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Original Research Article

Predictors of choosing long-acting reversible contraceptive methods when provided free-of-charge – A prospective cohort study in Finland ☆,☆☆

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ABSTRACT

Objective: To identify factors associated with choosing long-acting reversible contraception (LARC) (intrauterine device or contraceptive implant), when provided free-of-charge.
Study design: This register-based cohort study comprises all women living in the city of Vantaa in the Helsinki metropolitan area during 2013–2014, with information on LARC initiations retrieved from electronic health records. Since January 2013, women in Vantaa can receive their first LARC method free-of-charge at public contraceptive clinics. We performed multivariable regression to assess seven predictors based on literature and four predictors based on gynecological history for association with choosing LARC in this population.
Results: In 2013–2014, 9669 women entitled to a free-of-charge method visited a public clinic and 2035 (21.0%) women initiated LARC. Factors most associated with LARC initiation included history of delivery (odds ratio [OR] 5.4, 95% confidence intervals [CI] 4.7–6.2) and induced abortion (OR 1.4, 95%CI 1.2–1.6), and no previous visit at the clinic (OR 1.3, 95%CI 1.2–1.5). Previous delivery was associated with LARC initiation in all age-groups (OR, 95%CI by age-group; 15–19 years: 10.8, 5.1–23.4; 20–24 years: 6.4, 4.9–8.3; 25–29 years: 6.7, 5.2–8.6; 30–44 years: 3.6, 2.9–4.6).
Conclusion: History of delivery and induced abortion were strongly associated with choosing a LARC method, even though all women in the population were entitled to their first free-of-charge LARC method. The association was particularly strong among women less than 25 years of age.
Implications statement: Untargeted provision of free-of-charge LARC in public contraceptive services reached women with previous delivery or abortion well during the programs first years. However, as LARCs are recommended to all women, future research should focus on how uptake evolves and how to reach all women in need of long-term, effective contraception.

1. Introduction

Long-acting reversible contraception (LARC) – i.e. intrauterine devices and contraceptive implants – are the most effective reversible contraceptives available, but still used far less than short-acting methods [1].

Previous studies have identified several factors associated with initiating or planning to initiate LARC. These factors include history of delivery, childbearing at young age, age under 35, higher educational level, history of unintended pregnancy or induced abortion (hereafter abortion), being married and poverty or low socioeconomic status, although results vary between studies [1–5]. Interestingly, many of these characteristics are also found among women with unintended pregnancies or abortions [6,7]. On the

☆ **Declaration of interest:** Authors FG and TS are general practitioners employed by the city of Vantaa, Division of health care and social services. Author TS is the chief physician of the family planning services in Vantaa. Author TS has received payments for lectures from Novartis and Bayer. Author OH serves occasionally on advisory boards for Bayer AG, Gedeon Richter, HRA-Pharma, Sandoz A/S and Vifor Pharma, and has designed and lectured at educational events of these companies. Authors AB and MG: Declarations of interest: none.

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contrary, less than high-school education is associated with higher risk of unintended pregnancy [6], but higher LARC uptake [2]. Although LARC use has been advocated as a tool to eliminate health disparities regarding unintended pregnancy [8], the potential risk of targeting perceived high-risk women has also been discussed [9,10].

Price is often a barrier for choosing LARC [11], as these methods frequently have high up-front costs. When costs have been reduced by free-of-charge programs in several US settings, LARC initiation has increased [12–14]. In the city of Vantaa in the Helsinki metropolitan area, Finland, all women have been provided their first LARC method free-of-charge at public contraceptive clinics since January 2013. We have previously shown that LARC uptake increased rapidly after introduction of this program and the abortion rate declined, especially among adolescents [15]. The abortion rate was 80% lower among women choosing a free-of-charge LARC method compared to women not initiating a LARC method [16].

To better understand LARC use in populations for whom cost is not a barrier, we reviewed medical records of women seen at public clinics in Vantaa during 2013 and 2014 to identify those who chose LARC. Our primary aim was to investigate predictors of choosing LARC in this public program. Our secondary aim was to investigate whether there was evidence of interactions between age and other predictors and if so, to stratify the analysis by age group.

2. Material and methods

2.1. Setting

In Finland, public health care is markedly subsidized with patient costs for uncomplicated childbirth of approximately €100 (US$110), and medical abortion of €33 (US$37, European central bank exchange rate 2019, www.ecb.europa.eu). Pregnancy and postpartum care encompasses 11 visits at maternity clinics, all free-of-charge. Attendance at maternity clinics reaches 99% [17], as substantial maternity benefits are tied to these visits. After abortion, a follow-up visit is recommended by the Finnish national abortion guideline [18], but this visit is not linked to any benefits. In 2013–2014, 70% of abortion clients attended abortion follow-up visits in Vantaa, according to statistics from electronic health records. Contraceptive services are guaranteed by law and available free-of-charge for all and include contraceptive counseling, LARC insertion and removal, laboratory tests when needed, and abortion referrals and follow-up visits [19]. Contraceptive methods are not universally reimbursed but are moderately priced (e.g. €5–13 (US$6–14)/month for oral contraceptives, €155 (US$172) for levonorgestrel intrauterine systems). Additionally, some municipalities provide contraceptives free-of-charge at public clinics. Women in Vantaa frequently use public contraceptive services, with approximately one fourth of 15- to 24-year-old women visiting a clinic in 2014 [15].

LARC initiation is registered in Vantaa's electronic health records. Registration entitles general practitioners to a minor pay supplement (€7, US$8).

2.2. Study population

Our study population consists of all 15- to 44-year-old women entitled to a free-of-charge LARC method in Vantaa during the years 2013 and 2014. The two study groups comprise clients at public contraceptive clinics, either initiating or not initiating a free-of-charge method during this time. We have previously described formation of the study groups, their baseline characteristics, and study entering [16]. Only the first LARC method is provided free-of-charge; previous insertions or removals renders women not eligible. We excluded women with either a LARC insertion or removal during or after year 2000, women with baseline pregnancies ending in 2015, and women using permanent contraception (Fig. 1).

LARC methods provided included Copper (Cu) T380A intrauterine device (IUD), levonorgestrel (LNG) 52 mg intrauterine system (IUS), LNG 13.5 mg IUS, (since 2014), etonogestrel (ENG) implant and LNG two-rod implant.

2.3. Data sources

We identified all women who received free-of-charge LARC at a public clinic in 2013–2014. First, LARC insertion visits were retrieved by a computerized search of the electronic health records. Second, three members of the research team (two physicians [F.G. and T.S.] and a trained study nurse) reviewed the corresponding health records to confirm the clinic provided the LARC method free-of-charge. More than one researcher checked fifty visits to confirm the other's findings with no discrepancies identified. We also computed a binary variable of having no previous visit(s) during two years before start of study from the health records, to facilitate adjusting for previous contraceptive counseling.

We used validated Finnish national registers to obtain background information on the study participants [20–23]; all Finnish residents can be identified in these registers by a unique personal identification code. We used the Medical Birth Register (available since 1987), the Register of Induced Abortions (1983), the Sterilization Register (1987), and the Hospital Discharge Register (1969) and Primary Care Register (2011) for information on diagnosis of heavy, irregular or frequent menstrual bleeding (hereafter abnormal uterine bleeding, ICD-10 code N92), dysmenorrhea and other symptoms associated with the menstrual cycle (hereafter dysmenorrhea; ICD-10 code N94) and endometriosis (ICD-10 code N80). Further, we obtained information on *Chlamydia Trachomatis*, *Neisseria Gonorrhea*, and *Treponema Pallidum* infections from the Register of Infectious Diseases (1995).

We obtained information on the number of women in Vantaa as well as marital status and native language from the population register of Vantaa, and socio-economic status and educational level from Statistics Finland. As native language is a proxy for race or being an immigrant in Finland, we coded native language as a binary variable of speaking one of the two national languages in Finland (Finnish and Swedish). We coded education as a binary variable of having more or no more than elementary education. Socioeconomic status was defined as a five-category variable, with the group ´otheŕ comprising farmers, students, unemployed, retired, and housewives. The fifth group 'unknown' included women with no data on socioeconomic status in national registers.

2.4. Statistical methods

We combined the two LNG IUSs and the two contraceptive implants for all analyses. To explore whether effect of age was linear, we fitted a restricted cubic spline of age and observed a non-linear association ($P < 0.001$). Based on the spline function we used a four-category age variable in the regression models to assess age-group-specific ORs; 15- to 19-year-olds, 20- to 24-year-olds and 25- to 29-year-olds and 30- to 44-year-olds, with the oldest age group used as reference group.

We calculated frequencies for all variables in the two study groups, and by LARC method choice; LNG IUS, Cu IUD, or contraceptive implant, repeating the same calculations in the four age groups. We compared the distributions of categorical data by

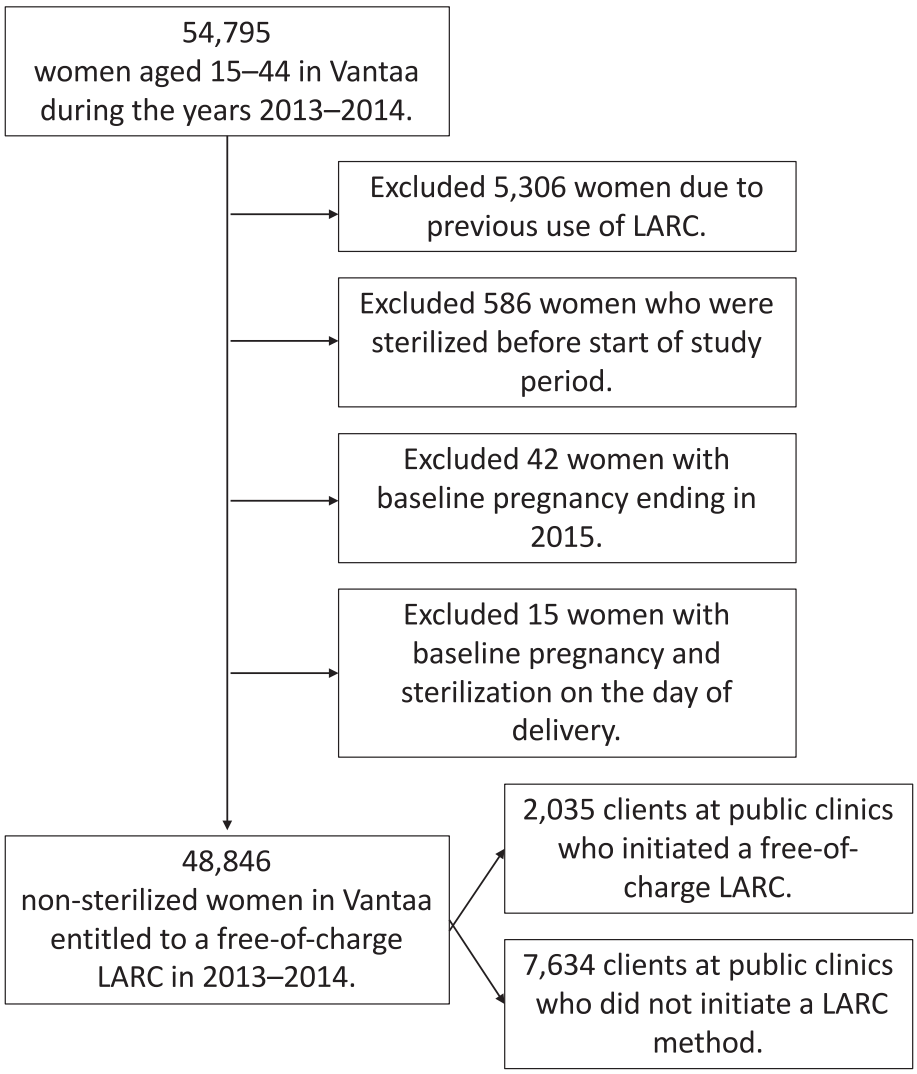

Fig. 1. Flow-chart of the formation of the study groups from the complete 15- to 44-year-old female population in Vantaa during 2013–2014.

initiating or not initiating a LARC and by LARC method with Pearson's Chi-square test or Fisher exact test, as appropriate.

To identify factors associated with choosing free-of-charge LARC, we fitted logistic regression models to obtain odds ratios (OR) with 95% confidence intervals (CI). First, we calculated crude ORs for seven factors previously established in the literature to associate with choosing a LARC method: age, history of delivery, history of abortion, marital status, educational level, socioeconomic status and speaking a national language as native language [1–5]. We then selected variables to include in the multivariate model by eliminating candidate predictors using backward elimination with Akaike's information criterion (AIC) as stopping rule, i.e. decreasing AIC for an improved model, reinserting excluded variables one by one and all together to further check whether including these variables improved the model [24]. This model selection yielded a model with categorical age, history of delivery, history of abortion and marital status as predictive variables. We opted to omit variables on educational level, socioeconomic status and native language because they did not improve the model. To examine whether variables on gynecological morbidity would further improve the model, we added prior diagnoses of abnormal uterine bleeding, dysmenorrhea, sexually transmitted infections, and no previous visits at clinics. We only found 35 women with endometriosis so we did not include this variable in the model. Because recent diagnoses are likely to be stronger predictors and hence of greater clinical relevance, we included diagnoses and infections from two years preceding the start of follow-up. We repeated the model selection procedure with the variables on gynecological morbidity to obtain the final regression model and found that diagnosed dysmenorrhea and being a first-time client improved the model. History of sexually transmitted infection and abnormal uterine bleeding did not improve the model and were not included.

Because the age span in the study population is wide and need and use of contraceptives vary with age, we further estimated an interaction model with the interaction of categorical age and the other predictive variables. We found evidence of significant interaction with categorical age and history of delivery, abortion, dysmenorrhea and being a first-time client, and continued to run the main model stratified by the four age categories.

We considered $p < 0.05$ as statistically significant and conducted all analyses using R statistical software (version 3.5.3).

2.5. Ethics approval

The ethics committee of the Hospital District of Helsinki and Uusimaa assessed and approved the study together with the

register keeping organizations of the registers used (City of Vantaa, National Institute for Health and Welfare and Statistics Finland).

3. Results

Of all 48,846 15- to 44-year-old women eligible to a free-of-charge LARC method, 9669 visited a public clinic in 2013–2014 and 2035 (21.0%) initiated a free-of-charge LARC method. The characteristics of women who did and did not choose LARC as well as women's characteristics across the three LARC methods differed significantly and are presented in Table 1. Particularly, women choosing LARC were older, and more frequently had history of delivery and abortion. The subject characteristics according to the four age groups are shown in Supplementary Table 1.

In the final multivariate regression model, five factors remained significantly associated with choosing free-of-charge LARC: age 20- to 24-years, history of abortion, history of delivery, being married and no previous visit at a clinic. Previous delivery had the highest OR of 5.39 (95% CI 4.69–6.19). Odds Ratios for initiating a LARC method from crude and adjusted regression models are presented in Table 2, and the results from the final multivariate model are summarized Fig. 2. The ORs for choosing a LARC method in the three younger age categories were less than 1 in the crude model, but greater than 1 after adjustment, compared to the reference group of 30- to 44-year-olds. We further examined this change by looking at two-variable-models with categorical age and the other variables and found the shift to occur after adjustment for delivery.

We present the interactions between categorical age and the other predictors, when tested one at a time with the logistic regression model for LARC initiation, in Supplementary Table 3. We found significant interactions between categorical age and prior delivery ($P = 0.006$ for 15- to 19-year-olds, $P = 0.001$ for 20- to 24-year-olds, and $P < 0.001$ for 25- to 29-year-olds), prior abortion ($P < 0.001$ for 15- to 19-year-olds and $P = 0.005$ for 20- to 24-year-olds), no previous visit at clinics ($P < 0.001$ for 15- to 19-year-olds and $P = 0.03$ for 20- to 24-year-olds) and history of dysmenorrhea diagnosis ($P = 0.01$ for 15- to 19-year-olds and $P < 0.001$ for 20- to 24-year-olds). Hence, we repeated the regression model in the four age groups (Fig. 3 and Supplementary Table 2). History of delivery remained statistically significant, with the highest OR of all variables in all age groups (ORs between 3.63 and 10.82). History of abortion was significantly associated with choosing LARC among 15- to 19- and 20- to 24-year-olds (ORs 3.16 [95% CI 1.91–5.11] and 1.82 [95% CI 1.39–2.37], respectively). Among 20- to 24-year-olds, prior diagnosis of dysmenorrhea was associated with choosing LARC (OR 3.78 [95% CI 2.06–6.73]). Being a new customer at the contraceptive clinic reduced the odds of choosing free-of-charge LARC in the youngest age group (OR 0.73 [95%CI 0.55–0.97]) but increased the odds in the three older groups.

4. Discussion

We found that parous women more likely chose free-of-charge LARC as compared to nulliparous women, with the highest odds in the youngest (15–19 years) age group. Among women less than 25 years of age, women choosing LARCs also more often had a prior abortion. We surmise that these women are more motivated to initiate a long-acting effective contraceptive compared to older women with a history of delivery or abortion.

Although the public program in Vantaa was not designed to target risk groups but provided all women their first LARC method free-of-charge, women who chose LARCs had characteristics similar to women with an unintended pregnancy choosing abortion [6,7,25]. The same characteristics have been identified in free-of-charge programs in the US, with history of unintended pregnancy and childbirth increasing the odds of choosing LARC [26,27]. This phenomenon might be explained in part by the service providers to characterize women as "high-risk" for unintended pregnancy [28,29]. While it is encouraging that young women with a history

Table 1
Characteristics of the 15- to 44-year-old female population in Vantaa attending a public clinic in 2013–2014 and eligible for free-of-charge LARC.

	All clients					LARC initiators					
	No LARC ($n = 7634$)		LARC initiators ($n = 2035$)		p-value	LNG IUS ($n = 1203$)		Cu-IUD ($n = 186$)		Implant ($n = 646$)		p-value
Age (years)					<0.001							<0.001
15–19	1864	(24.4)	237	(11.6)		49	(4.1)	5	(2.7)	183	(28.3)	
20–24	2361	(30.9)	453	(22.3)		209	(17.4)	43	(23.1)	201	(31.1)	
25–29	1518	(19.9)	475	(23.3)		296	(24.6)	64	(34.4)	147	(22.8)	
30–44	1891	(24.8)	870	(42.8)		649	(53.9)	74	(39.8)	147	(22.8)	
History of delivery	1818	(23.8)	1,308	(64.3)	<0.001	954	(79.3)	127	(68.3)	227	(35.1)	<0.001
History of abortion	1099	(14.4)	483	(23.7)	<0.001	312	(25.9)	50	(26.9)	121	(18.7)	0.001
Married	1556	(20.4)	804	(39.5)	<0.001	564	(46.9)	84	(45.2)	156	(24.1)	<0.001
Only elementary education	2519	(33.0)	598	(29.4)	<0.001	269	(22.4)	48	(25.8)	281	(43.4)	<0.001
Socioeconomic status[a]					<0.001							<0.001
Upper-level employees	522	(6.8)	225	(11.1)		166	(13.8)	24	(12.9)	35	(5.4)	
Lower-level employees	2889	(37.8)	799	(39.3)		516	(42.9)	66	(35.5)	217	(33.6)	
Manual workers	1481	(19.4)	376	(18.5)		214	(17.8)	38	(20.4)	124	(19.2)	
Other	2341	(30.7)	486	(23.9)		215	(17.9)	47	(25.2)	224	(34.7)	
Unknown	401	(5.3)	149	(7.3)		92	(7.6)	11	(5.9)	46	(7.1)	
Native language Finnish or Swedish	6637	(86.9)	1676	(82.4)	<0.001	1012	(84.1)	122	(65.6)	542	(83.9)	<0.001
No previous visit at clinic[b]	4336	(56.8)	1401	(68.8)	<0.001	882	(73.3)	131	(70.4)	388	(60.1)	<0.001
History of abnormal uterine bleeding[b]	179	(2.3)	54	(2.7)	0.47	38	(3.2)	3	(1.6)	13	(2.0)	0.25
History of dysmenorrhea[b]	141	(1.8)	42	(2.1)	0.58	23	(1.9)	1	(0.5)	18	(2.8)	0.15
History of STI[b]	331	(4.3)	59	(2.9)	0.006	25	(2.1)	2	(1.1)	32	(5.0)	<0.001

Note: Data are presented as n (% of group total). p-value obtained by X^2 and Fisher exact test for small expected values.
Abbreviations: LARC: Long-acting reversible contraception, LNG IUS: levonorgestrel intrauterine system (includes 52 mg and 13.5 mg products, Cu IUD: T380A Copper intrauterine device, Implant: etonogestrel implant and levonorgestrel 2-rod implant, STI: Sexually transmitted infection (*Chlamydia Trachomatis*, *Neisseria Gonorrhea* or *Treponema Pallidum*).
[a]Socioeconomic status classified according to Statistics Finland standards: Upper-level employees with administrative, managerial, professional and related occupations; Lower-level employees with administrative and clerical occupations; Manual workers and others including farmers, students, unemployed, retired, and housewives.
[b]Within two years before start of study.

Table 2
Odds ratios for predictors of initiating LARC from crude and adjusted logistic regression models in the 15- to 44-year-old female population in Vantaa attending a public clinic in 2013–2014 and eligible for free-of-charge LARC.

	Crude Model			Adjusted Model		
	OR (95% CI)		*p*-value	OR (95% CI)		*p*-value
Age 15–19	0.28	(0.24–0.32)	<0.001	1.15	(0.94–1.41)	0.16
Age 20–24	0.42	(0.37–0.47)	<0.001	1.25	1.07–1.47)	0.01
Age 25–29	0.68	(0.60–0.77)	<0.001	1.08	(0.94–1.25)	0.29
Age 30–44	ref	ref				
History of delivery	5.76	(5.18–6.39)	<0.001	5.39	(4.69–6.19)	<0.001
History of abortion	1.85	(1.64–2.09)	<0.001	1.39	(1.21–1.58)	<0.001
Married	2.55	(2.30–2.83)	<0.001	1.23	(1.08–1.4)	0.001
Only elementary education	0.81	(0.73–0.90)	<0.001	–		
Socioeconomic status[a]						
Upper-level employees	ref	–				
Lower-level employees	0.64	(0.54–0.77)	<0.001	–		
Manual workers	0.59	(0.49–0.71)	<0.001	–		
Other	0.48	(0.4–0.58)	<0.001	–		
Unknown	0.86	(0.67–1.1)	0.23	–		
Native language Finnish or Swedish	1.43	(1.25–1.63)	<0.001	–		
No previous visit at clinic[b]	1.68	(1.52–1.87)	<0.001	1.31	(1.17–1.46)	<0.001
History of abnormal uterine bleeding[b]	1.14	(0.83–1.53)	0.42	–		
History of dysmenorrhea[b]	1.12	(0.78–1.57)	0.52	1.4	(0.95–2.02)	0.08
History of STI[b]	0.67	(0.51–0.88)	0.01	–		

Abbreviations: LARC: Long-acting reversible contraception, OR: Odds Ratio, CI: Confidence Interval, STI: Sexually transmitted infection (*Chlamydia Trachomatis*, *Neisseria Gonorrhea* or *Treponema Pallidum*).
[a]Socioeconomic status classified according to Statistics Finland standards: Upper-level employees with administrative, managerial, professional and related occupations; Lower-level employees with administrative and clerical occupations; Manual workers and others including farmers, students, unemployed, retired, and housewives.
[b]Within two years before start of study.

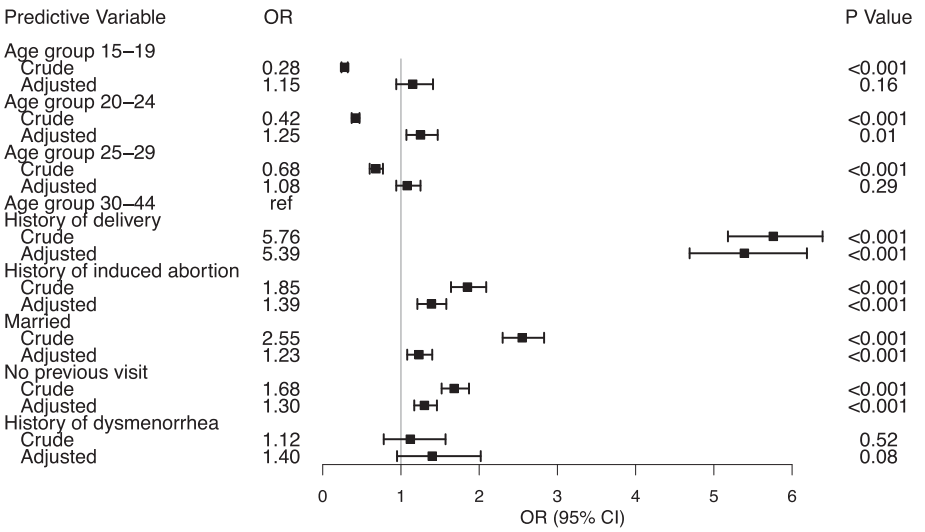

Fig. 2. Forest plot of crude and adjusted odds ratios of the predictors of initiating a free-of-charge LARC method. Results based on logistic regression models among 15- to 44-year-old women attending a public clinic and eligible for free-of-charge LARC. Abbreviations: OR: odds ratio, CI: confidence interval.

of pregnancy choose to rely on these reliable reversible contraceptive methods, it is equally important to provide women with no such history counseling on LARC methods.

High acceptance of LARC among women with a history of delivery or abortion may also be explained in part by the Finnish health care system. After both delivery and abortion, all women are invited to a follow-up visit, which includes contraceptive counseling per Finnish national guidelines. Short-acting methods can be prescribed at these visits, while LARC usually require another visit. Even though same-day insertions have been shown to markedly increase LARC uptake [30], this program reached women with prior induced abortion and delivery particularly well. Still, LARC uptake might have been even higher if same-day insertions at follow-up visits would have been available.

A major strength of this study is its real-world setting, which facilitates analyzing factors associated with choosing LARC when price is eliminated as a barrier. Our study population consisted of the complete eligible population and all women using public contraceptive services. Additionally, with use of the high-quality Finnish national registers, we investigated whether previous gynecological diagnoses and sexually transmitted infections were associated with choosing a LARC method. A limitation is that the findings may be unique to the City of Vantaa. The Finnish universal health care system differs from systems in other countries, which may affect the generalizability of the results. Further, the variable use of diagnostic codes might underestimate the real number of women with symptoms, as it is possible that mild symptoms are not registered in patient records.

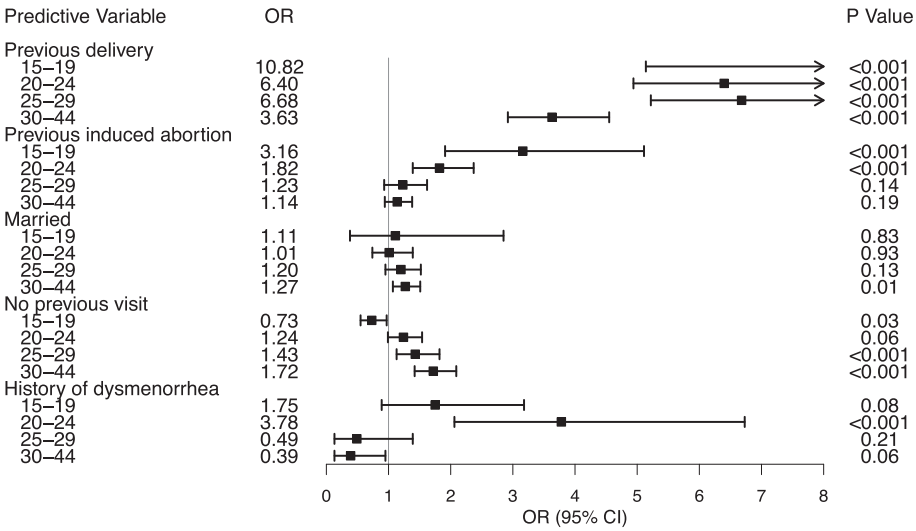

Fig. 3. Forest plot of adjusted odds ratios of the predictors of initiating a free-of-charge LARC method in the four age groups. Results based on logistic regression models stratified by the four age groups (15- to 19-year-olds, 20- to 24-year-olds, 25- to 29-year-olds, 30- to 44-year-olds) of women attending a public clinic and eligible for free-of-charge LARC. Abbreviations: OR: odds ratio, CI: confidence interval.

We conclude that a public program providing the population with LARC free-of-charge reaches women at high-risk for unintended pregnancy well. A challenge is to ensure that all women, regardless of their characteristics, receive high-quality LARC counseling and provision.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.contraception.2020.01.018.

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