventing unintended pregnancies by providing
416 no-cost contraception. *Obstet Gynecol* 2012;**120**(6):1291-7.

417

418 Pohjoranta E, Mentula M, Gissler M, Suhonen S, Heikinheimo O. Provision of intrauterine
419 contraception in association with first trimester induced abortion reduces the need of repeat
420 abortion: first-year results of a randomized controlled trial. *Hum Reprod* 2015;**30**(11):2539-46.

421

422 Pohjoranta E, Suhonen S, Mentula M, Heikinheimo O. Intrauterine contraception after medical
423 abortion: factors affecting success of early insertion. *Contraception* 2017;**95**(3):257-62.

424

425 Pohjoranta E, Mentula M, Suhonen S, Heikinheimo O. Predicting poor compliance with follow-up
426 and intrauterine contraception services after medical termination of pregnancy. *BMJ Sex Reprod*
427 *Health* 2018;**44**:278-285.

428

429

430 Rose SB, Lawton BA. Impact of long-acting reversible contraception on return for repeat abortion.
431 *Am J Obstet Gynecol* 2012;**206**(1):37 e1-6.

432

433 Royal College of Obstetricians and Gynaecologists. Faculty of Sexual and Reproductive Healthcare.
434 Medical Eligibility Criteria for Contraceptive Use. 2018; Available from:
435 <https://www.fsrh.org/ukmec/>. 15 November 2018, date last accessed.

436

437 Saav I, Stephansson O, Gemzell-Danielsson K. Early versus delayed insertion of intrauterine
438 contraception after medical abortion - a randomized controlled trial. *PLoS One* 2012;**7**(11):e48948.

439

440 Schreiber CA, Sober S, Ratcliffe S, Creinin MD. Ovulation resumption after medical abortion with
441 mifepristone and misoprostol. *Contraception* 2011;**84**(3):230-3.

442

443 Secura GM, Madden T, McNicholas C, et al. Provision of no-cost, long-acting contraception and
444 teenage pregnancy. *N Engl J Med* 2014;**371**(14):1316-23.

445

446 Shimoni N, Davis A, Ramos ME, Rosario L, Westhoff C. Timing of copper intrauterine device
447 insertion after medical abortion: a randomized controlled trial. *Obstet Gynecol* 2011;**118**(3):623-8.

448

449 Socialstyrelsen. Statistik om aborter 2017. 2018; Available from:
450 <https://www.socialstyrelsen.se/publikationer2018/2018-5-17>. 14 November 2018, date last
451 accessed.

452

453 THL (National Institute for Health and Welfare). Perinatal statistics 2017. 2018; Available from:
454 <http://urn.fi/URN:NBN:fi-fe2018103146930>. 7 January 2019, date last accessed.

455

456 THL (National Institute for Health and Welfare). Raskaudenkeskeytykset 2017. Induced abortions
457 2017. 2018; Available from: <http://www.julkari.fi/handle/10024/136527>. 14 November 2018, date
458 last accessed.

459

460 Toffol E, Pohjoranta E, Suhonen S, et al. Anxiety and quality of life after first-trimester termination
461 of pregnancy: a prospective study. *Acta Obstet Gynecol Scand* 2016;**95**(10):1171-80.

462

463 WHO (World Health Organization). Medical Eligibility Criteria for Contraceptive Use. 5th Edition.
464 2015; Available from: [https://www.who.int/reproductivehealth/publications/family_planning/Ex-](https://www.who.int/reproductivehealth/publications/family_planning/Ex-Summ-MEC-5/en/)
465 [Summ-MEC-5/en/](https://www.who.int/reproductivehealth/publications/family_planning/Ex-Summ-MEC-5/en/). 15 November 2018, date last accessed.

466

467 WHO (World Health Organization). Safe abortion: technical and policy guidance for health
468 systems. Second edition 2012; Available from:
469 http://apps.who.int/iris/bitstream/handle/10665/70914/9789241548434_eng.pdf?sequence=1.
470 16 November 2018, date last accessed.

471

472 Winner B, Peipert JF, Zhao Q, et al. Effectiveness of long-acting reversible contraception. *N Engl J*
473 *Med* 2012;**366**(21):1998-2007.

474

475

476

477 **Figure legends:**

478

479 Figure 1. Study flow chart.

480 Figure 2. Cumulative proportions of women without subsequent TOP or requested TOP during
481 five-year follow-up.

482 Figure 3A. Annual rate of subsequent TOP during five-year follow-up (/1000 years of follow-up).

483 Figure 3B. Average rate of subsequent TOP during five-year follow-up (/1000 years of follow-up).

1 **Early provision of intrauterine contraception as part of** 2 **abortion care – 5-year results of a randomised controlled trial**

3 Running title: Early provision of IUD as part of abortion care

4

5 Elina Pohjoranta¹ MD; Satu Suhonen³ PhD; Prof Mika Gissler², PhD; Pirjo Ikonen¹ RN; Maarit

6 Mentula¹ PhD; Prof Oskari Heikinheimo^{1*}, PhD

7

8

9 1. Department of Obstetrics and Gynaecology, University of Helsinki and Helsinki

10 University Hospital

11 2. Finnish Institute for Health and Welfare, Helsinki, Finland and Karolinska Institute,

12 Department of Neurobiology, Care Sciences and Society, Stockholm, Sweden

13 3. Centralized Family Planning, Department of Social Services and Health Care, City of

14 Helsinki, Helsinki, Finland

15

16 * Correspondence: O Heikinheimo, Department of Obstetrics and Gynaecology, Helsinki University

17 Hospital, PO Box 140, 00029-HUS, Helsinki, Finland.

18 E-mail: oskari.heikinheimo@helsinki.fi

19

20

21

22 **Abstract**

23 **Study question:** Can the incidence of subsequent termination of pregnancy (TOP) be diminished
24 by providing intrauterine contraception as part of abortion services?

25 **Summary answer:** Provision of IUD as part of TOP services reduced the need for subsequent TOP
26 during 5-year follow-up, but the effect was limited to the first three years.

27 **What is known already:** IUD is highly effective in preventing subsequent TOP. Prompt initiation
28 of IUD leads to higher usage rate during follow-up, as compliance with post-TOP IUD insertion
29 visits is low.

30 **Study design, size, duration:** The objective of this randomised controlled trial was to assess the
31 effect of early comprehensive provision of intrauterine contraception after TOP on the incidence
32 of subsequent TOP during five years of follow-up.

33 This study was conducted at Helsinki University Hospital between October 18th 2010 and January
34 21st 2013. Altogether 748 women undergoing a first trimester TOP were recruited and randomised
35 into two groups. The intervention group (n=375) was provided with an IUD during surgical TOP or
36 1–4 weeks following medical TOP at the hospital providing the abortion care. Women in the
37 control group (n=373) were advised to contact primary health care for follow-up and IUD
38 insertion. Subsequent TOPs during the 5-year follow-up were identified from the Finnish Register
39 on induced abortions.

40 **Participants, setting, methods:** The inclusion criteria were age ≥ 18 years, duration of gestation
41 ≤ 12 weeks, residence in Helsinki and accepting intrauterine contraception. Women with
42 contraindications to IUD were excluded.

43 **Main results and the role of chance:** The overall numbers of subsequent TOPs were 50 in the
44 intervention and 72 in the control group (26.7 vs. 38.6/1000 years of follow-up, $p=0.027$) and

45 those of requested TOPs including TOPs and early pregnancy failures 58 and 76 (30.9 vs.
46 40.8/1000, $p=0.080$). Altogether 40 (10.7%) women in the intervention and 63 (16.9%) in the
47 control group underwent one or several subsequent TOPs (HR 1.67 [CI 95% 1.13 to 2.49],
48 $p=0.011$). The number of TOPs was reduced by the intervention during years 0–3 (22.2 vs.
49 46.5/1000, $p=0.035$), but not during years 4–5 (33.3 vs. 26.8/1000, $p=0.631$).

50 **Limitations, reasons for caution:** Both medical and surgical TOP were used. This may be seen as
51 a limitation, but it also reflects the contemporary praxis of abortion care. The immediate post-TOP
52 care were provided by two different organizations allowing us to compare two different ways of
53 contraceptive service provision following TOP.

54 **Wider implications of the findings:** Providing TOP and IUD insertion comprehensively in a same
55 health care unit leads to significantly higher rates of attendance, IUD use and significantly lower
56 risk of subsequent TOP (HR 1.67 [CI 95% 1.13 to 2.49], $p=0.011$).

57 **Study funding/competing interest(s):** This study was supported by Helsinki University Central
58 Hospital Research funds and by research grants provided by the Jenny and Antti Wihuri
59 Foundation, the Yrjö Jahnsson Foundation, and Finska Läkaresällskapet. EP has received a personal
60 research grant from the Finnish Medical Society. The City of Helsinki supported the study by
61 providing the IUDs. The funding organisations had no role in planning or execution of the study, or
62 in analysing the study results.

63 **Trial registration number:** The trial was registered at clinicaltrials.gov (NCT01223521).

64 **Trial registration date:** 18th October 2010.

65 **Date of first patient's enrolment:** 18th October 2010.

66 **Keywords:** Abortion/termination of pregnancy, IUD/intrauterine contraception, subsequent TOP

67

68 Ethics approval

69 We received approvals from the Ethics Committee of the Hospital District of Helsinki and Uusimaa
70 (HUS 260/13/03/03/2009), the Ethics Committee of the City of Helsinki (10-1138/054). Approval to
71 carry out the study was granted by the Hospital District of Helsinki and Uusimaa (§12/30.03.2010).
72 The Finnish Institute for Health and Welfare (THL) granted an approval to use personal-level data,
73 which is required for registry-based studies in Finland (THL/1479/5.05.00/2013). All personal-level
74 data that could be used to identify individuals was removed before the analyses.

75 Transparency statement

76 The lead author* affirms that this manuscript is an honest, accurate, and transparent account of
77 the study being reported; that no important aspects of the study have been omitted; and that any
78 discrepancies from the study as planned (and, if relevant, registered) have been explained.

79 Patient and public information statement

80 The study was initiated in 2009, and at the time it was not customary to involve patients and/or
81 public in planning of a scientific study.

82 Dissemination declaration

83 The study results will be disseminated to the health care providers and organizations involved in
84 the study as well as to the public once the study has been published.

85

86

87

88 **Introduction**

89 The efficacy of long-acting reversible contraceptives (LARCs) and, especially, that of intrauterine
90 devices (IUD) in preventing unwanted pregnancy is well established (Peipert *et al.*, 2012; Winner
91 *et al.*, 2012; Blumenthal *et al.*, 2011; Secura *et al.*, 2014). According to several recent guidelines,
92 LARCs have become the recommended method of contraception for women in all age groups
93 (WHO, 2015; RCOG, 2018).

94 Previous cohort studies have shown that young age, parity, and history of termination of
95 pregnancy (TOP) are associated with increased risk of subsequent TOP (Heikinheimo *et al.*, 2008).
96 In addition, contraceptive choices affect the risk of subsequent unwanted pregnancy. In cohort
97 studies, post-abortal use of IUD has been associated with a 60–70% reduction in the need of
98 subsequent TOP (Okusanya *et al.*, 2014; Rose *et al.*, 2012).

99 Regardless of the method of TOP, the resumption of ovarian function occurs rapidly; 80% of
100 women ovulate within 6 weeks after TOP (Schreiber *et al.*, 2011). In addition, 50% of women
101 resume sexual activity in two weeks following TOP (Boesen *et al.*, 2004). Thus, in order to prevent
102 subsequent unwanted pregnancy, immediate initiation of effective contraception is important. In
103 Finland, contraceptive counselling and planning are routinely included in the TOP process, and
104 women are advised to initiate contraceptive use immediately. Yet, more than one in three women
105 undergoing a TOP have a history of one or several previous TOPs. Similar to several other
106 countries, this rate has been increasing during the past decade in Finland (THL, 2018;
107 Socialstyrelsen, 2018; INED, 2012; GOV.UK, 2018).

108 The insertion of IUD at the time of surgical TOP is effective and safe, and results in higher IUD use
109 during follow-up (Okusanya *et al.*, 2014; WHO, 2012; Sääv *et al.*, 2012; Bednarek *et al.*, 2011).

110 However, medical abortion has become the dominant method in several countries during the last
111 decades (THL, 2018; Socialstyrelsen, 2018; INED, 2012; GOV.UK, 2018). Medical abortion poses
112 challenges concerning IUD provision since compliance with post-abortion care in the service-
113 delivery systems assessed is often poor (Betstadt *et al.*, 2011; Pohjoranta *et al.*, 2018). Immediate
114 insertion of an IUD after medical TOP (MTOP) is safe, although it is associated with a higher risk of
115 partial expulsion (Korjamo *et al.*, 2017). In contrast, IUD provision at approximately one week after
116 MTOP does not significantly increase the risk of expulsion (Sääv *et al.*, 2012; Shimoni *et al.*, 2011;
117 Betstadt *et al.*, 2011). As with surgical abortion, the prompt provision of IUD leads to a higher rate
118 of use and subject satisfaction following MTOP (Sääv *et al.*, 2012).

119 In the present study, we studied the efficacy of routine provision of IUD as part of abortion care in
120 comparison to the current praxis of prescribing oral contraceptives as a bridging method and
121 directing women to primary health care (PHC) for IUD insertion. Our primary outcome measure
122 was the number of subsequent TOPs performed during the 5-year follow-up after the index
123 abortion. The secondary outcomes were the number of all requested TOPs during the follow-up
124 (including cases of miscarriage, blighted ovum or ectopic pregnancy) and the timing of subsequent
125 TOP. Previously, we published the 1-year follow-up results concerning the need for subsequent
126 TOP, success of early IUD insertion, rates of attendance and IUD use, as well as mental and sexual
127 well-being (Pohjoranta *et al.*, 2015; Pohjoranta *et al.*, 2017; Pohjoranta *et al.*, 2018; Toffol *et al.*,
128 2016). In the present study, we report the final 5-year results on the need for subsequent TOP.

129

130 **Methods**

131 **Study design and participants**

132 This study design has been described in detail previously (Pohjoranta *et al.*, 2015). The study was
133 conducted in collaboration with the Helsinki University Hospital and the City of Helsinki.

134 The inclusion criteria were age ≥ 18 years, residence in Helsinki, duration of gestation $\leq 12^{+0}$ weeks,
135 having a non-foetal indication for the abortion and signing an informed consent form. Women
136 with uterine anomaly, cervical screening result requiring surgical intervention, or inadequate
137 language skills in Finnish or Swedish were excluded. Acute liver disease and breast cancer were
138 contraindications for the levonorgestrel-releasing intrauterine system (LNG-IUS), and copper
139 allergy, iron deficiency anaemia, and Wilson's disease for copper intrauterine device (Cu-IUD). The
140 characteristics of the study participants are presented in Table 1.

141

142 Altogether 751 women were randomised into two groups (Figure 1). Women in the intervention
143 group (n=375) were provided with an IUD (either the 52mg levonorgestrel-releasing intrauterine
144 system, LNG-IUS, Mirena® or a Cu-IUD, Nova-T®, both manufactured by Bayer Ag [Turku, Finland]
145 and hereafter referred as IUD) at the hospital responsible for the abortion care. The IUD was
146 planned to be inserted at the time of surgical abortion (n=70), or at a follow-up visit performed 1–
147 4 weeks after MTOP (n=305). Women in the control group (n=373 [71 cases of surgical and 302
148 medical abortion]) were prescribed oral contraceptives and advised to contact their PHC unit for
149 follow-up and contraceptive services including IUD insertion, according to the current national
150 guideline on induced abortion (Duodecim, 2013). The subsequent TOPs were analysed on an
151 intention-to-treat analysis (ITT) to assess the efficacy of the intended intervention.

152 **Procedures**

153 All abortions were performed according to the national guideline (Duodecim, 2013). All the index
154 abortions in this study were performed due to a social indication, or based on the woman's age of
155 at least 40 years or having given birth to four or more children, both indications for abortion given
156 in the Finnish legislation. The participants were advised to contact the hospital in case of
157 suspected abortion-related adverse events or complications.

158 According to local guideline of the time, all women were invited for a follow-up at three months
159 after IUD insertion. For the intervention group, this was performed by study nurse. All women
160 were provided a follow-up visit by a specialist in obstetrics and gynaecology (SS) at one and five
161 years at the PHC family planning clinic of the City of Helsinki.

162 Data on subsequent induced abortions during five years after the index abortion were obtained
163 from the Finnish Register of Induced Abortions kept by the Finnish Institute for Health and Welfare
164 (THL). In Finland, reporting all TOPs to THL is mandatory by the law, and thus the coverage of the
165 register is very high (Heino *et al.*, 2018). These data were complemented with data from the
166 electronic patient files of the Hospital District of Helsinki and Uusimaa, where also the requested
167 TOPs later diagnosed as ectopic pregnancies or miscarriages were identified. All cases were
168 reviewed by two members of the study team. In case of a disagreement, a third review was
169 performed. IUD insertion and usage in the control group was followed up to one year using the
170 electronic patient files of the PHC of the City of Helsinki.

171 **Outcomes**

172 The primary outcome of the study was the number of subsequent TOP during five years of follow-
173 up. As a secondary outcome, we analysed all requested TOPs, including cases of miscarriage,
174 ectopic pregnancy or blighted ovum, diagnosed at the time of assessment for TOP.

175 **Randomisation and masking**

176 Randomisation was performed by using computer-assisted permuted-block method with random
177 block sizes of four to six. The investigators did not participate in randomisation, which was done
178 before commencing the study. The group assignments were kept in sealed envelopes, which the
179 study nurse opened after informing and recruiting the women.

180 **Statistical analysis**

181 Based on previous studies, a 15% incidence for subsequent abortion during five years was
182 assumed (Heikinheimo *et al.*, 2008). The power calculation was performed with an assumption
183 that the intervention would cause a 50% decrease in the incidence of subsequent abortion. By
184 using the log-rank test, for a power of 80% and a 5% significance level, a total of 350 participants
185 were needed for each group. To cover for the possible loss-to follow-up, 751 women were
186 randomised, and finally 748 women were included in the study. (Figure 1)

187 The outcomes were calculated by one thousand follow-up years. The Cox proportional hazards
188 model was used for calculating hazard ratios (HR). Cumulative subsequent TOPs or requests for
189 TOP were analysed by using the Kaplan-Meier method with the log-rank test. The Chi-square test
190 was used as appropriate for categorical variables. To compare distributions between continuous
191 variables, the Mann-Whitney U-test was used. Statistical analyses were performed with IBM SPSS
192 Statistics software, version 24 (IBM Corp., Armonk, NY). Statistical significance was defined as
193 $p < 0.05$.

194 **Role of the funding source**

195 The funders of the study had no role in study design, data collection, data analysis, data interpretation, or
196 writing of the report. The corresponding author had full access to all the data in the study and had final
197 responsibility for the decision to submit for publication.

198 **Results**

199 Of the 2305 eligible women undergoing a first trimester TOP at Kätilöopisto hospital, Department
200 of Obstetrics and Gynaecology, Helsinki University Hospital, 1139 were interested in intrauterine
201 contraception, 751 of whom were recruited and randomised between October 18th2010 and
202 January 21st2013. After randomisation, three women decided to continue with the pregnancy, and
203 were excluded from the study. Of all the abortions 141 (18.9%) were surgical and 607 (81.1%)
204 medical.

205 In the intervention group, 301 (80.3%) women received the IUD within four weeks after the
206 abortion as planned. By three months, 347 (92.5%) women had an IUD inserted. The remaining 28
207 (7.5%) women did not receive an IUD; 20 (5.3%) women did not attend the follow-up and 8 (2.1%)
208 declined IUD insertion.

209 In the control group, 76 (20.4%) women received an IUD at the PHC within three months.
210 Additionally, 19 (5.1%) women received an IUD at the hospital within three months, either at the
211 time of surgical abortion or at an additional visit, contrary to the study plan. By one year, a total of
212 166 (44.5%) women in the control group had an IUD inserted.

213 The cumulative proportion of women without a subsequent TOP during five years was 89.3% in
214 the intervention and 83.1% in the control group ($p=0.010$). The cumulative proportions of women
215 without a request for subsequent TOP were 87.7% and 82.3% ($p=0.028$), respectively (Figure 2).

216 During the 5-year follow-up, 40 (10.7%) women in the intervention and 63 (16.9%) in the control
217 group underwent at least one subsequent induced abortion (HR 1.67 [CI 95% 1.13 to 2.49],

218 $p=0.011$) (Table 2). Altogether 16 (2.1%) women (9 in the intervention and 7 in the control group)
219 had more than one subsequent TOP during the 5-year follow-up. The overall numbers of
220 subsequent induced abortions were 50 in the intervention and 72 in the control group, resulting in
221 an incidence of 26.7 vs. 38.6/1000 years of follow-up ($p=0.027$).

222 In the intervention group, 36 (11.8%) of the women undergoing a subsequent TOP had a medical
223 and 4 (5.8%) a surgical index TOP, whereas in the control group the numbers were 49 (16.4%) and
224 14 (18.9%), respectively. The method of abortion did not explain the risk for subsequent TOP in
225 either group (intervention group: HR 0.46 [CI 95% 0.16 to 1.34], $p=0.156$; control group: HR 1.19
226 [CI 95% 0.62 to 2.30], $p=0.603$).

227 The total number of women requesting termination of a subsequent unwanted pregnancy
228 (including cases of miscarriage, ectopic pregnancy and blighted ovum diagnosed at the time of
229 assessment for TOP) was 46 (12.3%) in the intervention and 66 (17.7%) in the control group (HR
230 1.52 [CI 95% 1.04 to 2.22], $p=0.029$). There were 58 requests for TOP in the intervention and 76 in
231 the control group (30.9 vs. 40.8/1000 years of follow-up, $p=0.080$).

232 The median time interval between the index TOP and the first subsequent TOP was 792 days (2.17
233 years [IQR 604–1439 days/1.65–3.94 years]) in the intervention, and 645 days (1.77 years [IQR
234 337–1076 days/0.92–2.94 years]) in the control group ($p=0.013$).

235 When looking at subsequent TOPs during the first three years, a significant difference between the
236 groups was seen; the number of women undergoing one or several TOP(s) was 23 (6.1%) in the
237 intervention and 48 (12.9%) in the control group (HR 1.71 [CI 95% 1.04 to 2.81], $p=0.035$). During
238 fourth and fifth year, 17 (4.5%) women in the intervention and 15 (4.0%) in the control group had
239 their first subsequent TOP (HR 1.19 [CI 95% 0.58 to 2.43], $p=0.631$).

240 The number of women requesting a subsequent TOP during the first three years was 27 (7.2%) in
241 the intervention and 52 (13.9%) in the control group (HR 2.02 [CI 95% 1.27 to 3.22], $p=0.003$), and

242 during the fourth and fifth year, 19 (5.1%) and 14 (3.8%), respectively (HR 0.80 [CI95% 0.40 to
243 1.59], $p=0.523$). Altogether 25 TOPs were performed in the intervention group and 52 in the
244 control group ($p=0.001$) during the first three years resulting in an incidence of 22.2 vs. 46.5/1000
245 years of follow-up. However, during the 4th and 5th year there were slightly more TOPs in the
246 intervention (25) than in the control group (20) (33.3 vs. 26.8/1000, $p=0.453$). Similarly, the
247 number of all requested TOPs was 30 vs. 56 (24.0 vs. 46.5/1000, $p=0.003$) during the first three
248 years, and 28 vs. 20 (25.3 vs. 18.8/1000, $p=0.240$) during the 4th and 5th year.

249 There were no cases of pregnancy during IUD use. Two women in the intervention group had an
250 unwanted pregnancy due to an unnoticed expulsion of the LNG-IUS; one attended the follow-up
251 visits at three months and one year, when the IUD was found to be *in situ*. The other one reported
252 IUD use at one year but did not attend the 1-year visit.

253 Based on self-reporting, information collected at the follow-up visits or based on the PHC database
254 of the City of Helsinki, 228 (60.8%) women in the intervention group and 100 (26.8%) women in
255 the control group were known to be currently using IUD at one year. Data on the contraceptive
256 method used at one year were unavailable for 118 (31.5%) women in the intervention and 192
257 (51.5%) in the control group. Based on these data, the 1-year continuation rate of IUD use in the
258 intervention group was at least 65.7%, but considering the missing data, possibly considerably
259 higher. In the intervention group, 225 (60.0%) women attended the 1-year follow-up, and 202
260 (89.8%) of them were using IUD at that time. In the control group, the corresponding figures were
261 significantly lower, i.e. 152 (41.4%, $p<0.001$) and 89 (58.6%, $p<0.001$).

262 The risk for subsequent TOP could not be predicted by smoking (HR 1.29 [0.85 to 1.96], $p=0.225$),
263 parity (1.16 [0.77 to 1.74], $p=0.488$), or history of TOP (0.96 [0.64 to 1.42], $p=0.827$).

264

265 **Discussion**

266 We find that provision of intrauterine contraception as part of abortion service was effective in
267 reducing both the number of women requesting subsequent TOP as well as the overall number of
268 TOPs. The efficacy of IUD in reducing the need of abortion was limited to the first three years after
269 the index TOP.

270 The overall rate of subsequent TOP was 14%, which is in line with previous studies as well as the
271 estimates on which the power calculations of the study were based. The total number of
272 subsequent TOPs was reduced by approximately one third during the 5-year follow-up due to the
273 intervention. This is slightly less than the presumed 50% reduction used in the power calculations.
274 However, these figures were derived from studies comparing IUD vs. non-IUD contraception
275 (Heikinheimo *et al.*, 2008). We found no predictive background factors for the risk of subsequent
276 TOP. Thus, the difference in the rate of subsequent abortion between the two study groups is
277 most likely due to their different rate of IUD use. For example, 93% of the intervention but only
278 26% of the control group had received the IUD by three months after the abortion (Pohjoranta *et*
279 *al.*, 2018). The reasons for this are likely to involve factors related both to the individuals as well as
280 to the service provision system separating abortion care from pre- and post-abortion
281 contraceptive care (Duodecim, 2013). Nevertheless, it is noteworthy that even among women who
282 are highly motivated for intrauterine contraception, providing the service as part of abortion care
283 makes a significant difference in IUD uptake and the need for future abortion.

284 The randomised study setting with a relatively large sample is a strength. The data on subsequent
285 TOPs was obtained from the national abortion register, which is of exceptionally high quality and
286 coverage. In 2011, the coverage of the register was 97% (Heino *et al.*, 2018). In our study data,
287 only one recurrent TOP identified in the hospital database was missing from the register data.

288 Both medical and surgical abortions, with different time points of IUD provision, were included.
289 This may be considered a weakness. However, use of both methods of abortion also reflects the
290 contemporary practice of TOP. Moreover, significant reduction in the need of subsequent TOP was
291 seen following both medical and surgical – and thus different means of IUD provision – index
292 abortion. In addition, due to poor attendance at follow-up and low response rates to the
293 questionnaires, especially in the control group, reliable information about IUD usage during the 5-
294 year follow-up was unavailable.

295 The study participants were residents of the City of Helsinki, which may limit the generalizability of
296 the results. Also, the study population represents women often in an evolving phase of life, and
297 during the follow-up some of the participants have moved inside Finland or even abroad. Thus, we
298 were unable to receive comprehensive information concerning the contraceptive methods used
299 during the follow-up. However, the data derived from the national abortion register cover all TOPs
300 performed in Finland. Unfortunately, we had no possibility to obtain data on possible subsequent
301 TOPs performed abroad.

302 It is noteworthy that the effect of intervention was significant during the first 3 years after the
303 index TOP. However, both the number of women requesting subsequent TOP and the overall
304 number of TOPs were approximately similar in both groups during the 4th and 5th year after the
305 index abortion. This is likely explained by discontinuation of IUD use before the follow-up was
306 complete.

307 The average age at first delivery in Finland is 29.2 years, whereas the median age of the study
308 participants at baseline was 27 years (THL, 2017). Thus, it is likely that many of the participants
309 had planned pregnancies during the five-year follow-up period. Our previous study also supports
310 this; the mean time from abortion to next pregnancy resulting in delivery was three years
311 (Heikinheimo *et al.*, 2009). Thus, the effect of the intervention in reducing requested TOPs

312 dissolved three years after the index abortion. The cost-effectiveness of this intervention is yet to
313 be shown, however in large populations, the provision of IUD post abortion has shown to be cost
314 effective in lowering the number of induced abortions (Ames *et al.*, 2012).

315 A key finding of the study is that the higher incidence of subsequent TOP in the control group was
316 associated with lower uptake of IUD. Besides the randomisation group, few risk factors for not
317 having the IUD inserted could be identified in our previous analysis (Pohjoranta *et al.* 2018). Thus,
318 in abortion care, in order to optimize the high efficacy of IUD in post-abortion contraception,
319 integration of counselling, easy-access service, and early and effective IUD provision is important.

320

321 **Data sharing**

322 • Deidentified participant data, study protocol, statistical analysis plan and study protocol will be
323 made available.

324 • These data will be available 6–36 months after publication for investigators whose proposed use
325 of the data has been approved by an independent review committee (“learned intermediary”)
326 identified for this purpose.

327 • Proposals should be directed to oskari.heikinheimo@helsinki.fi.

328

329 **Patient and Public Involvement**

330

331 This research was done without patient involvement. Patients were not invited to comment on
332 the study design and were not consulted to develop patient relevant outcomes or interpret the
333 results. Patients were not invited to contribute to the writing or editing of this document for
334 readability or accuracy.

335

336 **Acknowledgements**

337 The funders of this study, the Yrjö Jahnsson foundation, the Jenny and Antti Wihuri foundation,
338 Finska Läkaresällskapet and the Helsinki University Central Hospital Research funds are thanked
339 for supporting our research.

340 We wish to thank adjunct Professor Pasi Korhonen of EPID Research for his advice and help with
341 the power analysis and Helena Schmidt for her contribution with graphic designing. The authors
342 wish also to thank the City of Helsinki for providing the LNG-IUSs and Cu-IUDs used in the present
343 study.

344

345 **Declaration of interest**

346 OH has served on advisory boards for Bayer Healthcare AG, Gedeon-Richter, Sandoz AG, HRA-
347 Pharma and Vifor Pharma, and designed and lectured at educational events of these companies.

348 SS has served as an advisor for Exeltis, Sandoz AG and Gedeon Richter and lectured at educational
349 events of Bayer Healthcare AG. The other authors have no conflicts of interests to declare.

350

351 **Contributors**

352 All authors have contributed to planning the study protocol. EP, SS, PI, MM and OH were
353 responsible for the clinical visits. MG has provided the data from the national health registers. PI
354 has recruited and interviewed the participants and arranged the appointments. EP has performed
355 the statistical analysis and written the first draft of the report with input from SS and OH. SS and
356 OH were responsible for the overall study and obtained funding.

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371 **References**

372 Ames CM, Norman WV. Preventing repeat abortion in Canada: is the immediate insertion of
373 intrauterine devices postabortion a cost-effective option associated with fewer repeat abortions?
374 *Contraception* 2012;**85**(1):51-5.

375

376 Bednarek PH, Creinin MD, Reeves MF, et al. Immediate versus delayed IUD insertion after uterine
377 aspiration. *N Engl J Med* 2011;**364**(23):2208-17.

378

379 Betstadt SJ, Turok DK, Kapp N, Feng KT, Borgatta L. Intrauterine device insertion after medical
380 abortion. *Contraception* 2011;**83**(6):517-21.

381

- 382 Blumenthal PD, Voedisch A, Gemzell-Danielsson K. Strategies to prevent unintended pregnancy:
383 increasing use of long-acting reversible contraception. *Hum Reprod Update* 2011;**17**(1):121-37.
384
- 385 Boesen HC, Rorbye C, Norgaard M, Nilas L. Sexual behavior during the first eight weeks after legal
386 termination of pregnancy. *Acta Obstet Gynecol Scand* 2004;**83**(12):1189-92.
387
- 388 Duodecim (Working group set up by the Finnish Medical Society Duodecim and The Finnish Society
389 of Obstetrics and Gynaecology). Current Care Guideline. Induced abortion. 2013; Available from:
390 <http://www.kaypahoito.fi/web/kh/suosituksset/suositus?id=hoi27050#NaN>. 15 January 2019, date
391 last accessed.
392
- 393 GOV.UK. Abortion statistics for England and Wales: 2017. 2018; Available from:
394 <https://www.gov.uk/government/statistics/abortion-statistics-for-england-and-wales-2017>. 14
395 November 2018, date last accessed.
396
- 397 Heikinheimo O, Gissler M, Suhonen S. Age, parity, history of abortion and contraceptive choices
398 affect the risk of repeat abortion. *Contraception* 2008;**78**(2):149-54.
399
- 400 Heikinheimo O, Gissler M, Suhonen S. Can the outcome of the next pregnancy be predicted at the
401 time of induced abortion? *Hum Reprod* 2009;**24**(4):820-6.
402
- 403 Heino A, Niinimaki M, Mentula M, Gissler M. How reliable are health registers? Registration of
404 induced abortions and sterilizations in Finland. *Inform Health Soc Care* 2018;**43**(3):310-19.

405 INED (Institut National d'Etudes Demographiques). 2012; Available from: [https://ivg-](https://ivg-statistiques.site.ined.fr/en/)
406 [statistiques.site.ined.fr/en/](https://ivg-statistiques.site.ined.fr/en/). 14 November 2018, date last accessed.

407

408 Korjamo R, Mentula M, Heikinheimo O. Fast-track vs. delayed insertion of the levonorgestrel-
409 releasing intrauterine system after early medical abortion - a randomized trial. *Contraception*
410 2017;**96**(5):344-51.

411

412 Okusanya BO, Oduwole O, Effa EE. Immediate postabortal insertion of intrauterine devices.
413 *Cochrane Database Syst Rev* 2014(7):CD001777.

414

415 Peipert JF, Madden T, Allsworth JE, Secura GM. Preventing unintended pregnancies by providing
416 no-cost contraception. *Obstet Gynecol* 2012;**120**(6):1291-7.

417

418 Pohjoranta E, Mentula M, Gissler M, Suhonen S, Heikinheimo O. Provision of intrauterine
419 contraception in association with first trimester induced abortion reduces the need of repeat
420 abortion: first-year results of a randomized controlled trial. *Hum Reprod* 2015;**30**(11):2539-46.

421

422 Pohjoranta E, Suhonen S, Mentula M, Heikinheimo O. Intrauterine contraception after medical
423 abortion: factors affecting success of early insertion. *Contraception* 2017;**95**(3):257-62.

424

425 Pohjoranta E, Mentula M, Suhonen S, Heikinheimo O. Predicting poor compliance with follow-up
426 and intrauterine contraception services after medical termination of pregnancy. *BMJ Sex Reprod*
427 *Health* 2018;**44**:278-285.

428

429

430 Rose SB, Lawton BA. Impact of long-acting reversible contraception on return for repeat abortion.
431 *Am J Obstet Gynecol* 2012;**206**(1):37 e1-6.

432

433 Royal College of Obstetricians and Gynaecologists. Faculty of Sexual and Reproductive Healthcare.
434 Medical Eligibility Criteria for Contraceptive Use. 2018; Available from:
435 <https://www.fsrh.org/ukmec/>. 15 November 2018, date last accessed.

436

437 Saav I, Stephansson O, Gemzell-Danielsson K. Early versus delayed insertion of intrauterine
438 contraception after medical abortion - a randomized controlled trial. *PLoS One* 2012;**7**(11):e48948.

439

440 Schreiber CA, Sober S, Ratcliffe S, Creinin MD. Ovulation resumption after medical abortion with
441 mifepristone and misoprostol. *Contraception* 2011;**84**(3):230-3.

442

443 Secura GM, Madden T, McNicholas C, et al. Provision of no-cost, long-acting contraception and
444 teenage pregnancy. *N Engl J Med* 2014;**371**(14):1316-23.

445

446 Shimoni N, Davis A, Ramos ME, Rosario L, Westhoff C. Timing of copper intrauterine device
447 insertion after medical abortion: a randomized controlled trial. *Obstet Gynecol* 2011;**118**(3):623-8.

448

449 Socialstyrelsen. Statistik om aborter 2017. 2018; Available from:
450 <https://www.socialstyrelsen.se/publikationer2018/2018-5-17>. 14 November 2018, date last
451 accessed.

452

453 THL (National Institute for Health and Welfare). Perinatal statistics 2017. 2018; Available from:
454 <http://urn.fi/URN:NBN:fi-fe2018103146930>. 7 January 2019, date last accessed.

455

456 THL (National Institute for Health and Welfare). Raskaudenkeskeytykset 2017. Induced abortions
457 2017. 2018; Available from: <http://www.julkari.fi/handle/10024/136527>. 14 November 2018, date
458 last accessed.

459

460 Toffol E, Pohjoranta E, Suhonen S, et al. Anxiety and quality of life after first-trimester termination
461 of pregnancy: a prospective study. *Acta Obstet Gynecol Scand* 2016;**95**(10):1171-80.

462

463 WHO (World Health Organization). Medical Eligibility Criteria for Contraceptive Use. 5th Edition.
464 2015; Available from: [https://www.who.int/reproductivehealth/publications/family_planning/Ex-](https://www.who.int/reproductivehealth/publications/family_planning/Ex-Summ-MEC-5/en/)
465 [Summ-MEC-5/en/](https://www.who.int/reproductivehealth/publications/family_planning/Ex-Summ-MEC-5/en/). 15 November 2018, date last accessed.

466

467 WHO (World Health Organization). Safe abortion: technical and policy guidance for health
468 systems. Second edition 2012; Available from:

469 http://apps.who.int/iris/bitstream/handle/10665/70914/9789241548434_eng.pdf?sequence=1.

470 16 November 2018, date last accessed.

471

472 Winner B, Peipert JF, Zhao Q, et al. Effectiveness of long-acting reversible contraception. *N Engl J*
473 *Med* 2012;**366**(21):1998-2007.

474

475

476

477 **Figure legends:**

478

479 Figure 1. Study flow chart.

480 Figure 2. Cumulative proportions of women without subsequent TOP or requested TOP during
481 five-year follow-up.

482 Figure 3A. Annual rate of subsequent TOP during five-year follow-up (/1000 years of follow-up).

483 Figure 3B. Average rate of subsequent TOP during five-year follow-up (/1000 years of follow-up).

Table 1. Baseline characteristics of the study participants. The data are presented as n (%) unless stated otherwise.

	Intervention group (n=375)	Control group (n=373)	p-value
Age (years); median (IQR)	27 (11)	27 (10)	0.489
Marital status			0.157
Single	202 (53.9)	229 (61.4)	
Cohabiting	102 (27.2)	92 (24.7)	
Married	71 (18.9)	52 (13.9)	
Regular smoking	188 (50.1)	189 (51.4)	0.710
Regular use of alcohol	275 (73.3)	286 (77.9)	0.145
Contraceptive method used prior to index TOP			0.335
Combined hormonal contraception*	45 (12.0)	49 (13.1)	
Progestin-only pill	12 (3.2)	9 (2.4)	
Cu-IUD	–	1 (0.3)	
Condom	159 (42.4)	135 (36.2)	
Other	8 (2.1)	14 (3.8)	
None	151 (40.3)	165 (44.2)	
History of delivery	187 (49.9)	175 (46.9)	0.501
History of TOP	174 (46.4)	153 (41.0)	0.095
Method of abortion			
Surgical	69 (18.4)	74 (19.8)	0.617
Medical	306 (81.6)	299 (80.2)	
Duration of index pregnancy (days); median (IQR)	57 (17)	56 (16)	0.208

* Combined oral contraceptive pill, patch or ring

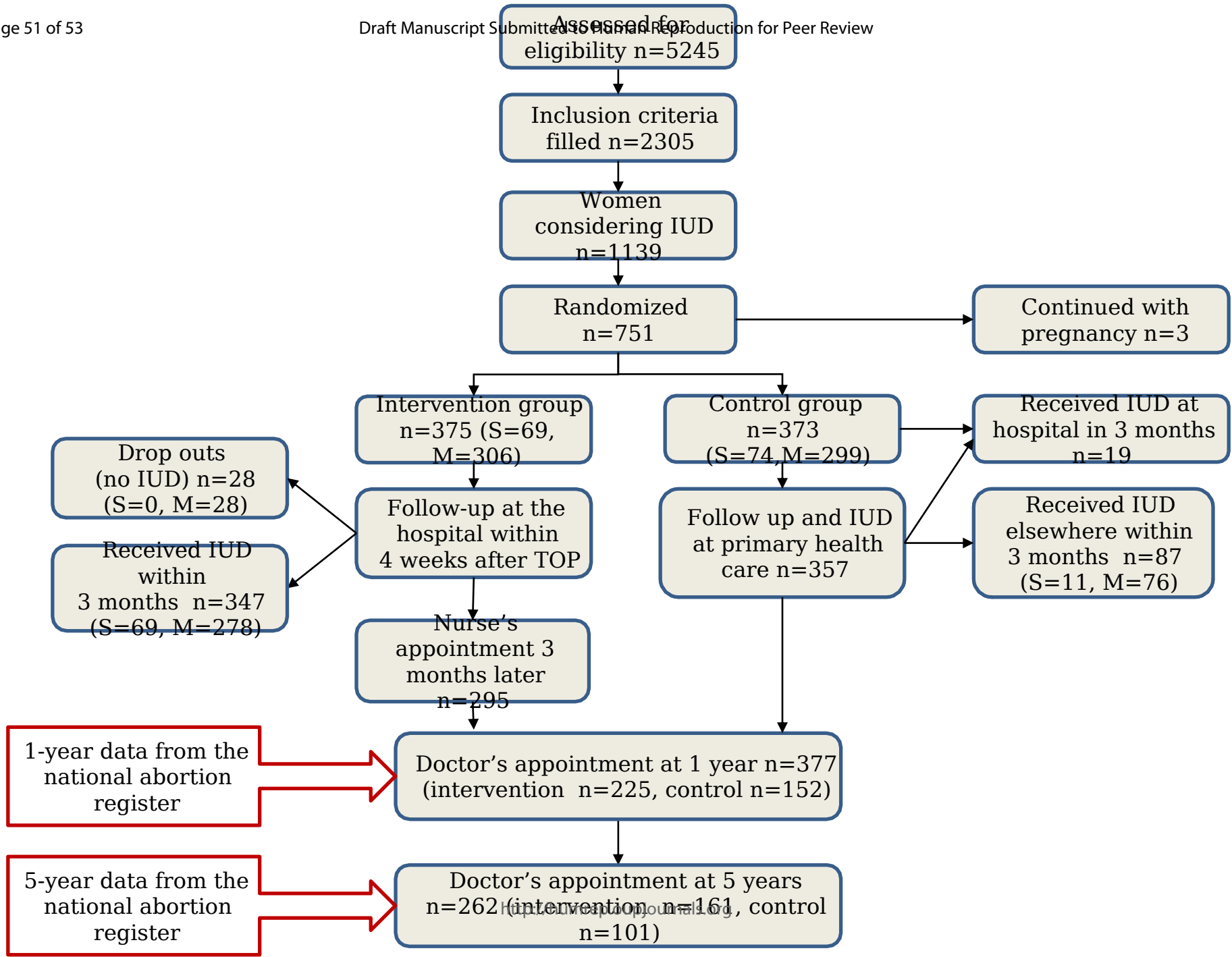
Table 2. Subsequent TOP(s) and requested TOP(s) during five-year follow-up.

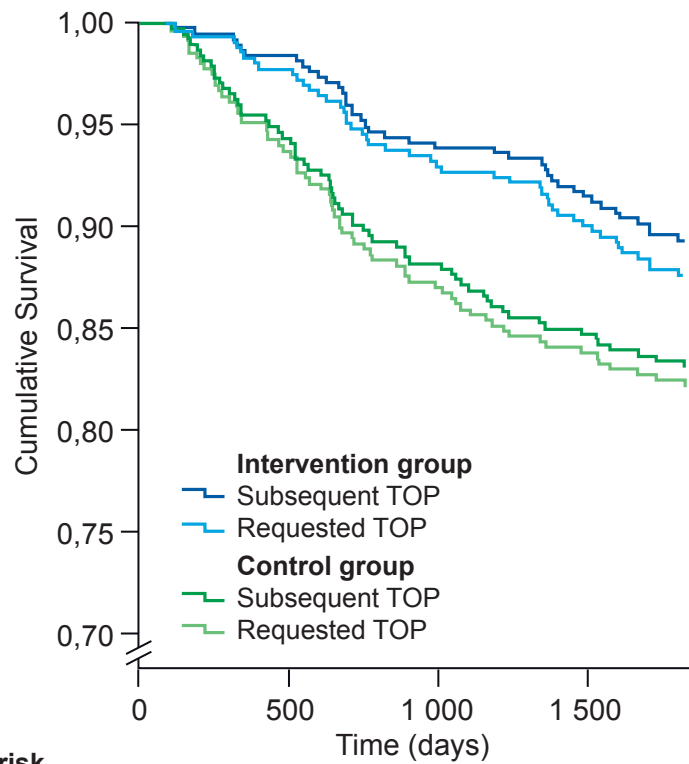
	Intervention group n=375 (%)	Control group n=373 (%)	HR (CI 95%)	p-value
Women with subsequent TOP(s)	40 (10.7)	63 (16.9)	1.67 (1.13–2.49)	0.011*
Women with requested TOP(s)	46 (12.3)	66 (17.7)	1.52 (1.04–2.22)	0.029*
Subsequent TOP				
- Number	50	72	–	0.027**
- Incidence***	26.7	38.6		
Requests for TOP				
- Number	58	76	–	0.080**
- Incidence***	30.9	40.8		

* Log rank test

** Chi square test

*** Number of TOP/1000 years of follow-up





Number at risk

Intervention group

Subsequent TOP	375	369	352	343
Requested TOP	375	367	349	338

Control group

Subsequent TOP	373	352	329	316
Requested TOP	373	350	325	313

Subsequent TOP: HR 1.67 (CI 95% 1.13–2.49); p=0.011.

Requested TOP: HR 1.52 (CI 95% 1.04–2.22); p=0.029.

Figure 3A. Rate of subsequent TOP during five-year follow-up (/1000 years of follow-up).

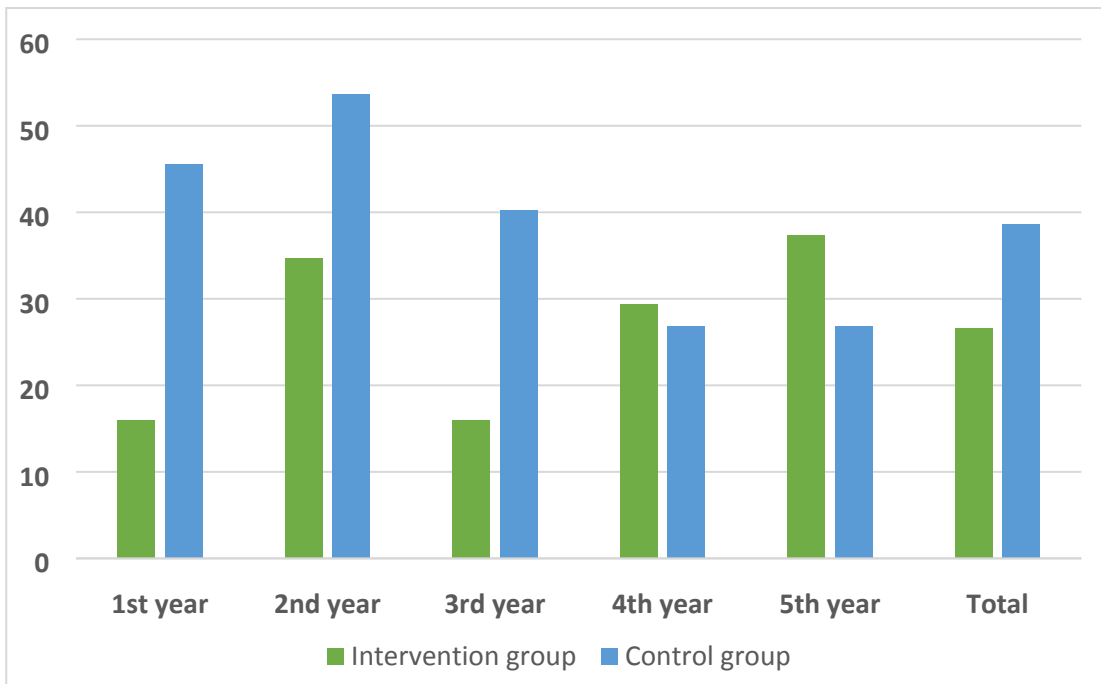


Figure 3B. Average rate of subsequent TOP during five-year follow-up (/1000 years of follow-up).

