Risk Factors and the Choice of Long-acting Reversible Contraception Following Medical Abortion – Effect on Subsequent Induced Abortion and Unwanted Pregnancy

Riina Korjamo, M.D., Oskari Heikinheimo, M.D., Prof., Maarit Mentula, M.D., Ph.D.

Department of Obstetrics and Gynaecology, University of Helsinki and Helsinki University Hospital, Helsinki, Finland

Address for correspondence:
Maarit Mentula, Department of Obstetrics and Gynaecology, Kätilöopisto Hospital, Helsinki University Hospital, P.O. Box 610, 00029-HUS, Helsinki, Finland
E-Mail: maarit.mentula@helsinki.fi

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Abstract (250 words)

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Objective: To analyse the post-abortion effect of long-acting reversible contraception (LARC) plans and initiation on the risk of subsequent unwanted pregnancy and abortion.

Materials and methods: A retrospective cohort study of 666 women who underwent medical abortion between January–May 2013 at Helsinki University Hospital, Finland. Altogether 159 (23.8%) women planning post-abortion use of levonorgestrel-releasing intrauterine system (LNG-IUS) participated in a randomized study and had an opportunity to receive the LNG-IUS free-of-charge from the hospital. The other 507(76.2%) women planned and obtained their contraception according to clinical routine. Demographics, planned contraception, and LARC initiation at the time of the index abortion were collected. Data on subsequent abortions were retrieved from the Finnish Abortion Register and electronic patient files until the end of 2014.

Results: During the 21 months ([median], IQR 20–22) follow-up, 54(8.1%) women requested subsequent abortions. When adjusted for age, previous pregnancies, deliveries, induced abortions, and gestational-age, planning LARC for post-abortion contraception failed to prevent subsequent abortion (33 abortions/360 women,9.2%) compared to other contraceptive plans (21/306, 6.9%) (HR1.22, 95%CI 0.68–2.17). However, verified LARC initiation decreased the abortion rate (4 abortions/177 women,2.3%) compared to women with uncertain LARC initiation status (50/489, 10.2%) (HR0.17, 95%CI 0.06–0.48). When adjusted for LARC initiation status, age <25 years was a risk factor for subsequent abortion (27 abortions/283 women,9.5%) compared to women ≥25 years (27/383, 7.0%, HR1.95, 95%CI 1.04–3.67).

Conclusions: Initiation of LARC as part of abortion service at the time of medical abortion is an important means to prevent subsequent abortion, especially among young women.

Keywords: abortion, termination of pregnancy, repeat abortion, long-acting reversible contraception

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Risk factors and LARC following medical abortion

Introduction

Recent estimates show that almost half of the pregnancies in the USA are unintended and about 40% of them end up in abortion [1]. Induced abortion is often a consequence of inadequate contraception and the reasons not to use contraception originate from lack of correct information [2]. Women undergoing an induced abortion are at higher risk for a subsequent induced abortion [3]. Although abortion incidence has declined in the developed world [4,5], the rate of repeat abortion has not decreased [6]. In research studies, the reported rates of subsequent induced abortions have been 5%, 11%, and 20% at one, two, and four years after the index abortion, respectively [7,8]. The number of repeat induced abortions should be diminished, as they increase the risk of needing surgical interventions and preterm delivery [9,10–13]. Long-acting reversible contraceptives (LARC), including intrauterine devices (IUDs) and implants, are associated with the lowest incidence of subsequent abortion [3,14,15], especially if initiated at the time of the abortion [8,16,17].

Several interventions have been performed to increase the uptake of LARC after induced abortion. Contraceptive counselling alone has not increased LARC uptake [18]. Yet women are motivated to choose LARC at the time of abortion, especially if they have a recent history of induced abortion [19]. Studies suggest that the reduction of financial barriers may facilitate women to initiate LARC methods [20–23]. Also, minimizing the number of visits needed increases LARC uptake; the effect is well documented for surgical abortion [3,14,15,17,24,25]. However, increasing use of medical instead of surgical abortion has challenged the option to initiate LARC methods immediately. Initiation may be delayed 3-4 weeks after the abortion, if a conservative protocol is followed. Studies have shown that immediate insertion of the etonogestrel-implant shortly after mifepristone intake at the initial visit for abortion did not affect the efficacy of medical abortion, but increased the implant initiation rate [26,27]. Similar effects are evident in response to shortening the interval

between medical abortion and IUD insertion, and offering it as a part of abortion service [8,28,29]. We recently performed a randomized clinical trial that demonstrated the feasibility and safety of the fast-track (≤3 days) insertion of a levonorgestrel-releasing intrauterine system (LNG-IUS) during medical induced abortion [30,31]. Moreover, immediate insertion resulted in better one-year continuation rates than later LNG-IUS insertion [16].

In this cohort study we assessed factors affecting the selection and initiation of LARC for post-abortion contraception at the time of medical induced abortion. We also analysed the effect of planned *vs.* initiated contraception on the risks of subsequent unwanted pregnancy and induced abortion both for LARCs and for other contraceptives.

Materials and Methods

This retrospective cohort study analyses the effects of contraceptive plans and initiation after medical induced abortion. The study was performed in tandem with a randomized study assessing immediate *vs.* later provision of free-of-charge LNG-IUS (Mirena®, Bayer AG, Turku, Finland) [30,31]. The study population consisted of adult (≥ 18 years) women undergoing medical abortion up to 20 weeks of gestation during January 17th to May 20th 2013 at the Department of Obstetrics and Gynaecology of the Helsinki University Hospital, Finland. The recruitment for randomised controlled trial occurred after contraceptive counselling among women showing interest in LNG-IUS contraception. During the study period all women showing interest in LNG-IUS contraception and meeting the inclusion criteria had an opportunity to participate to the study.

Medical induced abortion was performed using oral mifepristone 200 mg and misoprostol 400 to 800 mcg 1-3 days later according to the Finnish national guidelines [32]. Medical abortions up to 9

98 weeks of gestation (up to 63 days of amenorrhea) can be performed partially at home where
99 misoprostol is self-administered by the patient. Later abortions were performed at the hospital ward.
100
101 During the randomized trial [30,31] the LNG-IUS was offered either immediately (*i.e.* ≤3 days) or
102 2–4 weeks after the abortion. If the woman did not participate in the trial, the LNG-IUS, copper-
103 IUD (Cu-IUD, Nova T380, Bayer Pharma AG, Berlin, Germany), or contraceptive implant
104 (Nexplanon®, N.V. Organon, Oss, Netherlands) was offered from the hospital free-of-charge in
105 cases of previous induced abortions. During the study period two cities of the hospital district,
106 namely Helsinki and Vantaa, were offering the first contraceptive LNG-IUS, Cu-IUD, or implant
107 free-of-charge, but the insertion occurred at the primary health care at a separate visit scheduled by
108 the woman herself. These visits may be made up to three months after the first contact. We did not
109 have access to information on these possible insertions. Thus, all verified LARC insertions in this
110 study were free-of-charge. If the woman was planning other than LARC for post abortion
111 contraception, a three-month start-up package of pills, patch, or ring was provided from the hospital
112 liberally, but otherwise the patient had to buy contraception herself.
113
114 Finnish law and guidelines on induced abortion, require contraceptive counselling before induced
115 abortion [32]. Moreover, planned contraception, along with selected sociodemographic and
116 abortion-related data are reported to the national Abortion Register. The register has been validated,
117 and proven to be reliable and of high-quality [33,34].
118
119 The abortion procedure in Finland consists of two visits: first visit occurring at the primary health
120 care or private sector, and second at the hospital outpatient clinic. All women receive contraceptive
121 counselling during both these visits, LARC presentation being an important part of the counselling.
122 Data concerning planned contraception and background factors was collected as a part of the

randomized study, or from electronic patient records of the hospital system, and were completed from the Abortion Register. "*LARC presented"* is defined as LARC was recommended or presented to the woman and this was mentioned in the electronic patient files. "*LARC planned"* means that woman was recruited to the randomized study or the woman confirmed that LARC was planned for post-abortion contraception. "*LARC initiated"* means that initiation was verified as a part of the randomized study, or the insertion occurred in the hospital within one month following the abortion.

Marital status was divided into categories of single, cohabiting, and married. Socio-economic status was presented as white-collar workers, blue-collar workers, students (level of education not defined), and other or not known according to the stated occupation or the highest education level reported. The coding was based on national standards (Statistics Finland). Ethnicity was available from the hospital files and is presented as groups of native Finnish and others.

Information on subsequent pregnancies was derived from patient clinical records and The Finnish Abortion Register at the end of 2014. If woman was requesting subsequent abortion, but the pregnancy was diagnosed as a miscarriage or an ectopic, the pregnancy was defined as unwanted.

This study was approved by the hospital system of Helsinki and Uusimaa, and National Institute of Health and Welfare. The clinical trial was approved by the local Ethics Committee and registered to www.clinicaltrials.gov (NCT01755715).

Statistics

Categorical data were analysed by cross tabulation and p-values calculated by Chi-square test. Kaplan-Meier analysis and Log-Rank test was used to describe subsequent unwanted pregnancies.

147 Survival analysis and hazard ratios were analysed by Cox's regression model. All analyses were
148 performed with IBM SPSS statistical software version 24.
149
150 **Results**
151 ***Study Population***
152 Total of 666 women underwent medical abortion, representing 92.2% of all women undergoing an
153 induced abortion during the study period (Figure 1). Demographics of the women are presented in
154 Table 1. Most women were 20 to 35 years old, of normal weight and half of them smoked regularly.
155 Almost 60% of them had a history of previous pregnancy and one third a history of induced
156 abortion. Three out of four underwent early medical abortion (gestational age ≤63 days) and one out
157 of four participated in the randomized trial. Detailed demographics of the women participating in
158 the randomized study have been published previously [30, 31]. Briefly, women participating in the
159 randomized trial (n=159) compared to non-RCT-women (n=507) in this cohort belonged to older
160 age-groups (21–24 year olds 33 [20.8%] *vs.* 132 [26.0%]; 25–29 year olds 47 [29.6%] *vs.* 94
161 [18.5%], other groups data not shown, p=0.02), had more often history of previous pregnancy (113
162 [71.1%] *vs.* 282 [55.6%], p=0.001), delivery (91 [57.2%] *vs.* 205 [40.4%], p<0.001) and induced
163 abortion (70 [44.0%] *vs.* 159 [31.4%], p=0.003), and they requested the abortion at later gestational-
164 age (≤63 days 108 [67.9%] *vs.* 399 [78.7%], 64–84 days 43 [27.0%] *vs.* 93 [18.3%], ≥ 85 days 8
165 [5.0%] vs. 15 [3.0%], p=0.02).
166
167 ***Presentation, Planning, and Insertion of Post-abortal LARC***
168 Long-acting contraception was presented to 429 (64.4%) women (Table 2). LARC was presented
169 more often to women older than 25 years than to women younger than 25 years of age (271/383
170 [70.8%] *vs.* 158/283 [55.8%] risk ratio [RR] 1.27, 95% confidence interval [95%CI] 1.12–1.43,
171 p<0.001). Furthermore, LARC was presented more often to women who were obese and married or

cohabiting, had history of pregnancy, delivery or induced abortion, and were requesting second trimester abortion.

After the counselling, 360 (54.0%) women were planning initiation of post abortion LARC (Figure 1, Table 2). The most popular method was the LNG-IUS (n=268, 74.4%) and 159 (59.3%) of these women participated in the randomized study. Contraindication for progestin-containing contraception was present in only one woman (newly diagnosed breast cancer), whereas contraindications for intrauterine contraception occurred in four cases (one case of acute gonorrhoea, two cases of submucosal myomas and one uterus bicornus).

Altogether 177 (26.6%) women received LARC at the time or within 4 weeks of medical induced abortion. This represented 49.2% of all women planning LARC. Among the 159 women who participated in the randomized controlled trial 141 (88.7%) received the LNG-IUS. None of the women planning other forms of contraception received LARC. Most of these LARCs were LNG-IUSs (n=149, 84.2%) followed by implants (n=27, 15.3%) and one Cu-IUD. Even though LARC was planned more often for women older than 25 years, it was initiated similarly in younger and in older women (Table 2). Women with a history of previous pregnancy (either delivery or abortion) initiated a LARC more often than women with no such history. Abortion conducted at the hospital ward (late first-trimester or second trimester abortion) increased the uptake of LARC. Regardless of plans, native Finnish women initiated LARC more often than women of other ethnic groups. Only 36 of 201 (17.9%) women who planned LARC but did not participate in the randomized study received LARC compared to 141/159 (88.7%) women participating in the randomized study.

Subsequent Abortion and Unwanted Pregnancy

The median follow-up time was 649 days (IQR 614–679) (i.e. 21 months [20–22]). During the follow-up, altogether 54 women (8.1%) underwent a subsequent induced abortion. The median time to subsequent abortion was 336 days (246–450) (i.e. 11 months [8–15]). According to the patient files, there were five additional unwanted pregnancies: three women were diagnosed with miscarriage at the time they were requesting subsequent abortion; one woman had an ectopic pregnancy following the use of emergency contraception; and one pregnancy was diagnosed during oral contraceptive use following fibroid resection. Table 3 presents the distribution and hazard ratios of subsequent abortions and unwanted pregnancies according to selected risk factors, and LARC planning and initiation status. After adjustments, only initiated LARC decreased the rate of subsequent abortion (hazard ratio [HR] 0.17, 95% confidence interval [95% CI] 0.06–0.48, p=0.0008) and unwanted pregnancy (HR 0.15, 95% CI 0.05–0.43, p=0.0004). Four unwanted pregnancies occurred in women who participated in the randomized trial following initiation of LNG-IUS use. One pregnancy was recognized after an unnoticed expulsion, two LNG-IUSs were removed before the subsequent pregnancy, and one abortion was performed in a case where LNG-IUS had been inserted, but the patient never returned for follow-up. Age under 25 years remained an independent risk factor for both subsequent induced abortion and unwanted pregnancy even after adjusting LARC initiation status. Kaplan-Meier survival curves (Figure 2) display the effect of LARC initiation status on subsequent unwanted pregnancy. Verified initiation of LARC reduced the occurrence of subsequent unwanted pregnancy significantly during the follow-up. Conversely, planned but not initiated LARC resulted more often in unwanted pregnancy when compared to initiated LARC or other form of contraception.

Discussion

Findings and Interpretation

We found that during the nearly two years of follow-up, only initiated LARC decreased the need for subsequent abortion and unplanned pregnancy, when compared to only planning of LARC, or initiation of other contraceptive methods at the time of the abortion. Age less than 25 years was an independent risk factor for subsequent abortion and unwanted pregnancy.

Previous studies have shown that young age, second trimester abortion, and history of previous pregnancy, delivery, and induced abortion are risk factors for subsequent induced abortion [3, 35, 36,37]. LARC methods are the most effective in prevention of unintended pregnancy and subsequent abortion [3,14]. For example, the contraceptive CHOICE project in the U.S. has shown counselling that highlights LARC methods to be the most effective, and removing cost and access barriers can increase LARC initiation rates and reduce both total and repeat abortion rates [21,38]. The CHOICE investigators estimated that contraceptive policy facilitating LARC initiation could prevent up to 41% to 71% of abortions performed annually in the U.S. [21]. LARC methods have long been liberally recommended to all women in our clinic in need of contraception. However, in this study information concerning contraceptive counselling and LARC recommendations is based on retrospective data collected from patient files. Because of the clinic's long-standing tradition and parallel RCT recruitment, LARCs may have been discussed more often than recorded in the patient files. Even though we recommended and presented LARC more often to women older than 25 years of age compared to younger women, we initiated LARC similarly to both age groups. We speculate this was mostly due to easy and cost-free access to LNG-IUS insertion as part of the randomized study.

A key finding of this study is that only planning LARC does not decrease the need for subsequent abortion. In contrast, the need for effective contraception was highest in this group. However, this

may be due to the fact that women with an increased risk of subsequent abortion were successfully identified and plans to initiate LARC were made. But, as the plans did not lead to LARC initiation, this resulted in the highest need for another abortion in this group.

This study has practical implications. It shows that the policy of only discussing LARC, not leading into LARC initiation, is not effective. This is likely to be associated with the high up-font cost of LARC methods and structure of the contraceptive service delivery system. None of the women studied were willing or able to buy LARC beforehand even though this option is available. We are pleased to note discussion about possible free-of-charge provision of contraception, including LARC, is currently on-going in Finland [39].

Strengths and Weaknesses of the Study

The predominant strength of our analysis is that the study population is well representative of the average Finnish woman seeking abortion; in 2013, the incidence of abortion in Finland was highest among women aged 20–24 years (of the study population 25% were 20–24 years of age), 36% had experienced abortion previously (study population 34%), and 49% had a previous delivery (study population 44%) [40].

The setting of this study may be retrospective, but the important background characteristics are reliable and could be identified from the hospital records as they are routinely asked. In the Finnish healthcare setting, induced abortions are almost always treated in public health care (<6% in private clinics) (Anna Heino, National Institute for Health and Welfare, personal communication, March 26, 2016) [41]. In addition, the data concerning induced abortions are accurate and reliable, thus induced abortions can be identified from the Abortion Register [33,34]. Data on additional unwanted pregnancies was derived from the hospital patient files only, and may thus be

underestimated. According to Kaplan-Meier analysis (Figure 2), more accurate detection of unwanted pregnancies would have increased the differences between the initiated or planned LARC and other contraceptive plans.

However, a weakness of the study is that we have no information concerning the LARC initiation status in the group of women that planned LARC, but it was not initiated at the hospital. This is due to the fact that women came from several communities with different electronic patient file systems for which we had no access. Also, some of the LARCs might have been initiated by private physicians. Furthermore, all boundaries to access of effective contraception in primary healthcare could not be analysed. For example, it was unknown whether women attended a planned follow-up visit at primary health care. Previous studies from our group [42] and elsewhere [43] have shown that up to half of the women do not attend the scheduled post-abortion follow-up.

Conclusion

Fast-tract and easy access initiation of LARC as part of the abortion service provided at the time of the medical abortion is an important means to prevent subsequent abortion, especially among young women.

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Declaration of Interest Statement

OH has served on advisory boards for Bayer Healthcare and Gedeon Richter, and designed and lectured at educational events connected with these companies. OH has also lectured at educational events organized by Merck/MSD and Sandoz. The other authors (RK and MM) have no conflicts of interest to declare.

References

1. Finer LB, Zolna MR. Declines in Unintended Pregnancy in the United States, 2008-2011. *The New England journal of medicine* 2016 Mar 03;374(9):843-52. doi: 10.1056/NEJMsa1506575.
2. Mosher WD, Jones J. Use of contraception in the United States: 1982-2008. Vital and health statistics Series 23, Data from the National Survey of Family Growth. 2010 Aug(29):1-44.
3. Heikinheimo O, Gissler M, Suhonen S. Age, parity, history of abortion and contraceptive choices affect the risk of repeat abortion. *Contraception* 2008 Aug;78(2):149-54. doi: http://dx.doi.org/10.1016/j.contraception.2008.03.013.
4. Sedgh G, Bearak J, Singh S, et al. Abortion incidence between 1990 and 2014: global, regional, and subregional levels and trends. *Lancet* 2016 May 11. doi: 10.1016/s0140-6736(16)30380-4.
5. Gissler M, Fronteira I, Jahn A, et al. Terminations of pregnancy in the European Union. *Bjog* 2012 Feb;119(3):324-32. doi: 10.1111/j.1471-0528.2011.03189.x.
6. National Institute for Health and Welfare. Official Statistics of Finland. Induced Abortions 2015. Published Oct 2016. [cited 2017 Oct 26]. Available from http://urn.fi/URN:NBN:fi-fe2016102025429
7. Rose SB, Stanley J, Lawton BA. Time to second abortion or continued pregnancy following a first abortion: a retrospective cohort study. *Hum Reprod* 2015 Jan;30(1):214-21. doi: 10.1093/humrep/deu283.
8. Pohjoranta E, Mentula M, Gissler M, et al. Provision of intrauterine contraception in association with first trimester induced abortion reduces the need of repeat abortion: first-year results of a randomized controlled trial. *Hum Reprod* 2015 Nov;30(11):2539-46. doi: 10.1093/humrep/dev233.

9. Thorp JM, Jr., Hartmann KE, Shadigian E. Long-term physical and psychological health consequences of induced abortion: review of the evidence. *Obstetrical & gynecological survey* 2003 Jan;58(1):67-79. doi: 10.1097/01.ogx.0000045217.37578.0b.

10. Saccone G, Perriera L, Berghella V. Prior uterine evacuation of pregnancy as independent risk factor for preterm birth: a systematic review and metaanalysis. *Am J Obstet Gynecol.* 2016 May;214(5):572-91. doi: 10.1016/j.ajog.2015.12.044.

11. Kc S, Gissler M, Virtanen SM, et al. Risks of Adverse Perinatal Outcomes after Repeat Terminations of Pregnancy by their Methods: a Nationwide Register-based Cohort Study in Finland 1996-2013. *Paediatric and perinatal epidemiology* 2017 Aug 16. doi: 10.1111/ppe.12389.

12. Templeton A, Grimes DA. Clinical practice. A request for abortion. *The New England journal of medicine* 2011 Dec 08;365(23):2198-204. doi: 10.1056/NEJMcp1103639.

13. ESHRE Capri Workshop Group. Induced abortion. *Hum Reprod* 2017 Jun 01;32(6):1160-1169. doi: 10.1093/humrep/dex071.

14. Cameron ST, Glasier A, Chen ZE, et al. Effect of contraception provided at termination of pregnancy and incidence of subsequent termination of pregnancy. *Bjog* 2012 Aug;119(9):1074-80. doi: 10.1111/j.1471-0528.2012.03407.x.

15. Rose SB, Lawton BA. Impact of long-acting reversible contraception on return for repeat abortion. *Am J Obstet Gynecol* 2012 Jan;206(1):37.e1-6. doi: 10.1016/j.ajog.2011.06.102.

16. Korjamo R, Mentula M, Heikinheimo O. Immediate vs. delayed initiation of the levonorgestrel-releasing intrauterine system following medical termination of pregnancy - one year continuation rates: A randomised controlled trial. *Bjog* 2017 Jun 26. doi: 10.1111/1471-0528.14802.

17. Langston AM, Joslin-Roher SL, Westhoff CL. Immediate postabortion access to IUDs, implants and DMPA reduces repeat pregnancy within 1 year in a New York City practice. *Contraception* 2014 Feb;89(2):103-8. doi: 10.1016/j.contraception.2013.10.014.
18. Langston AM, Rosario L, Westhoff CL. Structured contraceptive counseling--a randomized controlled trial. *Patient education and counseling* 2010 Dec;81(3):362-7. doi: 10.1016/j.pec.2010.08.006.
19. Madden T, Secura GM, Allsworth JE, et al. Comparison of contraceptive method chosen by women with and without a recent history of induced abortion. *Contraception* 2011 Dec;84(6):571-7. doi: 10.1016/j.contraception.2011.03.018.
20. Secura GM, Madden T, McNicholas C, et al. Provision of no-cost, long-acting contraception and teenage pregnancy. *The New England journal of medicine* 2014 Oct 2;371(14):1316-23. doi: 10.1056/NEJMoa1400506.
21. Peipert JF, Madden T, Allsworth JE, et al. Preventing unintended pregnancies by providing no-cost contraception. *Obstet Gynecol* 2012 Dec;120(6):1291-7. doi: http://10.1097/AOG.0b013e318273eb56.
22. Krashin JW, Stuart GS, Garrett J, et al. Contraception Insurance Coverage and Receipt of Long-Acting Reversible Contraception or Depot Medroxyprogesterone Acetate on the Day of Abortion. *Obstet Gynecol* 2017 Jul;130(1):109-117. doi: 10.1097/aog.0000000000002070.
23. Secura GM, Allsworth JE, Madden T, et al. The Contraceptive CHOICE Project: reducing barriers to long-acting reversible contraception. *Am J Obstet Gynecol* 2010 Aug;203(2):115.e1-7. doi: 10.1016/j.ajog.2010.04.017.
24. Okusanya BO, Oduwole O, Effa EE. Immediate postabortal insertion of intrauterine devices. *Cochrane Database Syst Rev* 2014 Jul 28;7:Cd001777. doi: 10.1002/14651858.CD001777.pub4.

25. Rose SB, Garrett SM, Stanley J. Immediate postabortion initiation of levonorgestrel implants reduces the incidence of births and abortions at 2 years and beyond. *Contraception* 2015 Jul;92(1):17-25. doi: 10.1016/j.contraception.2015.03.012.

26. Raymond EG, Weaver MA, Tan YL, et al. Effect of Immediate Compared With Delayed Insertion of Etonogestrel Implants on Medical Abortion Efficacy and Repeat Pregnancy: A Randomized Controlled Trial. *Obstet Gynecol* 2016 Feb;127(2):306-12. doi: 10.1097/aog.0000000000001274.

27. Hognert H, Kopp Kallner H, Cameron S, et al. Immediate versus delayed insertion of an etonogestrel releasing implant at medical abortion-a randomized controlled equivalence trial. *Hum Reprod* 2016 Sep 22. doi: 10.1093/humrep/dew238.

28. Cameron ST, Berugoda N, Johnstone A, et al. Assessment of a 'fast-track' referral service for intrauterine contraception following early medical abortion. *J Fam Plann Reprod Health Care* 2012 Jul;38(3):175-8. doi: http://dx.doi.org/10.1136/jfprhc-2011-100166.

29. Saav I, Stephansson O, Gemzell-Danielsson K. Early versus delayed insertion of intrauterine contraception after medical abortion - a randomized controlled trial. *PLoS ONE* 2012;7(11):e48948. doi: http://dx.doi.org/10.1371/journal.pone.0048948.

30. Korjamo R, Mentula M, Heikinheimo O. Fast-track vs. delayed insertion of the levonorgestrel-releasing intrauterine system after early medical abortion - a randomized trial. *Contraception* 2017 Aug 05. doi: 10.1016/j.contraception.2017.07.008.

31. Korjamo R, Mentula M, Heikinheimo O. Expulsions and adverse events following immediate and later insertion of a levonorgestrel-releasing intrauterine system after medical termination of late first and second trimester pregnancy: A randomised controlled trial. *Bjog* 2017 Jul 10. doi: 10.1111/1471-0528.14813.

32. Working group set up by the Finnish Medical Society Duodecim and the Finnish Society of Obstetrics and Gynaecology. Induced abortion (online). Current Care Guidelines. The

Finnish Medical Society Duodecim. 2013. [cited 2017 Oct 26]. Available from: http://kaypahoito.fi/web/english/guidelineabstracts/guideline?id=ccs00034

33. Heino A, Niinimaki M, Mentula M, et al. How reliable are health registers? Registration of induced abortions and sterilizations in Finland. *Informatics for health & social care* 2017 Apr 07:1-10. doi: 10.1080/17538157.2017.1297306.

34. Gissler M, Ulander VM, Hemminki E, et al. Declining induced abortion rate in Finland: data quality of the Finnish abortion register. *International journal of epidemiology* 1996 Apr;25(2):376-80.

35. Mentula MJ, Niinimaki M, Suhonen S, et al. Young age and termination of pregnancy during the second trimester are risk factors for repeat second-trimester abortion. *Am J Obstet Gynecol* 2010 Aug;203(2):107.e1-7. doi: http://dx.doi.org/10.1016/j.ajog.2010.03.004.

36. Cameron ST, Riddell J, Brown A, et al. Characteristics of women who present for abortion towards the end of the mid-trimester in Scotland: national audit 2013-2014. *Eur J Contrcept Reprod Health Care* 2015 Nov 15:1-6. doi: 10.3109/13625187.2015.1111326.

37. St John H, Critchley H, Glasier A. Can we identify women at risk of more than one termination of pregnancy? *Contraception* 2005 Jan;71(1):31-4. doi: 10.1016/j.contraception.2004.07.003.

38. Birgisson NE, Zhao Q, Secura GM, et al. Preventing Unintended Pregnancy: The Contraceptive CHOICE Project in Review. *Journal of women's health (2002)*. 2015 May;24(5):349-53. doi: 10.1089/jwh.2015.5191.

39. Suggestion to Helsinki community to offer free-of-cost contraception to women under 25 years. [cited 2017 Oct 4]. Available from: https://www.kuntalaisaloite.fi/fi/aloite/2161

40. National Institute for Health and Welfare. Official Statistics of Finland. Induced Abortions 2013. Published Oct 2014. [cited 2017 Oct 26]. Available from http://urn.fi/URN:NBN:fi-fe2014101645230

41. Anna Heino, National Institute for Health and Welfare, personal communication (March 26, 2016).

42. Pohjoranta E, Suhonen S, Heikinheimo O. Attendance at post-abortal follow-up visits is low - can the risks of non-attendance be identified? *Acta Obstet Gynecol Scand* 2011 May;90(5):543-6. doi: http://dx.doi.org/10.1111/j.1600-0412.2011.01099.x.

43. Madden T, Westhoff C. Rates of follow-up and repeat pregnancy in the 12 months after first-trimester induced abortion. *Obstet Gynecol* 2009 Mar;113(3):663-8. doi: 10.1097/AOG.0b013e318195dd1e.

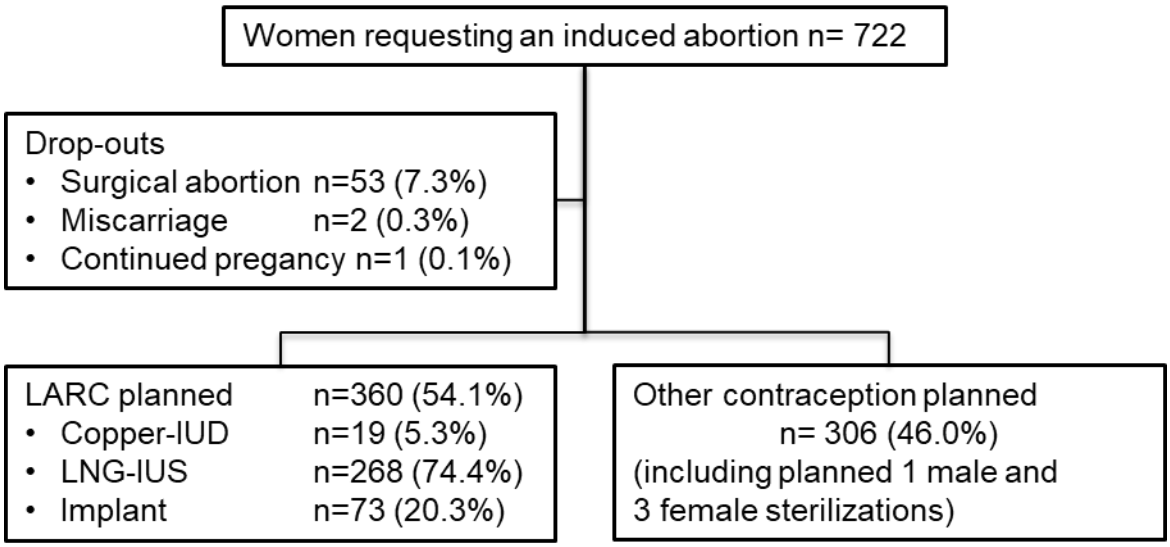
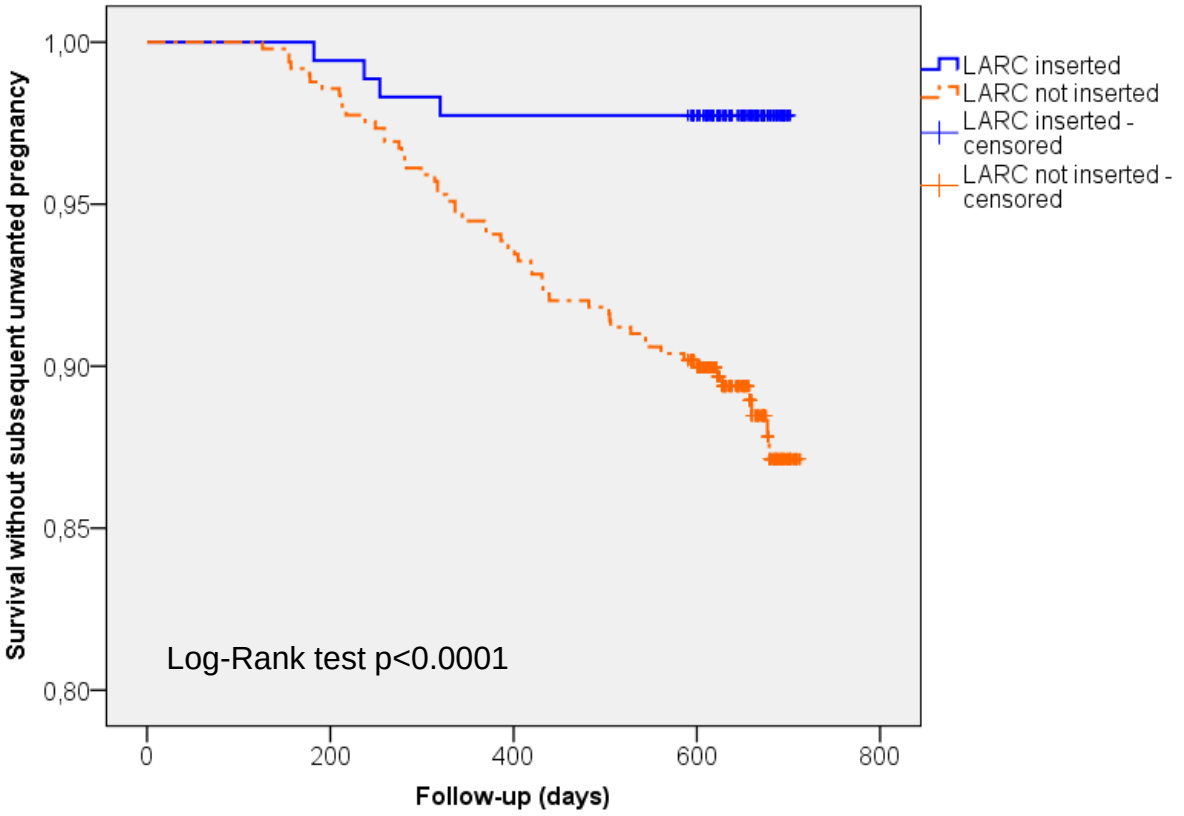


Figure 1. The formation of the study group of 666 women undergoing medically induced abortion and their planned contraception during January 17th to May 20th 2013.

444 a)



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446 b)

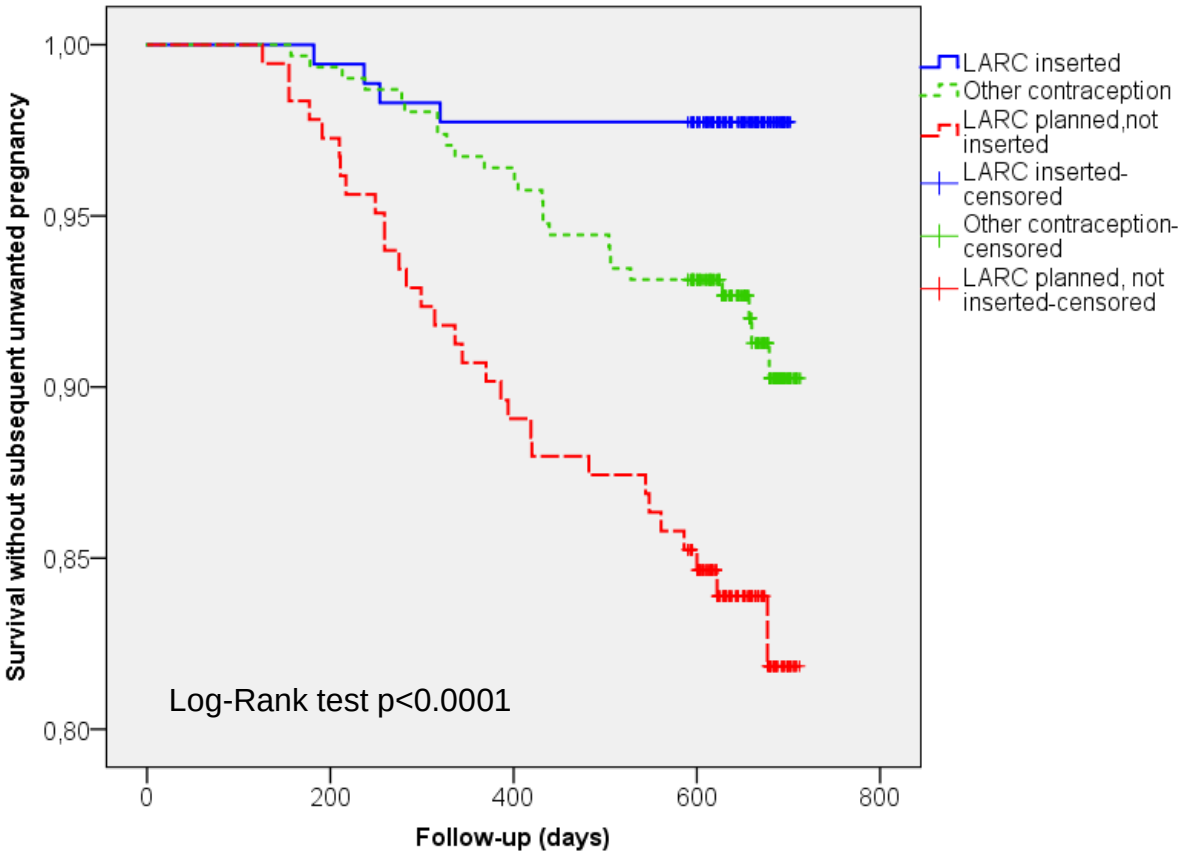

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Figure 2. Kaplan-Meier survival without subsequent unwanted pregnancy among 666 women requesting medical abortion during January 17th to May 20th 2013.

a) According to initiation status of long-acting reversible contraception (LARC).

b) According to verified LARC insertion, planning but not necessarily starting LARC, or other contraceptive plans at the time of index abortion.

Median follow-up time was 649 days (interquartile range 614–679, i.e. 21 months [20–22]).

457 **Table 1**. Demographics of the 666 women undergoing medical induced abortion during January

458 17th to May 20th 2013. Data are presented as n (%) unless stated other vice.

Age (years) (median [IQR])	26.0 (22.0–32.0)
Age groups	
≤ 20 years	118 (17.7%)
21 to 24 years	165 (24.8%)
25 to 29 years	141 (21.2%)
30 to 34 years	124 (18.6%)
35 to 39 years	84 (12.6%)
≥ 40 years	34 (5.1%)
Body mass index (kg/m^2) (missing n=90 [13.5%]) (median [IQR])	22.7 (20.7–25.6)
Normal weight (body mass index <25 kg/m^2)	413 (62.0%)
Regular smoking (missing n=17 [2.6%])	308 (46.2%)
Regular use of alcohol (missing n=59 [8.9%])	407 (61.1%)
Socioeconomic status	
White collar workers	130 (19.5%)
Blue collar workers	235 (35.3%)
Students	163 (24.5%)
Others or not known	138 (20.7%)
Marital status (missing n=14 [2.1%])	
Married or cohabiting	272 (40.8%)
Single	380 (57.1%)
Ethnicity native Finnish	513 (77.0%)
Residence Helsinki or Vantaa*	517 (77.6%)
Previous pregnancy	395 (59.3%)
Previous delivery	296 (44.4%)
Previous vaginal delivery	272 (40.8%)
Previous cesarean section	45 (6.8%)
Previous induced abortion	229 (34.4%)
Previous misscarriage	97 (14.6%)
Gestational age (median [IQR])	54 (47–63)
≤63 days	507 (76.1%)
64–84 days	136 (20.4%)
≥85 days	23 (3.5%)
Abortion partially at home among gestational age of ≤63 days	437 (86.2%)

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460 * Cities offering a first intrauterine device or system or implant free of costs

461

462 Table 2. LARC presented, planned, and inserted according to selected demographic factors among

463 666 women undergoing medical abortion during January 17th to May 20th 2013.

	n	LARC presented^	p-value	LARC planned^	p-value	LARC inserted^	p-value
Age							
<25 years	283	158 (55.8%)	<0.001	135 (47.7%)	0.005	66 (23.3%)	0.10
≥25 years	383	271 (70.8%)		225 (58.7%)		111 (29.0%)	
Body mass index (kg/m^2)							
<25	413	273 (66.1%)	<0.001	228 (55.2%)	<0.001	112 (27.1%)	0.006
25-30	108	65 (60.2%)		53 (49.1%)		32 (29.6%)	
≥30	55	46 (83.6%)		42 (76.4%)		21 (38.2%)	
Not known	90	45 (50.0%)		37 (41.1%)		12 (13.3%)	
Socioeconomic status							
White collar workers	130	83 (63.8%)	0.08	67 (51.5%)	0.15	34 (26.2%)	0.08
Blue collar workers	235	164 (69.8%)		141 (60.0%)		73 (31.1%)	
Students	163	93 (57.1%)		84 (51.5%)		44 (27.0%)	
Others or not known	138	89 (64.5%)		68 (49.3%)		26 (18.8%)	
Marital status							
Married or cohabiting	272	193 (71.0%)	0.002	159 (58.5%)	0.049	72 (26.5%)	0.38
Single	380	224 (58.9%)		191 (50.3%)		99 (26.1%)	
Not known	14	12 (85.7%)		10 (71.4%)		6 (42.9%)	
Ethnicity							
Native Finnish	513	327 (63.7%)	0.51	273 (53.2%)	0.43	147 (28.7%)	0.026
Other	153	102 (66.7%)		87 (56.9%)		30 (19.6%)	
Residence							
Helsinki or Vantaa*	517	336 (65.0%)	0.56	281 (54.4%)	0.77	137 (26.5%)	0.93
Other	149	93 (62.4%)		79 (53.0%)		40 (26.8%)	
Previous pregnancy							
Yes	395	305 (77.2%)	<0.001	256 (64.8%)	<0.001	131 (33.2%)	<0.001
No	271	124 (45.8%)		104 (38.4%)		46 (17.0%)	
Previous delivery							
Yes	296	236 (79.7%)	<0.001	202 (68.2%)	<0.001	98 (33.1%)	0.001
No	370	193 (52.2%)		158 (42.7%)		79 (21.4%)	
Previous induced abortion							
Yes	229	182 (79.5%)	<0.001	149 (65.1%)	<0.001	81 (35.4%)	<0.001
No	437	247 (56.5%)		211 (48.3%)		96 (22.0%)	
Gestational-age group							
≤63 days	507	318 (62.7%)	0.047	265 (52.3%)	0.040	114 (22.5%)	<0.001
64-84 days	136	91 (66.9%)		77 (56.6%)		48 (35.3%)	
≥85 days	23	20 (87.0%)		18 (78.3%)		15 (65.2%)	
Early medical abortion (≤63 days)							
Yes	507	318 (62.7%)	0.10	265(52.3%)	0.10	114 (22.5%)	<0.001
No	159	111 (69.8%)		95 (59.7%)		63 (39.6%)	
Abortion partially at home among gestation of ≤63 days							
Yes	437	272 (62.2%)	0.58	226 (51.7%)	0.53	89 (20.4%)	0.004
No	70	46 (65.7%)		39 (55.7%)		25 (35.7%)	
Participated in randomized trial							
Yes	159	159 (100.0%)	<0.001	159 (100.0%)	<0.001	141 (88.7%)	<0.001
No	507	270 (53.3%)		201 (39.6%)		36 (7.1%)	

464 ^ 'LARC presented' was defined as it was recommended or presented to the woman and mentioned

465 in the electronic patient file. 'LARC planned' means that woman was recruited to the randomized

study or LARC was planned otherwise to post abortion contraception. ‘LARC initiated’ means that initiation was verified as a part of the randomized study or insertion occurred in a hospital within one month following the abortion.

* Cities offering the first long-acting reversible contraceptives free-of-cost to their citizens.

Table 3: Risk factors of subsequent abortion and unwanted pregnancy during the follow-up (median 21 months, interquartile range 20–22 months) among 666 women undergoing medical induced abortion during January 17th to May 20th 2013. Cox regression model.

	Subsequent abortion					**Subsequent abortion or unwanted pregnanacy**				
	n (%)	Unadjusted HR (95%CI)	p-value	Adjusted HR (95%CI)	p-value	n (%)	Unadjusted HR (95%CI)	p-value	Adjusted HR (95%CI)	p-value
Planned other contraception (n=306)	21 (6.9%)	Reference		Reference*		25 (8.2%)	Reference		Reference*	
Planned LARC[a] (n=360)	33 (9.2%)	1.37 (0.79–2.37)	0.26	1.22 (0.68–2.17)	0.51	34 (9.4%)	1.19 (0.71–2.00)	0.51	1.02 (0.59–1.76)	0.95
Planned other contraception (n=306)	21 (6.9%)	Reference		Reference*		25 (8.2%)	Reference		Reference*	
LARC planned, not inserted (n=183)	29 (15.8%)	2.47 (1.41–4.33)	0.002	2.22 (1.23–3.98)	0.008	30 (16.4%)	2.15 (1.27–3.66)	0.005	1.86 (1.07–3.24)	0.028
LARC inserted (n=177)	4 (2.3%)	0.33 (0.11–0.95)	0.04	0.26 (0.08–0.77)	0.015	4 (2.3%)	0.27 (0.10–0.79)	0.016	0.21 (0.07–0.62)	0.005
LARC not inserted (n=489)	50 (10.2%)	Reference		Reference*		55 (11.2%)	Reference		Reference*	
LARC inserted (n=177)	4 (2.3%)	0.21 (0.08–0.59)	0.003	0.17 (0.06–0.48)	<0.001	4 (2.3%)	0.19 (0.07–0.54)	0.002	0.15 (0.05–0.43)	<0.001
Age ≥25 (n=383)	27 (7.0%)	Reference		Reference^		31 (8.1%)	Reference		Reference^	
<25 (n=283)	27 (9.5%)	1.34 (0.79–2.29)	0.28	1.95 (1.04–3.67)	0.04	28 (9.9%)	1.22 (0.73–2.03)	0.45	1.84 (1.00–3.38)	0.049
No previous pregnanacy (n=271)	18 (6.6%)	Reference		Reference^		19 (7.0%)	Reference		Reference^	
Has previous pregnanacy (n=395)	36 (9.1%)	1.38 (0.78–2.43)	0.26	1.81 (0.63–5.19)	0.27	40 (10.1%)	1.45 (0.84–2.51)	0.18	1.49 (0.53–4.21)	0.45
No previous delivery (n=370)	25 (6.8%)	Reference		Reference^		26 (7.0%)	Reference		Reference^	
Has previous delivery (n=296)	29 (9.8%)	1.48 (0.86–2.52)	0.15	1.63 (0.65–4.10)	0.30	33 (11.1%)	1.62 (0.97–2.70)	0.07	1.95 (0.80–4.80)	0.14
No previous induced abortion (n=437)	37 (8.5%)	Reference		Reference^		39 (8.9%)	Reference		Reference^	
Has previous induced abortion (n=229)	17 (7.4%)	0.86 (0.48–1.53)	0.61	0.75 (0.37–1.53)	0.43	20 (8.7%)	0.96 (0.56–1.64)	0.88	0.88 (0.46–1.72)	0.72
Gestational age ≤63 days (n=507)	39 (7.7%)	Reference		Reference^		43 (8.5%)	Reference		Reference^	
64-84 days (n=136)	12 (8.8%)	1.09 (0.57–2.08)	0.79	1.15 (0.59–2.21)	0.68	13 (9.6%)	1.06 (0.57–1.98)	0.85	1.12 (0.60–2.10)	0.72
≥85 days (n=23)	3 (13.0%)	1.65 (0.51–5.34)	0.40	2.73 (0.82–9.09)	0.10	3 (13.0%)	1.49 (0.46–4.81)	0.50	2.60 (0.78–8.62)	0.12

[a] Long-acting reversible contraception (copper-containing intrauterine device, levonorgestrel-releasing intrauterine system and implant)

* Adjusted by age (<25 years *vs.* ≥25 years), previous pregnancy (yes *vs.* no), previous delivery (yes *vs.* no), previous induced abortion (yes *vs.* no) and gestational-age groups (≤63 days *vs.* 64-84 days *vs*. ≥85 days.

^ Adjusted by factors mentioned above and LARC insertion status (inserted *vs.* not inserted).