Original Research

Association of Age and Parity With Intrauterine Device Expulsion

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OBJECTIVE: To investigate whether age 14 to 19 years and nulliparity are associated with expulsion of levonorgestrel and copper intrauterine devices (IUDs).

METHODS: This was a planned secondary analysis of the Contraceptive CHOICE Project. We used Kaplan–Meier survival analysis to estimate expulsion rates for the first levonorgestrel or copper IUD received during study participation. Cox proportional hazards regression models were used to investigate baseline characteristics associated with expulsion.

RESULTS: A total of 5,403 females were included; 4,219 (78%) used the levonorgestrel IUD and 1,184 (22%) used the copper IUD. There were 432 initial expulsions reported. The 36-month cumulative expulsion rate was 10.2 per 100 IUD users and did not vary by IUD type (levonorgestrel IUD 10.1 compared with copper IUD 10.7, $P=.99$). In the bivariate analysis, multiple characteristics including age, nulliparity, immediate postabortion insertion, and heavy menses were associated with expulsion. The cumulative rate of expulsion was lower in nulliparous women compared with parous women (8.4 compared with 11.4; $P<.001$) and higher in females aged 14 to 19 compared with older women (18.8 compared with 9.3; $P<001$). After adjusting for confounders and stratifying by IUD type, the hazard ratio of expulsion for females aged 14 to 19 years was 2.26 (95% confidence interval [CI] 1.68–3.06) for the levonorgestrel IUD and 3.06 (95% CI 1.75–5.33) for the copper IUD. Compared to parous levonorgestrel IUD users, expulsion was lower for nulliparous levonorgestrel IUD users (adjusted hazard ratio 0.59, 95% CI 0.44–0.78).

CONCLUSION: IUD expulsions were not increased in nulliparous females. More expulsions were observed in females aged 14 to 19 compared with older women regardless of parity or IUD type.

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LEVEL OF EVIDENCE: II

Increased use of the intrauterine device (IUD) has the potential to reduce unintended pregnancy.[1] The IUDs have numerous advantages, including high rates of effectiveness, safety, and long duration of use.[2,3] First-year expulsion rates of the IUD are commonly quoted as 2% to 10% and vary by IUD type.[4–7] A large randomized trial of parous women aged 18 to 38 assigned to the 20-mcg-releasing levonorgestrel intrauterine system or the copper T380Ag IUD observed the highest rates of expulsion during the first year of use (6.3 compared with 5.6/100 women, respectively).[5] Over the 5 year study period, the cumulative rate of expulsion was higher with the levonorgestrel IUD

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compared to the copper T380Ag (11.8 and 7.4 per 100 users, respectively).

Previously described risk factors for expulsion include age younger than 20 years, nulliparity, dysmenorrhea, menorrhagia, and immediate postabortion or postpartum placement.[4,8–10] A systematic review of copper IUD use by nulliparous women found that nulliparity was associated with an increased risk of expulsion.[7] Several other studies have found no increase in the risk of expulsion in nulliparous compared with parous women.[6,11,12] Multiple studies have demonstrated an increased risk of expulsion in adolescents, although most have been limited by a small sample size.[8,12–14]

The objective of this analysis was to measure cumulative expulsion rates of users of the levonorgestrel IUD (20 mcg/day) and the copper IUD (T380A), and to investigate whether adolescent age (14–19 years) and nulliparity were associated with higher rates of expulsion.

Table 1. Baseline Demographic and Reproductive Characteristics of Intrauterine Device Users by Whether an Expulsion Occurred

Characteristic	No IUD Expulsion (n=4,971)	IUD Expulsion (n=432)	*P*
Age (y)			<.001
14–19	452 (9.1)	77 (17.8)	
20–29	3,261 (65.6)	258 (59.7)	
30–45	1,258 (25.3)	97 (22.5)	
Race			<.001
Black	2,222 (44.7)	249 (57.6)	
White	2,375 (47.8)	154 (35.7)	
Other	374 (7.5)	29 (6.7)	
Hispanic ethnicity			.91
Yes	248 (5.0)	21 (4.9)	
Education (missing, n=1)			<.001
High school or less	1,462 (29.4)	167 (38.7)	
Some college	2,165 (43.6)	194 (44.9)	
College or more	1,343 (27.0)	71 (16.4)	
Insurance (missing, n=22)			<.001
None	1,955 (39.3)	155 (35.9)	
Private	2,316 (46.6)	171 (39.6)	
Public	680 (13.7)	104 (24.1)	
Marital status (missing, n=3)			.18
Single	2,712 (54.6)	259 (60.0)	
Married or living with a partner	1,853 (37.3)	141 (32.6)	
Separated or divorced or widowed	403 (8.1)	32 (7.4)	
Low socioeconomic status* (missing, n=1)			<.001
Yes	2,829 (56.9)	293 (67.8)	
BMI (kg/m^2) (missing, n=56)			.001
Less than 25	2,018 (40.6)	144 (33.3)	
25–30	1,311 (26.4)	107 (24.8)	
30 or higher	1,590 (32.0)	177 (41.0)	
Nulliparous			<.001
Yes	2,047 (41.2)	135 (31.3)	
Painful periods (missing, n=16)			.07
Yes	1,529 (30.8)	153 (35.4)	
Heavy periods (missing, n=16)			<.001
Yes	1,030 (20.7)	136 (31.5)	
IUD type			.84
Copper IUD	1,091 (22.0)	93 (21.5)	
Levonorgestrel IUD	3,880 (78.0)	339 (78.5)	
Immediate postabortion insertion			.002
Yes	820 (16.5)	97 (22.5)	

BMI, body mass index; IUD, intrauterine device.
Data are n (%) unless otherwise specified.
Totals may not add up to 100% because of rounding or missing data.
* Low socioeconomic status defined as receipt of public assistance or reported difficulty paying for transportation, housing, medical expenses, or food in past 12 months.

Table 2. Rates of Cumulative Expulsion for Cohort Overall and by Selected Baseline Characteristics at 3, 6, 12, 24, and 36 Months (Per 100 Intrauterine Device Users)

	Months of IUD Use					
	3		6		12	
Characteristic	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)
Overall	5,053	2.6 (2.2–3.0)	4,750	4.2 (3.7–4.8)	4,217	6.2 (5.5–6.9)
Age (y)						
Younger than 20	493	3.5 (2.2–5.5)	451	7.1 (5.2–9.7)	378	10.5 (8.0–13.5)
20 or older	4,560	2.5 (2.1–2.9)	4,301	3.9 (3.4–4.5)	3,839	5.7 (5.1–6.4)
Baseline BMI (kg/m^2)						
Less than 30	3,366	2.1 (1.7–2.6)	3,163	3.8 (3.2–4.5)	2,780	5.6 (4.8–6.4)
30 or higher	1,631	3.6 (2.8–4.6)	1,537	5.2 (4.3–6.4)	1,389	7.5 (6.3–8.8)
Parity						
0	2,065	1.5 (1.1–2.2)	1,955	2.9 (2.3–3.7)	1,747	4.3 (3.5–5.3)
1 or more	2,988	3.2 (2.7–3.9)	2,795	5.1 (4.4–6.0)	2,470	7.4 (6.5–8.4)
Immediate postabortion insertion						
Yes	832	4.4 (3.2–6.0)	773	6.8 (5.3–8.6)	671	8.7 (7.0–10.8)
No	4,222	2.2 (1.8–2.7)	3,977	3.7 (3.2–4.3)	3,547	5.6 (5.0–6.4)
IUD type						
Levonorgestrel IUD	3,941	2.7 (2.2–3.2)	3,726	4.4 (3.8–5.1)	3,312	6.3 (5.6–7.1)
Copper IUD	1,114	2.2 (1.5–3.2)	1,024	3.6 (2.7–4.9)	905	5.7 (4.5–7.3)
Heavy menses						
Yes	1,070	3.9 (3.0–5.3)	987	6.5 (5.2–8.1)	887	8.8 (7.2–10.6)
No	3,967	2.2 (1.8–2.7)	3,748	3.6 (3.1–4.2)	3,315	5.4 (4.8–6.2)

IUD, intrauterine device; CI, confidence interval; NA, not applicable; BMI, body mass index.
n for subgroups may not add up to total N because of missing data.
* *P* calculated using the log-rank test.

MATERIALS AND METHODS

This study was a planned secondary analysis of the Contraceptive CHOICE Project. The CHOICE Project was a prospective cohort study of 9,256 adolescents and women who were provided with the reversible contraceptive method of choice at no cost. The objectives of the CHOICE Project were to reduce unintended pregnancy by promoting the use of long-acting reversible contraceptive methods. The methods of this study have been described in detail previously.[15]

Adolescents and women were enrolled between August 2007 and September 2011, and they were eligible to participate if they were 14 to 45 years of age, resided in St. Louis City or County, had been sexually active with a male partner in the past 6 months or anticipated sexual activity in the next 6 months, had not had a tubal sterilization or hysterectomy, did not desire pregnancy in the next year, and were interested in starting a new reversible contraceptive method. Participants completed follow-up surveys by telephone at 3 and 6 months and every 6 months for the study duration (3 years for the first 5,090 participants, 2 years for the remaining cohort). Follow-up was completed by December 2013. We obtained approval from Washington University in St. Louis School of Medicine Human Research Protection Office before recruitment of participants.

Participants were eligible for inclusion in this analysis if they received a levonorgestrel or copper IUD at any time during study participation. Forty-four females who participated in a substudy investigating immediate postplacental IUD placement were excluded from this analysis, because expulsion rates after immediate postplacental IUD insertion have been shown to be as high as 24%.[10,16] The outcome of interest was the initial expulsion that occurred–meaning the expulsion of the first IUD a participant received that occurred during the study period. Both partial and complete expulsions were included in the outcome. Data about IUD expulsion were collected by follow-up telephone surveys and other participant contact such as in-person visits to the study clinic or telephone calls to research staff. When the date of IUD expulsion was unknown or not reported, participants' charts were reviewed and consensus was reached on a range of possible dates when the expulsion could have occurred (T.M. and D.L.E.). The date of expulsion was then randomly imputed using this range.

We compared the baseline demographic and reproductive characteristics of IUD users by

Months of IUD Use				
24		36		
N	Rate (95% CI)	N	Rate (95% CI)	*P**
2,416	8.5 (7.7–9.3)	815	10.2 (9.2–11.3)	NA
				<.001
203	16.4 (13.2–20.3)	60	18.8 (15.1–23.4)	
2,213	7.7 (6.9–8.5)	755	9.3 (8.3–10.4)	
				<.001
1,564	7.4 (6.6–8.4)	549	9.1 (8.0–10.4)	
807	10.7 (9.3–12.4)	259	12.3 (10.6–14.3)	
				<.001
967	6.5 (5.4–7.7)	321	8.4 (7.0–10.1)	
1,449	9.9 (8.8–11.0)	494	11.4 (10.1–12.8)	
				<.001
438	11.0 (9.0–13.5)	165	13.4 (10.9–16.3)	
1,978	8.0 (7.2–8.9)	650	9.5 (8.5–10.7)	
				.99
1,940	8.5 (7.6–9.4)	670	10.1 (9.0–11.3)	
476	8.6 (7.0–10.6)	145	10.7 (8.6–13.3)	
				<.001
500	12.8 (10.9–15.0)	180	14.6 (12.2–17.3)	
1,908	7.3 (6.5–8.2)	630	9.0 (8.0–10.2)	

expulsion occurrence using the χ^2 tests. Using the Kaplan–Meier survival function, we estimated rates of cumulative expulsion at 3, 6, 12, 24, and 36 months. Females were censored at the time of IUD removal or the date of last study contact. We then compared cumulative expulsions rates for selected baseline characteristics, including age 14 to 19 years and nulliparity (both measured at the time of study enrollment). We used the log-rank test to determine if there was a statistically significant difference in the overall rates. To investigate interactions between baseline covariates of interest, we conducted stratified analyses between IUD type, age group, and parity.

We performed univariable and multivariable Cox proportional hazards regressions to estimate the hazards ratio (HR) for characteristics associated with expulsion. Given our a priori hypotheses and previous studies, we planned to include adolescent age, nulliparity, and immediate postabortion placement in our multivariable model, regardless of statistical significance.[9] All covariates that altered the HR for

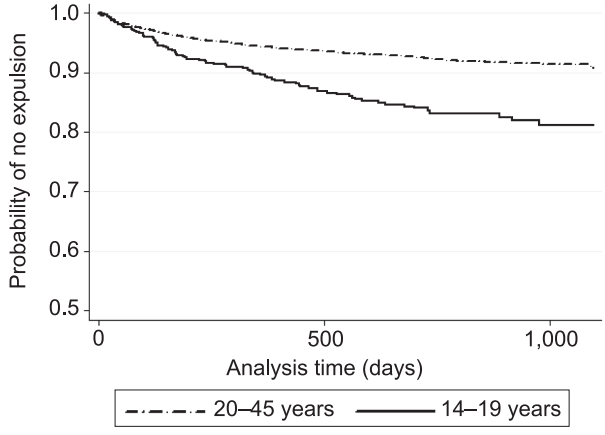

Fig. 1. Cumulative probability of not having an intrauterine device expulsion stratified by age.
Madden. IUD Expulsion. Obstet Gynecol 2014.

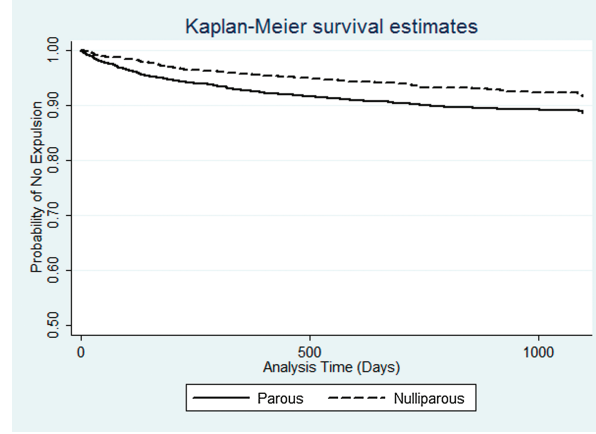

Fig. 2. Cumulative probability of not having an intrauterine device expulsion stratified by parity.
Madden. IUD Expulsion. Obstet Gynecol 2014.

Table 3. Rates of Cumulative Expulsion for Nulliparous Compared With Parous Women Stratified by Age (Per 100 Intrauterine Device Users)

	3 mo		6 mo		12 mo	
Age and Parity	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)
Age younger than 20 y						
Nulliparous	340	3.1 (1.7–5.5)	311	6.6 (4.4–9.8)	268	9.8 (7.1–13.5)
Parous	154	4.3 (2.1–8.9)	140	8.2 (4.9–13.8)	111	11.9 (7.7–18.3)
Age 20 y or older						
Nulliparous	1,725	1.2 (0.8–1.9)	1,645	2.2 (1.6–3.0)	1,479	3.2 (2.5–4.2)
Parous	2,835	3.2 (2.6–3.9)	2,657	5.0 (4.2–5.8)	2,360	7.2 (6.3–8.2)

IUD, intrauterine device; CI, confidence interval.
* Log-rank test for equality of survivor function for difference in expulsion rates.

age 14 to 19 years or nulliparity by 10% or more were included in the multivariable model. We included an interaction term for age (14–19 years compared with age older than 19 years) and nulliparity (yes or no), and one for IUD type and nulliparity. The former was not significant in the univariable or adjusted regression, and thus was not included in the final model. We found a significant interaction between IUD type and nulliparity; therefore, we stratified our adjusted Cox proportional hazards model by IUD type. To create a more parsimonious model, we collapsed the categorical race and marital status variables to dichotomous (black compared with white or other race and married or living with partner compared with single or separated or divorced or widowed). Multicollinearity was checked and the proportional hazards assumption was tested in the final model. We performed all statistical analyses using STATA 11 (StataCorp).

We performed a post hoc power calculation to ensure that we had an adequate sample size to detect a significant difference in expulsion rates. Based on previous studies, we assumed that there would be a two-fold increase in the HR of expulsion for both nulliparous females and females 14 to 19 years old (HR 2.0). Assuming a type 1 error of 0.05 and 80% power, we required a total of 65 expulsions to observe a statistically significant difference between groups. We had a total of 432 expulsions; therefore, we were powered to detect the difference in expulsion rates by age or by parity. When stratified by IUD types, we had 339 expulsions for the levonorgestrel IUD and 93 expulsions for the copper IUD; therefore, we also had an adequate sample to detect the two-fold difference in the stratified analysis.

RESULTS

There were 5,403 females who received an initial IUD through the CHOICE Project; 4,219 (78%) received a levonorgestrel IUD and 1,184 (22%) received a copper IUD. The mean follow-up time was 22.6±11 months. There were 64 (1%) females who provided no follow-up data. These women were more likely to have a high school education or less, be separated, divorced, or widowed, have no insurance or public insurance, have higher parity, and have received an immediate postabortion IUD. There were 2,182 nulliparous females (40%) and 529 participants between 14 and 19 years of age (10%) in our cohort. Females aged 14 to 19 years were more likely to be nulliparous than parous

Table 4. Rates of Cumulative Expulsion for Nulliparous Compared With Parous Women Stratified by Intrauterine Device Type (Rates Are Per 100 Intrauterine Device Users)

	3 mo		6 mo		12 mo	
IUD Type and Parity	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)
LNG-IUS						
Nulliparous	1,604	1.4 (0.9–2.1)	1,527	2.7 (2.0–3.6)	1,368	3.8 (3.0–4.9)
Parous	2,337	3.5 (2.9–4.3)	2,199	5.5 (4.7–6.5)	1,944	7.9 (6.9–9.1)
Copper IUD						
Nulliparous	462	2.1 (1.1–3.8)	429	3.6 (2.3–5.8)	379	6.0 (4.1–8.6)
Parous	652	2.2 (1.3–3.7)	596	3.6 (2.4–5.3)	529	5.5 (4.0–7.6)

LNG-IUS, levonorgestrel intrauterine system; IUD, intrauterine device; CI, confidence interval.
* Log-rank test for equality of survivor function for difference in expulsion rates.

24 mo		36 mo		
N	Rate (95% CI)	N	Rate (95% CI)	P*
144	15.3 (11.7–20.0)	44	18.7 (14.1–24.4)	.47
59	18.9 (13.2–26.7)	16	18.9 (13.2–26.7)	
823	4.7 (3.8–5.9)	277	6.5 (5.1–8.2)	<.001
1,390	9.4 (8.3–10.6)	478	11.0 (9.7–12.4)	

(69% compared with 31%; $P<.001$). The baseline characteristics by expulsion status are shown in Table 1. Females who had expulsions differed from those who did not have expulsions by age, race, education, insurance status, socioeconomic status, body mass index (calculated as weight (kg)/[height (m)]^2), nulliparity, history of self-reported heavy periods, and immediate postabortion insertion. There was no difference in expulsion by type of IUD.

There were a total of 432 initial expulsions for a cumulative expulsion rate of 10.2 per 100 IUD users over the course of the 36-month study period. Table 2 shows the cumulative expulsion rates for the study population overall as well as stratified by selected baseline characteristics. The expulsion rates were higher in parous women, women younger than 20 years of age, obese participants (body mass index 30 or higher), those who underwent an immediate postabortion insertion, and those with self-reported heavy menses; this was also true for cumulative expulsion rates at every time point. The rate of expulsion did not vary by IUD type. Figures 1 and 2 show the Kaplan–Meier curve for the cumulative probability of not having an expulsion for females aged 14 to 19 years compared with those aged 20 to 45 years and nulliparous compared with parous females.

When stratified by parity (Table 3), the cumulative expulsion rate at 36 months was similar among nulliparous and parous females aged 14 to 19 years (18.7/100 compared with 18.9 respectively; $P=.47$). However, the 95% confidence intervals around these estimates are wide, likely reflecting the small number of participants included in the numerator and the denominator.

We found that IUD type acted as an effect modifier for the association of parity and expulsion. The rate of expulsion was lower among nulliparous levonorgestrel IUD users compared with parous users (6.9 compared with 12.2/100 users; $P<.001$). The rate of expulsion was higher among nulliparous copper IUD users compared with parous users (14.3 compared with 8.2), although this finding among copper IUD users did not reach statistical significance ($P=.10$). These results are shown in Table 4. Similar proportions of nulliparous and parous females chose the copper IUD (22.6% compared with 21.5%).

In the univariable Cox proportional hazards regression analysis (Table 5), multiple baseline characteristics were associated with an increased risk of expulsion, including age 14 to 19 years, black race, obesity, high school education, public insurance, low socioeconomic status, self-reported heavy menses, and immediate postabortion insertion. Having a college education, being married or living with a partner, and nulliparity were associated with a decreased risk

24 mo		36 mo		
N	Rate (95% CI)	N	Rate (95% CI)	P*
758	5.4 (4.4–6.7)	264	6.9 (5.5–8.6)	<.001
1,155	10.5 (9.3–11.9)	406	12.2 (10.7–13.9)	
182	10.3 (7.6–13.9)	57	14.3 (10.3–19.6)	.10
294	7.5 (5.6–9.9)	88	8.2 (6.2–11.0)	

Table 5. Adjusted Cox Proportional Hazards Regression of Baseline Characteristics Associated With Intrauterine Device Expulsion Stratified by Intrauterine Device Type*

	Levonorgestrel IUD			Copper IUD		
Characteristic	N	HR	95% CI	N	HR	95% CI
Age 14–19 y	439	2.26	1.68–3.06	90	3.06	1.75–5.33
Age 20 y or older	3,780	Ref	Ref	1,094	Ref	Ref
White or other race	2,192	Ref	Ref	740	Ref	Ref
Black race	2,027	1.32	1.03–1.68	444	0.92	0.56–1.49
BMI (kg/m^2) less than 30	2,776	Ref	Ref	804	Ref	Ref
BMI 30 or higher	1,401	1.27	1.02–1.60	366	1.16	0.72–1.86
Married or living with a partner	1,511	0.85	0.67–1.08	483	0.91	0.58–1.45
Single or separated or divorced or widowed	2,707	Ref	Ref	699	Ref	Ref
Low socioeconomic status	2,445	1.48	1.13–1.92	677	0.83	0.53–1.31
Nulliparous	1,690	0.59	0.44–0.78	492	1.11	0.67–1.84
Heavy periods	961	1.64	1.30–2.06	205	1.73	1.08–2.78
Immediate postabortion insertion	749	1.33	1.03–1.71	168	1.01	0.55–1.83

IUD, intrauterine device; HR, hazard ratio; CI, confidence interval; Ref, reference; BMI, body mass index.
* Model adjusted for age 14–19 years, race, obesity, marital status, low socioeconomic status, nulliparity, self-reported heavy periods, and immediate postabortion placement.

of expulsion (data not shown). We did find a statistically significant interaction between nulliparity and IUD type in the univariable model. After stratifying the adjusted proportional hazards model by IUD type, age 14 to 19 years remained associated with a more than two-fold increase in expulsion for both levonorgestrel IUD and copper IUD users (adjusted HR 2.26 [95% confidence interval 1.68–3.06] and adjusted HR 3.06 [95% confidence interval 1.75–5.33], respectively). Heavy periods were also associated with an increased risk of expulsion among users of both types of IUDs. Nulliparity was associated with a reduction in expulsion among levonorgestrel IUD users, but not among copper IUD users. Black race was associated with a slight increase in the risk of expulsion among levonorgestrel IUD users but not copper IUD users.

DISCUSSION

This analysis describes the cumulative 36-month rates of expulsion of the two most commonly used IUDs among a large cohort of adolescents and women in the United States. Expulsions were increased among females aged 14 to 19 years, regardless of parity and IUD type. We did not observe any increased risk in expulsion among nulliparous participants. In fact, we found that nulliparity was associated with fewer expulsions among levonorgestrel IUD users, but not in copper IUD users.

Unlike the Sivin[5] study, we found similar cumulative expulsion rates between the two types of IUDs. Our 36-month cumulative expulsion rate for the levonorgestrel IUD of 10.1 per 100 is similar to the rate reported in the Sivin[5] study. However, our 36-month cumulative expulsion rate for the copper T 380A of 10.7 per 100 is higher than the 7.1 reported for the copper T 380Ag.[5] When stratified by parity, our expulsion rate for parous copper IUD users was 8.2, similar to the rate published by Sivin et al.[5] Differences in our findings may be attributable to different study populations. The Sivin[5] study was a randomized controlled trial with selective inclusion criteria and included only parous women aged 18 to 35 years, whereas the CHOICE Project was a cohort study with minimal eligibility criteria that included more than 500 adolescents and more than 2,000 nulliparous women.

A previous study of two lower-dose levonorgestrel IUDs found a cumulative 3-year risk of expulsion of 3.6% to 4.6%, although the authors did not stratify by parity.[17] Although this percentage is lower than our reported rate, women younger than 18 years of age were not included and the IUDs were smaller than those included in our study. A recent retrospective cohort study published in *Obstetrics & Gynecology* found an expulsion rate of 6% over the course of 3 years.[18] This is lower than our rate, in part because this 6% does not incorporate time-to-event but rather is a direct proportion. The investigators also did not find a significantly higher rate of expulsion among women aged 14 to 19 years, but this may be attributable to their smaller sample of adolescents (n=249).

We were not surprised to observe a greater rate of expulsion after immediate postabortion IUD insertion because previous studies have demonstrated this increase in risk.[9] Despite this slight increase in the risk of expulsion, immediate postabortion IUD insertion has been shown to be cost-effective[19] and to decrease the risk of a subsequent unintended pregnancy.[20]

Although the expulsion rates in our immediate postabortion group reflect females who had undergone first-trimester and second-trimester surgical abortion procedures, our 6-month rates are similar to the 6-month expulsion rates published by Bednarek et al[21] of 5.0% after immediate postabortion insertion and 2.7% after interval insertion.

The strengths of our study include its prospective cohort design, our large cohort of IUD users, and high retention among study participants. The 3-, 6-, 12-, 24-, and 36-month follow-up rates in the CHOICE Project were 98%, 97%, 95%, 86%, and 81% respectively. We captured data about expulsion at multiple contact points, including scheduled telephone surveys, unscheduled telephone calls to study staff, and visits to our research clinic.

One limitation of this study is that we relied on participant self-report to determine expulsion. Therefore, it is possible that we are underestimating the true incidence of expulsion if the participant did not recognize the expulsion or did not report it to the study staff. Another potential limitation is the lack of detail about partial compared with complete expulsions. If some clinicians performed routine ultrasound scans and considered an IUD positioned low in the uterus to be a "partial expulsion," this could have artificially elevated our expulsion rate. Finally, our findings may not be generalizable to other populations because the CHOICE Project was limited to a single geographical region. However, our cohort was racially and socioeconomically diverse, with a large number of nulliparous and adolescent and young women IUD users, and our findings likely are applicable to other urban populations.

The higher incidence of expulsion observed among females aged 14 to 19 years should not discourage health care providers from recommending IUDs for this population. The American College of Obstetricians and Gynecologists has recommended IUDs and implants as first-line contraceptive options for teenage girls.[22] There are few contraindications associated with IUDs, and in most situations the advantages outweigh the risks.[23] Furthermore, the observed risk of expulsion is lower than the risk of discontinuation with a shorter-acting method such as oral contraceptives or depo-medroxyprogesterone.[24] The higher risk of IUD expulsion in teenage girls should be included at the time of contraceptive counseling but should not restrict IUD use in this population.

REFERENCES

1. Peipert JF, Madden T, Allsworth JE, Secura GM. Preventing unintended pregnancies by providing no-cost contraception. Obstet Gynecol 2012;120:1291–7.
2. Winner B, Peipert JF, Zhao Q, Buckel C, Madden T, Allsworth JE, et al. Effectiveness of long-acting reversible contraception. N Engl J Med 2012;366:1998–2007.
3. O'Neil-Callahan M, Peipert JF, Zhao Q, Madden T, Secura G. Twenty-four-month continuation of reversible contraception. Obstet Gynecol 2013;122:1083–91.
4. Hatcher RA, Trussell J, Nelson AL, Cates W, Kowal D, Policar MS, editors. Contraceptive Technology. 20th ed. New York (NY): Ardent Media; 2011.
5. Sivin I, el Mahgoub S, McCarthy T, Mishell DR Jr, Shoupe D, Alvarez F, et al. Long-term contraception with the levonorgestrel 20 mcg/day (LNg 20) and the copper T 380Ag intrauterine devices: a five-year randomized study. Contraception 1990;42:361–78.
6. Duenas JL, Albert A, Carrasco F. Intrauterine contraception in nulligravid vs parous women. Contraception 1996;53:23–4.
7. Hubacher D. Copper intrauterine device use by nulliparous women: review of side effects. Contraception 2007;75:S8–11.
8. Zhang J, Feldblum PJ, Chi IC, Farr MG. Risk factors for copper T IUD expulsion: an epidemiologic analysis. Contraception 1992;46:427–33.
9. Grimes DA, Lopez LM, Schulz KF, Stanwood NL. Immediate postabortal insertion of intrauterine devices. The Cochrane Database of Systematic Reviews 2010, Issue 6. Art. No.: CD001777. DOI: 10.1002/14651858.CD001777.pub3.
10. Chen BA, Reeves MF, Hayes JL, Hohmann HL, Perriera LK, Creinin MD. Postplacental or delayed insertion of the levonorgestrel intrauterine device after vaginal delivery: a randomized controlled trial. Obstet Gynecol 2010;116:1079–87.
11. Bahamondes MV, Hidalgo MM, Bahamondes L, Monteiro I. Ease of insertion and clinical performance of the levonorgestrel-releasing intrauterine system in nulligravidas. Contraception 2011;84:e11–6.
12. Behringer T, Reeves MF, Rossiter B, Chen BA, Schwarz EB. Duration of use of a levonorgestrel IUS amongst nulliparous and adolescent women. Contraception 2011;84:e5–10.
13. Teal SB, Sheeder J. IUD use in adolescent mothers: retention, failure and reasons for discontinuation. Contraception 2012;85:270–4.
14. Rivera R, Chen-Mok M, McMullen S. Analysis of client characteristics that may affect early discontinuation of the TCu-380A IUD. Contraception 1999;60:155–60.
15. Secura GM, Allsworth JE, Madden T, Mullersman JL, Peipert JF. The Contraceptive CHOICE Project: reducing barriers to long-acting reversible contraception. Am J Obstet Gynecol 2010;203:115.e1–7.
16. Whitaker AK, Endres LK, Mistretta SQ, Gilliam ML. Postplacental insertion of the levonorgestrel intrauterine device after cesarean delivery vs. delayed insertion: a randomized controlled trial. Contraception 2013;89:534–9.
17. Nelson A, Apter D, Hauck B, Schmelter T, Rybowski S, Rosen K, et al. Two low-dose levonorgestrel intrauterine contraceptive systems: a randomized controlled trial. Obstet Gynecol 2013;122:1205–13.
18. Aoun J, Dines VA, Stovall DW, Mete M, Nelson CB, Gomez-Lobo V. Effects of age, parity, and device type on complications and discontinuation of intrauterine devices. Obstet Gynecol 2014;123:585–92.
19. Salcedo J, Sorensen A, Rodriguez MI. Cost analysis of immediate postabortal IUD insertion compared to planned IUD insertion at the time of abortion follow up. Contraception 2013;87:404–8.

20. Goodman S, Hendlish SK, Reeves MF, Foster-Rosales A. Impact of immediate postabortal insertion of intrauterine contraception on repeat abortion. Contraception 2008;78:143–8.

21. Bednarek P, Creinin MD, Reeves MF, Cwiak C, Espey E, Jensen JT. Immediate versus delayed IUD insertion after uterine aspiration. N Engl J Med 2011;364:2208–17.

22. Adolescents and long-acting reversible contraception: implants and intrauterine devices. Committee Opinion 539. American College of Obstetricians and Gynecologists. Obstet Gynecol 2012;120:983–8.

23. Centers for Disease Control and Prevention. United States medical eligibility criteria for contraceptive use, 2010. MMRW Recomm Rep 2010;59:1–86.

24. Rosenstock JR, Peipert JF, Madden T, Zhao Q, Secura GM. Continuation of reversible contraception in teenagers and young women. Obstet Gynecol 2012;120:1298–305.