Contraception 100 (2019) 89–95

Contents lists available at ScienceDirect

Contraception

journal homepage: www.elsevier.com/locate/con

Original research article

Prevalence and predictors of initiation of intrauterine devices and subdermal implants immediately after surgical abortion☆,☆☆

Andrea Hsu Roe [a,b,c,*,1,2], Jennifer Fortin [c], Elizabeth Janiak [a,b,c], Rie Maurer [a], Alisa B. Goldberg [a,b,c]

[a] Department of Obstetrics, Gynecology, and Reproductive Biology, Brigham and Women's Hospital, Boston, MA
[b] Harvard Medical School, Boston, MA
[c] Planned Parenthood League of Massachusetts, Boston, MA

ARTICLE INFO

Article history:
Received 20 November 2018
Received in revised form 29 April 2019
Accepted 1 May 2019

Keywords:
Contraception
Surgical abortion
Post-abortion contraception
Long-acting reversible contraception
LARC

ABSTRACT

Objectives: To estimate uptake of long-acting reversible contraception (LARC) methods immediately after surgical abortion in a system that makes these methods readily available, and to determine demographic, medical, social, and visit-specific predictors of immediate post-abortion intrauterine device (IUD) and implant initiation.
Study design: We performed a retrospective cohort study of LARC (levonorgestrel intrauterine system [IUS], copper IUD, and subdermal implant) initiation at the time of surgical abortion up to 21w0d gestation at Planned Parenthood League of Massachusetts from 2012 through 2017. We calculated proportions of IUD and implant initiation and used mixed effect logistic regression to estimate predictors of each outcome.
Results: Among 26,858 surgical abortion patients, 25.4% received immediate post-abortion LARC: 14.2%, 4.2%, and 7.0% received a levonorgestrel IUS, copper IUD, and implant, respectively. Compared to White women, Black women had lower odds of initiating an IUD (aOR 0.81, 95% CI 0.74–0.89). Multiparous women had greater odds than nulliparous women of initiating an IUD (aOR 1.69, 95% CI 1.57–1.82) or implant (aOR 1.36, 95% 1.20–1.53). We found age was the strongest predictor of implant initiation (<18 versus≥35: aOR 3.26, 95% CI 2.26–4.71), but was not associated with IUD uptake. Gestational age was not associated with IUD or implant uptake. Implant uptake increased from 2.4% (2012) to 8.7% (2017) (aOR 3.65, 95% CI 2.36–5.65) while IUD uptake remained fairly constant.
Conclusion: About 25% of women chose to initiate intrauterine or implantable contraception immediately after surgical abortion when these methods are readily available. Implant uptake has increased significantly in recent years. Women who initiated IUDs and implants differed in their demographic and social profiles.
Implications: Women seeking surgical abortion should have same-day access to IUDs and implants. Clinicians and researchers should analyze IUD and implant initiation separately.

1. Introduction

Surgical abortion represents an important health care opportunity during which women can initiate any method of contraception [1,2]. For women who desire long-acting reversible contraception (LARC) with an intrauterine device (IUD) or subdermal implant, pairing contraceptive initiation with abortion is particularly important, since most women who intend to return for interval IUD placement after abortion will not do so [3,4].

Recently, contraceptive delivery and access have become measures of health care quality. The Centers for Medicare and Medicaid Services proposed, and the National Quality Forum endorsed in October 2016, contraceptive care measures that quantify the percentage of reproductive-aged women who use a moderately or most effective form of contraception, as well as the percentage who use a LARC method [5]. However, the truest measure of contraceptive quality is the rate at which women obtain the method they want when they want it. Women undergoing abortion have specific contraceptive counseling preferences [6], and likely contraceptive use preferences, that may differ from the general population. Therefore, we should better understand the rates at which they use immediate post-abortion LARC when given the option and easy access, as well as current time trends, before we can consider applying such contraceptive care measures.

☆ The findings and conclusions expressed in this article are those of the authors and do not necessarily reflect the views of Planned Parenthood Federation of America, Inc.
☆☆ Funding Source: This work was supported by the Society of Family Planning Research Fund [grant number SFPRF17-2].
* Corresponding author. Tel.: +1 267 254 0225; fax: +1 215 349 8513.
E-mail address: andrea.roe@uphs.upenn.edu (A.H. Roe).
[1] Present address: Department of Obstetrics and Gynecology, Penn Medicine, Philadelphia, PA.
[2] Present address: University of Pennsylvania, Department of Obstetrics and Gynecology, 3400 Spruce Street, Philadelphia, PA 19104.

https://doi.org/10.1016/j.contraception.2019.05.001
0010-7824/

We currently lack these estimates for the United States. Since the contraceptive coverage mandate of the Affordable Care Act was implemented in 2012 [7], no contemporary estimates of LARC uptake after surgical abortion in the United States have been published. In a New Zealand abortion clinic that provided IUDs and implants at no cost, 26% of patients received a post-abortion IUD, and 20% received a post-abortion implant [8]. With the rising popularity of LARC methods nationwide [9], enhanced insurance coverage of these methods, and improving integration of LARC provision into abortion care, we suspected that the rate of post-abortion LARC uptake in this country has increased significantly over the past decade.

Structural factors such as government policy, clinician training, and financial reimbursement improve same-day LARC access and increase post-abortion LARC uptake [10,11]. However, patient factors that predict LARC initiation at the time of surgical abortion have not been examined in depth. Previous studies have relied primarily on descriptive statistics, not accounting for confounding variables [8,12], or have not examined a complete array of reversible contraceptive methods, due to clinic limitations on immediate post-abortion contraceptive options [13,14].

We performed a retrospective cohort study in order to provide an updated estimate of the rates of post-abortion IUD and implant initiation, as well as individual predictors of post-abortion IUD and implant initiation, in a United States high-volume clinic setting that provides the full spectrum of contraceptive options with minimal barriers to LARC initiation.

2. Material and methods

2.1. Setting

We performed a retrospective observational cohort study of LARC uptake by women receiving surgical abortion care at Planned Parenthood League of Massachusetts (PPLM) from October 2012 through April 2017. PPLM includes three clinic sites that provide surgical abortion up to 21w0d gestation (during the study period, the gestational limit was increased from 18w6d to 21w0d). All of the sites offered comprehensive post-abortion contraception: all health counselors offered the option of post-abortion LARC prior to the procedure, all abortion providers placed post-abortion LARC, and clinics were well-stocked with devices. Counselors used an individualized, patient-centered approach to contraceptive counseling, and patients were able to decline both counseling and a contraceptive method if they so chose. PPLM clinics offered all LARC and prescription-required reversible contraceptives commercially available during the study period, including the levonorgestrel IUS, copper IUD, subdermal implant, depot medroxyprogesterone injection, oral contraceptive pills, transdermal patch, and monthly vaginal ring.

Massachusetts passed a health care reform law mandating universal health coverage and subsidizing health insurance for its low-income residents in 2006, and the Massachusetts state Medicaid program and most private insurances cover the cost of both the abortion and a LARC device inserted immediately post-abortion. A minority of PPLM patients paid cash for their abortion and lacked contraceptive insurance; however, women with an income less than 300% of the federal poverty level and without insurance coverage for LARC qualified for free products funded by institutional grants.

2.2. Data sources

We used diagnosis and billing codes to identify all patients who had surgical abortion procedures during the study period and whether they received an immediate post-abortion LARC product. We used the electronic medical record to obtain demographic, medical, and visit-specific information that could affect contraceptive decision-making. Medical variables routinely recorded in checkbox format included contraindications to estrogen-containing contraception, such as hypertension, migraines with aura, and history of venous thromboembolism. These medical conditions may decrease the likelihood of initiating estrogen-containing methods and increase the likelihood of instead selecting LARC methods, which are safe for women contraindications to estrogen [15]. Social variables included a history of intimate partner violence and insurance coverage, which previous research has suggested may be associated uptake of certain contraceptive methods [14,16].

Visit-specific variables included gestational age of the pregnancy (determined by ultrasound on the day of initial consultation), anesthesia type, and number of procedure days. Anesthesia type may affect LARC initiation due to perceived or actual impact on insertion-related pain. Anesthesia options included either local anesthesia alone (a paracervical block and a non-steroidal anti-inflammatory [NSAID]) or intravenous sedation in addition to the paracervical block and NSAID. We also assessed whether the procedure was completed in 1 day, with no cervical preparation or same-day preparation, or in 2 days, with osmotic dilator placement on the day prior to the abortion. Although number of procedure days correlates with gestational age, in the mid-trimester gestational age range, the number of procedure days was at the provider's clinical discretion. While the number of procedure days, independent of gestation, has not previously been shown to relate to contraceptive uptake, we hypothesized the additional time to contemplate contraceptive method choice associated with a two-day procedure could plausibly impact choice and uptake of contraception. Finally, we recorded health counselor and physician, since individual providers might, knowingly or unknowingly, have influenced patient decision-making.

Any patient with a completed abortion procedure was included in the study. For patients who had more than one surgical abortion during the study period, only the first procedure was analyzed. Our primary aim was to describe the proportions of immediate post-abortion IUD and implant insertion.

2.3. Analysis

In addition to determining overall proportions of post-abortion LARC uptake, we developed logistic regression models of predictors of LARC uptake. We performed separate analyses by method, comparing women who initiated an immediate post-abortion IUD to those who did not, and women who initiated an immediate post-abortion implant to those who did not. We used mixed effect logistic regression in order to account for the nesting of patients under individual counselors and physicians; these providers were included as random effects in the models. We used a purposeful selection process to build our regression models. After an initial univariable analysis, we entered those variables with significance $p<.1$ in the multivariable model. We performed a test of collinearity for the race and ethnicity variables, which were suspected to be highly associated, prior to inclusion in the multivariable model. Our final model retained variables with $p<.05$. Variables with $p<.1$ in the univariable analysis but not included in the final model were manually entered to assess for confounding effects. We considered a variable a potential confounder that must be retained regardless of significance if it changed any remaining parameter estimate more than 15%. All statistical analysis was performed using SAS version 9.4 (Cary, NC).

2.4. Funding

The Society of Family Planning Research Fund provided financial support for this research. The funder had no role in study design, data collection and analysis, or publication.

3. Results

A total of 26,858 surgical abortion patients met inclusion criteria. The proportion of immediate post-abortion LARC uptake was 25.4%: 4941 (18.4%) received an IUD and 1885 (7.0%) received an implant. Of

women who initiated an immediate post-abortion IUD, 77.0% selected a levonorgestrel IUS and 23.0% selected a copper IUD.

Table 1 presents the demographic, reproductive, social, medical, and procedural characteristics of women who initiated the IUD or the implant and their counterparts who did not initiate the same type of LARC.

Table 2 presents the variables associated with post-abortion IUD use. We note an interaction effect between parity and education: higher education was correlated with IUD uptake, and parity modified this effect, with the impact of a college or post-graduate degree on IUD uptake being higher among nulliparous women. IUD uptake rose briefly and then fell over the course of the study period, starting at 15.6% in 2012 and ending at 16.9% in 2017 (Fig. 1).

Table 3 presents the variables associated with post-abortion implant use. Age younger than 18 years was the strongest predictor of implant initiation, and elementary or middle school education level predicted implant initiation independent of age. We identified a consistent time trend: women who had abortions in the later part of the study period were more likely than those at the beginning to receive an implant (8.7% in 2017 versus 2.4% in 2012, aOR 3.65, 95% CI 2.36–5.65) (Fig. 1).

We analyzed the total of 112 counselors and 52 physicians as random effects to assess their contribution to the variability in IUD and implant uptake. For IUD uptake, the intraclass correlation coefficient (ICC) was 2% for counselors and 0.2% for physicians, therefore we included only the counselor effect in the multivariable model. For implant uptake,

Table 1
Demographic, reproductive, social, medical, and procedural characteristics of women undergoing surgical abortion at Planned Parenthood League of Massachusetts, 2012–2017 (N=26,858)

	Total (N=26,858)	IUD initiators (n=4941)	Non-IUD initiators (n=21,917)	p-Value	Implant initiators (n=1885)	Non-implant initiators (n=24,973)	p-Value
Age (years)				<.001			<.001
<18	607 (2.2)	93 (1.9)	514 (2.4)		69 (3.7)	538 (2.1)	
18–24	10,251 (38.2)	1746 (35.3)	8505 (38.8)		872 (46.3)	9379 (37.6)	
25–34	12,219 (45.5)	2414 (48.9)	9805 (44.7)		819 (43.4)	11,400 (45.7)	
≥35	3781 (14.1)	688 (13.9)	3093 (14.1)		125 (6.6)	3656 (14.6)	
Race				<.001			<.001
White	12,391 (46.2)	2378 (48.1)	10,013 (45.7)		769 (40.8)	11,622 (46.6)	
Black	4478 (16.7)	780 (15.8)	3698 (16.9)		378 (20.0)	4100 (16.4)	
Asian	1595 (5.9)	202 (4.1)	1393 (6.3)		52 (2.8)	1543 (6.2)	
Other*	628 (2.3)	125 (2.5)	503 (2.3)		48 (2.6)	580 (2.3)	
Unknown	7766 (28.9)	1456 (29.5)	6310 (28.8)		638 (33.8)	7128 (28.5)	
Ethnicity				<.001			<.001
Hispanic or Latino	4364 (16.3)	933 (18.9)	3431 (15.7)		480 (25.5)	3884 (15.6)	
Not Hispanic or Latino	18,056 (67.2)	3232 (65.4)	14,824 (67.6)		1169 (62.0)	16,887 (67.6)	
Unknown	4438 (16.5)	776 (15.7)	3662 (16.7)		236 (12.5)	4202 (16.8)	
Education				<.001			<.001
8th grade or less/Some high school	2560 (9.5)	455 (9.2)	2105 (9.6)		306 (16.2)	2254 (9.0)	
High school diploma	5473 (20.4)	1056 (21.4)	4417 (20.2)		489 (25.9)	4984 (20.0)	
Some college/Associate degree	8279 (30.8)	1608 (32.6)	6671 (30.4)		565 (30.0)	7714 (30.9)	
Bachelor's/Post-graduate degree	5029 (18.7)	881 (17.8)	4148 (18.9)		178 (9.5)	4851 (19.4)	
Unknown	5517 (20.6)	941 (19.0)	4576 (20.9)		347 (18.4)	5170 (20.7)	
Insurance type				<.001			<.001
Public	13,422 (50.0)	3045 (61.6)	10,377 (47.3)		1356 (71.9)	12,066 (48.3)	
Private	7569 (28.2)	1609 (32.6)	5960 (27.2)		441 (23.4)	7128 (28.6)	
Self-pay	5867 (21.8)	287 (5.8)	5580 (25.5)		88 (4.7)	5779 (23.1)	
Prior live birth	13,092 (48.8)	2876 (58.2)	10,216 (46.6)	<.001	1050 (55.7)	12,042 (48.2)	<.001
Prior induced abortion	11,016 (42.1)	2230 (46.2)	8786 (41.2)	<.001	807 (44.1)	10,209 (42.0)	.003
Gestational age				.146			<.001
<14w0d	24,497 (92.1)	4506 (91.8)	19,991 (92.2)		1671 (89.2)	22,826 (92.4)	
≥ 14w0d	2087 (7.9)	405 (8.3)	1682 (7.8)		202 (10.8)	1885 (7.6)	
Intimate partner violence				.435			<.001
Yes	252 (0.9)	59 (1.2)	193 (0.9)		27 (1.4)	225 (0.9)	
No	21,232 (79.1)	3958 (80.1)	17,274 (78.8)		1627 (86.3)	19,605 (78.5)	
Unknown	5374 (20.0)	924 (18.7)	4450 (20.3)		231 (12.3)	5143 (20.6)	
Opioid maintenance therapy	768 (2.9)	174 (3.5)	594 (2.7)	.003	57 (3.0)	711 (2.9)	.472
Hypertension	628 (2.3)	147 (3.0)	481 (2.2)	.001	41 (2.2)	587 (2.3)	.471
Migraines				.005			.009
No migraine	21,727 (80.9)	3932 (79.6)	17,795 (81.2)		1472 (78.1)	20,255 (81.1)	
Migraine with aura	1488 (5.6)	327 (6.6)	1161 (5.3)		104 (5.5)	1384 (5.5)	
Migraine without aura	2346 (8.7)	440 (8.9)	1906 (8.7)		200 (10.6)	2146 (8.6)	
Unknown	1297 (4.8)	242 (4.9)	1055 (4.8)		109 (5.8)	1188 (4.8)	
Venous thromboembolism	107 (0.4)	26 (0.5)	81 (0.4)	.002	5 (0.3)	102 (0.4)	.207
Total procedure days				.083			.030
One	25,556 (95.2)	4686 (94.8)	20,870 (95.2)		1766 (93.7)	23,790 (95.3)	
Two	1302 (4.9)	255 (5.2)	1047 (4.8)		119 (6.3)	1183 (4.7)	
Anesthesia type				<.001			<.001
Intravenous sedation	21,282 (79.7)	4018 (81.7)	17,264 (79.2)		1601 (85.3)	19,681 (79.3)	
Local	5426 (20.3)	902 (18.3)	4524 (20.8)		276 (14.7)	5150 (20.7)	
Clinic site				.472			.063
Boston	16,394 (61.0)	3125 (63.3)	13,269 (60.5)		1320 (70.0)	15,074 (60.4)	
Worcester	5478 (20.4)	909 (18.4)	4569 (20.9)		325 (17.3)	5153 (20.6)	
Springfield	4986 (18.6)	907 (18.3)	4079 (18.6)		240 (12.7)	4746 (19.0)	

Variables are presented with frequency (%). p-Values refer to results from univariable logistic regression analyses.
* "Other" race refers to: Native Hawaiian, Other Pacific Islander, Native American, American Indian, Alaska Native, or more than one race.

the ICC was 6% for counselors and 9% for physicians, and we included both as random effects in the multivariable model.

4. Discussion

In this study of contraception after surgical abortion, one-quarter of women obtained an immediate post-abortion LARC device. This estimate exceeds the contemporary rate of LARC use in the general United States population, 10.3% [17]. This estimate also represents a large increase from the rate of 6.6% cited in a survey of National Abortion Federation clinics nearly a decade ago [18], likely reflecting both a growing acceptance of and accessibility to these methods overall and the particularly accommodating environment in Massachusetts, where many abortion patients are insured. Implant initiation in particular saw a dramatic uptrend over time: women at the end of the study period were nearly four times more likely to initiate an implant than women from the start of the study period. Our rate of immediate post-abortion LARC uptake resembles the rate of interest in highly-effective methods of contraception among women presenting for first-trimester surgical abortion in Chicago (25.8%) [14], suggesting that when LARC is accessible, women's received method may closely align with their desired method.

Table 2
Multivariable logistic regression model of predictors of intrauterine device initiation immediately after surgical abortion at Planned Parenthood League of Massachusetts, 2012–2017

Predictor	Unadjusted odds ratio (95% Confidence interval)	p-Value	Initial adjusted odds ratio (95% Confidence interval)	p-Value	Adjusted odds ratio (95% Confidence interval)	p-Value
Age (years)		<.001		.051	n/a	n/a
<18	Reference		Reference			
18–24	1.14 (0.91–1.44)	.247	1.05 (0.82–1.35)	.696		
25–34	1.36 (1.08–1.71)	.008	1.05 (0.81–1.36)	.715		
≥ 35	1.23 (0.97–1.56)	.087	0.91 (0.69–1.20)	.509		
Race*		<.001		<.001		<.001
White	Reference		Reference		Reference	
Black	0.87 (0.80–0.96)	.001	0.75 (0.68–0.83)	<.001	0.81 (0.74–0.89)	<.001
Asian	0.60 (0.51–0.70)	<.001	0.64 (0.54–0.75)	<.001	0.59 (0.50–0.69)	<.001
Other**	1.07 (0.87–1.31)	.515	0.95 (0.77–1.17)	.613	1.01 (0.82–1.24)	.950
Unknown	0.96 (0.89–1.03)	.253	0.92 (0.84–0.99)	.037	0.93 (0.86–1.01)	.086
Ethnicity		<.001	n/a	n/a	n/a	n/a
Not Hispanic or Latino	Reference					
Hispanic or Latino	1.24 (1.14–1.35)	<.001				
Unknown	0.98 (0.89–1.07)	.609				
Education*		<.001		<.001		<.001
8th grade or less/some high school	Reference		Reference		Reference	
High school diploma	1.11 (0.98–1.26)	.087	1.11 (0.97–1.27)	.119	1.08 (0.95–1.23)	.254
Some college/associate degree	1.12 (1.00–1.26)	.054	1.26 (1.10–1.43)	<.001	1.18 (1.05–1.33)	.007
Bachelor's/post-graduate degree	0.96 (0.85–1.09)	.554	1.40 (1.21–1.62)	<.001	1.08 (0.95–1.24)	.242
Unknown	0.91 (0.80–1.05)	.186	1.03 (0.89–1.20)	.653	0.94 (0.81–1.08)	.378
Insurance type		<.001		<.001	n/a	n/a
Public	Reference		Reference			
Private	0.91 (0.85–0.98)	.001	0.98 (0.91–1.07)	.677		
Self-pay	0.17 (0.15–0.19)	<.001	0.18 (0.16–0.21)	<.001		
Prior live birth (One or more vs. none)*	1.64 (1.54–1.75)	<.001	1.46 (1.35–1.58)	<.001	1.69 (1.57–1.82)	<.001
Prior induced abortion	1.25 (1.17–1.33)	<.001	1.03 (0.96–1.11)	.358	n/a	n/a
Opioid maintenance therapy	1.31 (1.10–1.56)	.003	0.93 (0.78–1.12)	.456	n/a	n/a
Hypertension	1.40 (1.15–1.69)	<.001	1.19 (0.98–1.46)	.082	n/a	n/a
Migraines		.005		.152	n/a	n/a
No migraine	Reference		Reference			
Migraine with aura	1.26 (1.11–1.43)	<.001	1.14 (0.99–1.31)	.056		
Migraine without aura	1.06 (0.95–1.18)	.335	0.99 (0.88–1.11)	.824		
Unknown	1.13 (0.89–1.44)	.297	0.42 (0.10–1.76)	.232		
Venous thromboembolism	1.47 (0.93–2.33)	.002	1.26 (0.79–2.01)	.250	n/a	n/a
Total procedure days (Two vs. one)*	1.21 (0.97–1.49)	.083	1.09 (0.79–1.50)	.604	1.28 (1.02–1.60)	.032
Anesthesia type (Intravenous sedation vs. local)*	1.17 (1.08–1.27)	<.001	1.16 (1.06–1.26)	.001	1.20 (1.11–1.31)	<.001
Year of service*		.013		.022		.008
2012	Reference		Reference		Reference	
2013	1.19 (1.02–1.38)	.026	1.16 (0.99–1.35)	.068	1.19 (1.02–1.38)	.026
2014	0.94 (0.85–1.04)	.245	1.05 (0.89–1.25)	.569	1.10 (0.94–1.30)	.237
2015	0.99 (0.89–1.10)	.822	1.07 (0.90–1.28)	.450	1.11 (0.93–1.31)	.248
2016	0.90 (0.81–1.00)	.052	0.95 (0.79–1.14)	.560	0.98 (0.82–1.17)	.808
2017	0.98 (0.84–1.14)	.762	0.95 (0.77–1.18)	.664	0.96 (0.78–1.18)	.687
Interaction between education and prior live birth*				n/a		<.001
Assessing education for one or more live births						
8th grade or less/some high school	n/a	n/a	n/a		Reference	
High school diploma					1.07 (0.92–1.25)	.394
Some college/associate degree					1.19 (1.03–1.39)	.023
Bachelor's/post-graduate degree					0.88 (0.73–1.06)	.175
Unknown					0.94 (0.80–1.12)	.504
Assessing education for no live birth						
8th grade or less/some high school					Reference	
High school diploma					1.09 (0.88–1.34)	.432
Some college/associate degree					1.17 (0.97–1.41)	.098
Bachelor's/post-graduate degree					1.33 (1.10–1.62)	.004
Unknown					0.93 (0.75–1.15)	.518

* These variables remained in the final logistic regression model.
** "Other" race refers to: Native Hawaiian, Other Pacific Islander, Native American, American Indian, Alaska Native, or more than one race.

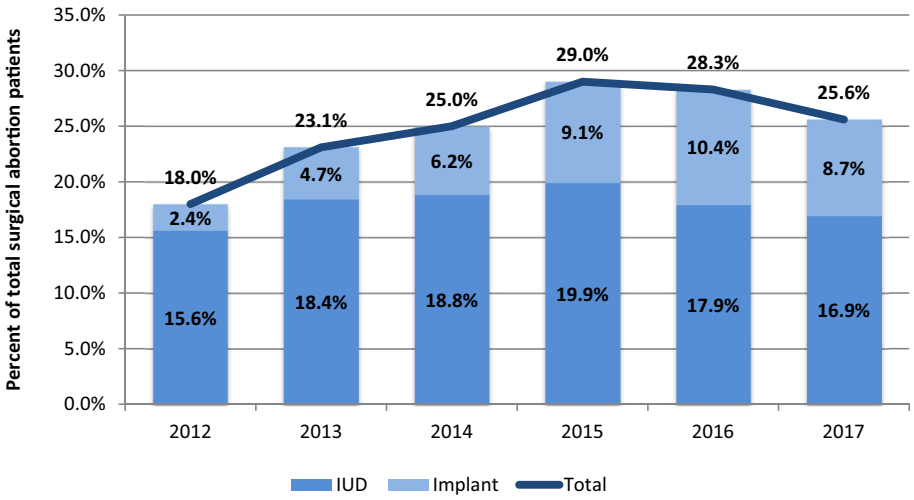

Fig. 1. Intrauterine device (IUD) and subdermal implant uptake immediately after surgical abortion over time.

Our retrospective study design relied on diagnosis and billing codes to define our study population and primary outcomes. These data may have suffered from inaccuracies of which we are unaware. We were unable to review individual medical histories and were thus unable to obtain information about the number of women with contraindications to LARC. However, given the limited number of contraindications to each LARC method, and the unlikely patient medical history that would preclude use of all three types of LARC, we assume that nearly all patients would have been eligible for at least one type.

An additional limitation of this study was imperfect LARC access. With 50% and 28% of our study population using public and private insurance with coverage for immediate post-abortion LARC, the majority of women in our study had access to no-cost, same-day LARC. However, 22% of the study population paid cash for their abortion. These women may not have been able to afford LARC in addition to the cost of their abortion and some may not have qualified for a free, grant-funded device. We do not have information about how many self-pay patients received a grant-funded device. Since LARC access was incomplete, and we cannot tell exactly how incomplete, we cannot generalize our findings to other populations with markedly different patterns of payment for post-abortion LARC. However, we hypothesize that with more complete financial coverage for abortion, immediate post-abortion LARC initiation might have been higher than we observed.

One strength of this study was our assessment of the effects of individual health counselors and physicians on patient uptake of LARC. Women undergoing surgical abortion may experience pressure to initiate contraception, especially LARC [19]. To measure this possibility, we included both counselors and physicians as random effects in the multivariable models. We found that the variability in these medical staff contributed minimally to the variability in contraceptive uptake, suggesting that they did not significantly impact IUD and implant initiation within the cohort as a whole. More granular data were not available: patient autonomy was not routinely measured and documented in the patient chart and thus could not be assessed in this retrospective study.

Logistical factors at the time of surgical abortion may play a role in women's choice of contraceptive method. We found that use of intravenous sedation for procedural anesthesia predicted both IUD and implant initiation, suggesting that the promise of sedation may reduce the burden of pain associated with placement of these devices. In addition, women undergoing two-day procedures were significantly more likely to initiate an IUD. While both use of intravenous sedation and two-day procedures correlate with gestational age, the fact these variables contributed to our multivariable models, when gestational age did not, implies that the convenience of pairing a contraceptive procedure with an abortion procedure may make LARC methods more palatable. However, we cannot know whether two-day procedures represent another aspect of the abortion experience (such as increased time to contemplate contraceptive method choice, as we originally hypothesized) or are simply a proxy for gestational age. Women at 16 weeks' gestation and beyond have been shown to differ significantly from women at 13–15 weeks' gestation along demographic and socioeconomic lines [20], and all women in our cohort beyond 16 weeks' gestation would have had two-day procedures. Because of its association with a change in clinical management, 16 weeks' gestation may signify a more important threshold than the 14 weeks we used to define first- and second-trimester pregnancy, which was not associated with LARC uptake.

Previous analyses of predictors of post-abortion contraceptive initiation have combined IUD and implant uptake into a single outcome. However, we examined these contraceptive methods separately and uncovered two distinct demographic profiles associated with their uptake: IUD initiators were more likely to be White, parous women with some college education, while implant initiators were more likely to be non-Asian, young, parous women with a middle or elementary school level of education, public insurance, and a history of previous abortion and intimate partner violence. Along multiple axes, implant users appear to be more socially disenfranchised than IUD users. While previous studies have linked LARC initiation at surgical abortion to age, race, socioeconomic status, education, and intimate partner violence [13,18,21–23], our study is the first to parse out the differential association of these factors with the uptake of IUDs and implants.

Studies of patient factors influencing contraceptive choice should analyze IUD and implant uptake as separate outcomes. While clinicians and researchers often group LARC methods based on their similarly high effectiveness, this study demonstrates that women selecting one or the other LARC device vary significantly along demographic and social lines and may differ in their contraceptive decision-making. Further investigation is required to understand how women choose their post-abortion contraceptive method and how their personal histories impact that choice.

This is a large study of post-abortion contraception after implementation of the Affordable Care Act in 2012. Performed in a setting with easy access to LARC, it allowed us to examine the prevalence of LARC initiation in the relative absence of structural barriers to their uptake, as well as evaluate patient-specific factors that predict initiation of these methods. As national contraceptive care delivery measures are considered, our estimates may be useful in accounting for demographic patterns in contraceptive uptake and in developing risk-adjusted measures specific to the abortion setting.

Table 3
Multivariable logistic regression model of predictors of subdermal implant initiation immediately after surgical abortion at Planned Parenthood League of Massachusetts, 2012–2017.

Predictor	Unadjusted odds ratio (95% Confidence interval)	p-Value	Initial adjusted odds ratio (95% Confidence interval)	p-Value	Adjusted odds ratio (95% Confidence intervals)	p-Value
Age category*		<.001		<.001		<.001
≥35	Reference		Reference		Reference	
<18	3.99 (2.92–5.45)	<.001	3.17 (2.19–4.58)	<.001	3.26 (2.26–4.71)	<.001
18–24	2.83 (2.34–3.43)	<.001	3.09 (2.50–3.83)	<.001	3.08 (2.49–3.81)	<.001
25–34	2.12 (1.75–2.57)	<.001	2.02 (1.65–2.47)	<.001	2.02 (1.66–2.47)	<.001
Race*		<.001		<.001		<.001
White	Reference		Reference		Reference	
Black	1.39 (1.22–1.58)	<.001	1.09 (0.95–1.25)	.206	1.11 (0.96–1.27)	.149
Asian	0.47 (0.35–0.63)	<.001	0.60 (0.45–0.81)	.001	0.60 (0.44–0.81)	<.001
Other**	1.32 (0.97–1.79)	.078	1.09 (0.79–1.50)	.600	1.09 (0.79–1.49)	.610
Unknown	1.54 (1.37–1.72)	<.001	1.27 (1.13–1.44)	<.001	1.28 (1.13–1.45)	<.001
Ethnicity		<.001	n/a	n/a	n/a	n/a
Not Hispanic or Latino	Reference					
Hispanic or Latino	1.92 (1.71–2.15)	<.001				
Unknown	1.02 (0.87–1.19)	.822				
Education*		<.001		<.001		<.001
8th grade or less/some high school	Reference		Reference		Reference	
High school diploma	0.72 (0.61–0.83)	<.001	0.82 (0.70–0.97)	.024	0.82 (0.69–0.97)	.019
Some college/associate degree	0.53 (0.46–0.62)	<.001	0.70 (0.59–0.83)	<.001	0.70 (0.59–0.82)	<.001
Bachelor's /post-graduate degree	0.25 (0.20–0.30)	<.001	0.55 (0.44–0.69)	<.001	0.54 (0.43–0.68)	<.001
Unknown	0.65 (0.54–0.77)	<.001	0.88 (0.72–1.07)	.199	0.87 (0.71–1.07)	.179
Insurance type*		<.001		<.001		<.001
Public	Reference		Reference		Reference	
Private	0.51 (0.46–0.57)	<.001	0.73 (0.64–0.84)	<.001	0.73 (0.64–0.83)	<.001
Self-pay	0.12 (0.10–0.15)	<.001	0.17 (0.13–0.21)	<.001	0.17 (0.13–0.21)	<.001
Prior live birth (One or more vs. none)*	1.47 (1.33–1.61)	<.001	1.37 (1.21–1.55)	<.001	1.36 (1.20–1.53)	<.001
Prior induced abortion (One or more vs. none)*	1.16 (1.05–1.28)	.003	1.15 (1.03–1.28)	.013	1.15 (1.03–1.28)	.011
Gestational age					n/a	n/a
<14w0d	Reference		Reference			
≥ 14w0d	1.56 (1.29–1.89)	<.001	1.17 (0.94–1.46)	.163		
Intimate partner violence*		<.001		<.001		<.001
Yes vs. no	1.38 (0.92–2.08)	.123	1.15 (0.75–1.76)	.531	1.15 (0.75–1.78)	.527
Yes vs. unknown	2.61 (1.67–4.09)	<.001	1.87 (1.14–3.04)	.013	1.86 (1.15–3.03)	.012
Migraines*		.009		.049		.006
No migraines	Reference		Reference		Reference	
Migraines without aura	1.27 (1.08–1.48)	.003	1.00 (0.80–1.24)	.983	1.15 (0.97–1.35)	.098
Migraines with aura	1.03 (0.84–1.27)	.753	1.14 (0.97–1.34)	.123	1.00 (0.80–1.24)	.972
Unknown	1.39 (0.97–1.99)	.069	1.70 (1.10–2.61)	.016	1.87 (1.27–2.73)	.001
Total procedure days (Two vs. one)	1.39 (1.03–1.87)	.030	0.82 (0.52–1.32)	.417	n/a	n/a
Anesthesia type (Intravenous sedation vs. local)*	1.53 (1.34–1.75)	<.001	1.24 (1.08–1.43)	.003	1.25 (1.09–1.44)	.001
Clinic site*		.063		<.001		<.001
Boston	Reference		Reference		Reference	
Worcester	0.69 (0.49–0.96)	.028	0.67 (0.48–0.92)	.015	0.68 (0.49–0.95)	.022
Springfield	0.78 (0.54–1.14)	.202	0.47 (0.33–0.67)	<.001	0.48 (0.34–0.66)	<.001
Year of service*		<.001		<.001		<.001
2012	Reference		Reference		Reference	
2013	2.08 (1.49–2.90)	<.001	1.63 (1.13–2.35)	<.001	1.65 (1.14–2.38)	.008
2014	3.07 (2.17–4.34)	<.001	2.22 (1.48–3.32)	<.001	2.24 (1.50–3.34)	<.001
2015	4.95 (3.50–7.00)	<.001	3.70 (2.47–5.54)	<.001	3.73 (2.49–5.57)	<0.001
2016	5.75 (4.05–8.15)	<.001	4.37 (2.91–6.56)	<.001	4.42 (2.95–6.63)	<.001
2017	4.54 (3.10–6.65)	<.001	3.63 (2.34–5.63)	<.001	3.65 (2.36–5.65)	<.001

* These variables remained in the final logistic regression model.
** "Other" race refers to: Native Hawaiian, Other Pacific Islander, Native American, American Indian, Alaska Native, or more than one race.

References

[1] Okusanya BO, Oduwole O, Effa EE. Immediate postabortal insertion of intrauterine devices. Cochrane Database Syst Rev 2014(7):CD001777.
[2] Roe AH, Bartz D. Society of Family Planning clinical recommendations: contraception after surgical abortion. Contraception 2019;99(1):2–9.
[3] Stanek AM, Bednarek PH, Nichols MD, Jensen JT, Edelman AB. Barriers associated with the failure to return for intrauterine device insertion following first-trimester abortion. Contraception 2009;79(3):216–20.
[4] 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;89(2):103–8.
[5] Centers for Medicare & Medicaid Services. Maternal and infant health initiative contraceptive care measures: Technical specifications and resource manual for Federal Fiscal Year 2016 reporting; 2016.
[6] Matulich M, Cansino C, Culwell KR, Creinin MD. Understanding women's desires for contraceptive counseling at the time of first-trimester surgical abortion. Contraception 2014;89:36–41.
[7] http://nationalacademies.org/hmd/~/media/Files/Report%20Files/2011/Clinical-Preventive-Services-for-Women-Closing-the-Gaps/preventiveservicesforwomenreportbrief_updated2.pdf, Accessed date: 5 November 2018.
[8] 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;92(1):17–25.
[9] Daniels K, Daugherty J, Jones J. Current contraceptive status among women aged 15–44: United States, 2011–2013. National Health Statistics Reports, No 173. 2014.
[10] Harper CC, Rocca CH, Thompson KM, Morfesis J, Goodman S, Darney PD, et al. Reductions in pregnancy rates in the USA with long-acting reversible contraception: a cluster randomized trial. Lancet 2015;386(9993):562–8.
[11] Kavanaugh ML, Jones RK, Finer LB. Perceived and insurance-related barriers to the provision of contraceptive services in U.S abortion care settings. Women's Health Issues 2011;21(3 Suppl):S26–31.
[12] Goodman S, Hendlish SK, Reeves MF, Foster-Rosales A. Impact of immediate postabortal insertion of intrauterine contraception on repeat abortion. Contraception 2008;78(2):143–8.
[13] Steinauer JE, Upadhyay UD, Sokoloff A, Harper CC, Diedrich JT, Drey EA. Choice of the levonorgestrel intrauterine device, etonogestrel implant or depot

medroxyprogesterone acetate for contraception after aspiration abortion. Contraception 2015;92(6):553–9.
[14] Keene M, Roston A, Keith L, Patel A. Effect of previous induced abortions on post-abortion contraception selection. Contraception 2015;91(5):398–402.
[15] Curtis KM, Tepper NK, Jatlaoui TC, et al. U.S. medical eligibility criteria for contraceptive use, 2016. MMWR Recomm Rep 2016;65(No. RR-3):1–104.
[16] Bell KN, Meyn LA, Chen BA. Long-acting reversible contraceptive uptake before and after the affordable care act contraceptive mandate in women undergoing first trimester surgical abortion. Womens Health Issues 2018;28(4):301–5.
[17] Daniels K, Abma JC. Current contraceptive status among women aged 15–49: United States, 2015–2017. NCHS data brief, no 327. Hyattsville, MD , National Center for Health Statistics; 2018.
[18] Thompson KM, Speidel JJ, Saporta V, Waxman NJ, Harper CC. Contraceptive policies affect post-abortion provision of long-acting reversible contraception. Contraception 2011;83(1):41–7.
[19] Brandi K, Woodhams E, White KO, Mehta PK. An exploration of perceived contraceptive coercion at the time of abortion. Contraception 2018;97(4):329–34.
[20] Jones RK, Finer LB. Who has second-trimester abortions in the United States? Contraception 2012;85(6):544–51.
[21] Goyal V, Canfield C, Aiken AR, Dermish A, Potter JE. Postabortion contraception use and continuation when long-acting reversible contraception is free. Obstet Gynecol 2017;129(4):655–62.
[22] Aiken A, Lohr PA, Aiken CE, Forsyth T, Trussell J. Contraceptive method preferences and provision after termination of pregnancy: a population-based analysis of women obtaining care with the British pregnancy advisory service. BJOG 2016;124(5):815–24.
[23] Fang NZ, Sheeder J, Teal SB. Factors associated with initiating long-acting reversible contraception immediately first-trimester abortion. Contraception 2018;98(4):292–5.