HHS Public Access

Author manuscript

Am J Obstet Gynecol. Author manuscript; available in PMC 2018 July 11.

Published in final edited form as:

Am J Obstet Gynecol. 2017 June ; 216(6): 590.e1–590.e8. doi:10.1016/j.ajog.2017.02.003.

Two-year continuation of intrauterine devices and contraceptive implants in a mixed-payer setting: a retrospective review

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Abstract

BACKGROUND—As the popularity of long-acting reversible contraception increases, so does the need for accurate data on method continuation in diverse clinical settings. We determined 2-year continuation rates for the levonorgestrel 52-mg intrauterine device, the copper T380A intrauterine device, and the 68-mg etonogestrel contraceptive implant in an academic healthcare system with mixed-payer reimbursement.

OBJECTIVE—The purpose of this study was to examine the proportion and characteristics of women who continue intrauterine device and implant use to 2 years and to relate continuation to device type when controlling for patient characteristics.

STUDY DESIGN—This retrospective chart review assessed University of Utah Healthcare System patients who had an intrauterine device or contraceptive implant inserted between January 1, 2004, and December 31, 2012. We identified users and dates of insertions and removals by querying billing, medication, and procedural data in the Electronic Data Warehouse. Multivariable Poisson regression was conducted to estimate incidence risk ratios and to relate the probability of 2-year continuous use to device type.

RESULTS—Data on 8603 device insertions were obtained with the following distribution: levonorgestrel 52-mg intrauterine devices (6459; 75.1%), copper T380A intrauterine devices (1136; 13.2%), and 68-mg etonogestrel implant (1008; 11.7%). Two-year continuation rates were 77.8%, 73.1%, and 75.9%, respectively. There was no statistical difference in 2-year continuation between levonorgestrel 52-mg intrauterine device users (adjusted risk ratio, 1.1; 95% confidence interval, 1.0–1.1) and 68-mg etonogestrel implant users (adjusted risk ratio, 1.1; 95% confidence interval, 1.0–1.1) compared with copper device users, after we controlled for age, Hispanic ethnicity, payer type, and year of insertion. Older-age, self-pay, or public payer insurance (reference commercial payer) and Hispanic ethnicity were associated with 2-year continuation.

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Presented as an abstract and poster at the 28th annual Academy of Managed Care Pharmacy (AMCP), San Francisco, CA, April 20–22, 2016.

CONCLUSION—Three-quarters of women with an intrauterine device or implant continue using it for 2 years. In this cohort, the 2-year continuation rates were 77.8%, 73.1%, and 75.9% for the levonorgestrel 52-mg intrauterine device, copper T380A intrauterine device, and 68-mg etonogestrel implant, respectively.

Keywords

continuation; contraceptive implant; healthcare system; intrauterine device

Forty-three million women in the United States would be at risk of an unintended pregnancy without access to and the use of reliable contraception.[1] The use of long-acting reversible contraceptive methods, which include intrauterine devices (IUDs) and sub-dermal contraceptive implants, is increasing in the United States across demographic groups and geographic regions.[2,3] In the United States, the use of IUDs and implants increased from 2–12% between 2002 and 2012.[4] Increased uptake of these highly effective and reversible contraceptive methods has potential to reduce the incidence of unintended pregnancy and, as a result, improve maternal, neonatal, and childhood outcomes.[5–7]

The IUD and implant are not only the most effective reversible contraceptive methods available but also can be used in the least frequent mode of administration, which ranges from 3–10 years. The US Food and Drug Administration (FDA) approved the 68-mg etonogestrel implant for 3 years of use, the levonorgestrel 52-mg IUD for 5 years, and the copper T380A IUD for 10 years. However, there is limited information available that compares the typical duration of use of these different methods in real-world settings. The Contraceptive Choice Project (CHOICE) in St. Louis, MO, provided no cost contraception to >9000 women and observed them for 2 to 3 years.[8,9] In this study, 75% of participants chose an IUD or an implant; 1 year after enrollment, 88% of levonorgestrel 52 mg IUD users, 84% of copper T380A IUD users, and 83% of 68-mg etonogestrel implant users were still using the method that had they received at study onset (P=.96).[10] At 2 years, IUD and implant continuation rates were significantly higher than short-acting methods, with 77% of IUD and implant users continuing their method compared with 44% for short-acting method users (P<.05). Levonorgestrel 52-mg IUD and copper T380A IUD continuation rates were similar at 2 years (P=.77), yet significantly higher than implant users (P<.001).[9] However, when these continuation rates are examined, it is important to note that the CHOICE study involved structured counseling and ongoing support efforts that are beyond standard of care in most healthcare settings.

Nevertheless, there is a paucity of data regarding long-term use of contraceptive methods in typical settings. For example, the National Survey of Family Growth reports detailed information on the prevalence of IUD and implant use, which included the recent increase in use of IUDs and implants, but reports on duration of use are not available.[4] Review of a nationwide US sample of IUD users from a single private insurer showed teenagers were no more likely than older women to have their device removed within the first year of use. This dataset lacked information on the contraceptive implant and was limited by having a single payer source.[11]

Additionally, IUDs and implants have been shown to be cost-effective when compared with oral contraception pills, patches, rings, and injections.[12,13] Cost-neutrality is reached well before the FDA-approved durations for both IUDs and implants. In a weighted analysis of women aged 20–29 years, cost-neutrality for mixed-IUDs and implants relative to mixed short-acting methods was achieved at 2.1 years.[14] Continuous use of IUDs and implants therefore would be of interest to patients, payers, and policy makers because of the potential for increased cost-savings with extended duration of use.

Gathering data from healthcare systems with frequent IUD and implant use enables us to determine typical use continuation rates in a mixed-payer setting. This research explores the proportion and characteristics of women who discontinue IUD and implant use before 2 years and relates continuation to device type when controlled for patient characteristics.

Materials and Methods

This retrospective chart review assessed University of Utah Healthcare System (UUHS) patients who had the levonorgestrel 52-mg IUD, copper T380A IUD and the 68-mg etonogestrel implant inserted between January 1, 2004, and December 31, 2012. Women aged 15 to <45 years at the time of insertion were included in the analysis. Records with missing medication orders that confirmed device type were excluded from the analysis.

We queried the UUHS Electronic Data Warehouse (EDW) to identify specific Healthcare Common Procedure Codes System, International Classification of Diseases, Ninth Edition, and Current Procedural Terminology codes. Patient records were assessed for insertion and discontinuation. Device type was determined with the Healthcare Common Procedure Codes System or the event description from the EDW (Appendix).

Our team based analyses on continuous periods of use identified by codes demarcating insertion and removal of contraceptive device. We tracked patients until reaching 1 of 3 endpoints: method discontinuation, FDA-approved duration of use, or end of the study period (December 31, 2014). If the patient was not seen for device removal within the UUHS, they were censored at FDA expiration or at December 31, 2014. Continuation incidence was calculated at 2-years after insertion.

We characterized continuation by demographic characteristics at the time of insertion. Demographic characteristics included age, race, Hispanic ethnicity, payer type, and obstetric history (when available). Because only 40% of the sample could be linked to any pregnancy or obstetric history, the data on parity, gravidity, and number of living children were limited; we used multiple imputations to account for missing data and retained these data for analysis because parity has been shown to be associated with 1-year continuation.[15] In addition, we considered year of insertion as a potential confounder, given that changes in IUD and implant perceptions may impact uptake and continuation. For example, increased provider acceptability for IUD and implant use among younger patients may encourage longer continuation in younger women. Additionally, media attention, either favorable or negative, may have contributed to changes in rates of uptake and continuation, depending on the nature of the coverage. We assessed age at insertion as both a continuous and categoric

variable; we treated age as a continuous variable in the regression analysis and described age as a categoric variable, broken down into 5-year intervals, when examining differences in patient characteristics by device type. We computed differences between the 3 device types using chi-square tests and the Hochberg procedure to address the issue of multiple comparators. Normality of continuous variables was assessed, and we used descriptive analyses to examine demographic characteristics of participants with the use of chi-squared or *t*-test, where appropriate (Table 1).

Our analysis used multivariable Poisson regression to relate the probability of 2-year continuous use to device type controlling for potential confounders. We present results from a series of bivariate Poisson regression and a reduced multivariate model (Table 2). The multivariate model includes variables that demonstrated statistical significance in either the bivariate or a full model (adjustment for payer type, race, ethnicity, parity, age, and insertion year). Results are presented as incidence risk ratios (IRR), the exponentiated form of the beta from the Poisson logistic regression. The IRR corresponds to a 1-unit difference in the predictor value, and significance is assessed with the use of a 95% confidence interval (CI). We used adjusted proportions to estimate differences in adjusted risk differences among the 3 devices. We computed proportion estimates using marginal standardization after fitting the multivariable regression model to control for potential confounders.

In addition to abstracting data from the EDW, a trained research nurse conducted independent chart review of the electronic medical record on approximately 10% of the patients who were included in the dataset. The charts were selected with the use of the Microsoft Excel 2014 “RAND” function (Microsoft Corporation, Redmond, WA) to sort all eligible medical record numbers randomly and then select the first 10% for review. The manual chart review was used to strengthen our confidence in the accuracy of the start and end dates and to identify an upper and lower bound of misclassification that would inform the sensitivity analysis. After an initial data query, we anticipated a sample of >1000 device users of each type, which would allow us to detect a range of possible differences in length of use between different types of devices. A formal a priori power calcuation was not determined; however, given the large sample size of IUD and implant users in the EDW, we anticipated the ability to detect differences in continuation of <5%. The University of Utah Institutional Review Board approved this study. All analysis was completed Stata software (version 14; Stata Corporation, College Station, TX).

Results

Data abstraction from the UUHS EDW identified 17,322 patients with an IUD or implant insertion, removal, or surveillance. We excluded events outside the date range, removals with no documented insertions, surveillance without a previously documented insertion, and events without a medication order documented (n=4073). An additional 4265 insertions that occurred after December 31, 2012, were excluded to allow for the 2-year time horizon. An additional 381 patients were excluded from the primary analysis because their age exceeded 45 at the time of insertion. Overall, a total of 8603 women were identified in the UUHS EDW cohort as having a IUD or implant inserted between January 01, 2004, and December 31, 2012, with the following distribution: levonorgestrel 52-mg IUD (6459; 75.1%), copper

T380A IUD (1136; 13.2%), and implant (1008; 11.7%; Figure). The overall cohort of IUD and implant users predominately identified their race as white and ethnicity as non-Hispanic; of those with linked obstetric history, most were parous. Most subjects had documentation of private insurance coverage at the time their IUD or implant was inserted. There were significant differences in patient characteristics across device type (Table 1). Women who used the implant tended to be younger than women who used either the levonorgestrel 52-mg IUD or the copper T380A IUD, with over one-third of implant users ≤19 years old. Implant users also had higher proportions of Hispanic/Latina users, nulliparous users, and women with public insurance than were seen in the other 2 device cohorts. Levonorgestrel 52-mg IUD users were younger than copper T380A IUD users, with 36.4% of the users under the age of 25 years. Levonorgestrel 52-mg IUD had the highest proportion of white and non-Hispanic users of the 3 device types. Parity and payer type were similar between the levonorgestrel 52-mg IUD and the copper T380A IUD users.

Two-year continuation rates were 77.8%, 73.1%, and 75.9% for the levonorgestrel 52-mg IUD, copper T380A IUD, and 68-mg etonogestrel implant, respectively. In the unadjusted model, device type, payer type, ethnicity, age at insertion, and year of insertion were shown potentially to be associated with 2-year continuation. With the use of an adjusted Poisson regression with robust variance estimates, levonorgestrel 52-mg IUD users had a 1.08-fold increased likelihood of use beyond 2 years compared with copper T380A IUD users (IRR, 1.08; 95% CI, 1.03–1.11) after being controlled for payer type, ethnicity, age, and year of insertion. The absolute difference was 5%, with 78% for levonorgestrel 52-mg IUD and 73% for copper T380A IUD (adjusted risk difference, 5.6%; 95% CI, 2.4–8.8%). In the same adjusted model, a 1.08-fold increased likelihood of 2-year continuation was detected between the implant and copper T380A IUD (risk difference, 5.3%; 95% CI, –1.1 to –9.5%). No difference in 2-year continuation was detected between the implant and the levonorgestrel 52-mg IUD (adjusted risk difference, 0.2%; 95% CI, 0–3%). In the multivariable Poisson regression, which modeled 2-year continuation in relation to payer type at insertion, device type, race, ethnicity, parity, and year of insertion, only insurance status at insertion was associated with continuation beyond 2 years. Self-pay patients (IRR, 1.13; 95% CI, 1.05–1.20) and those using a public payer (IRR, 1.04; 95% CI, 1.01–1.08) at the time of insertion were associated with reaching 2-year continuation. Device type (IRR, 1.01; 95% CI, 1.00–1.01), Hispanic ethnicity (IRR, 1.05; 95% CI, 1.00–1.08), race, parity, and year of insertion were not associated with use beyond 2 years. To assess the impact of missing data on the analysis, we conducted an additional assessment imputing missing data to assess the influence. These data are available in Table 2. Additionally, these findings were consistent in the sensitivity analysis, which accounted for 5% misclassification (removals outside of the UUHS system that may have been missed the data). We also performed a sensitivity analysis assessing a subcohort of patients that had both an insertion and removal in the system. This analysis confirmed the tenability of the assumption that women without removals in the UUHS system could be considered continuers at 2 years.

We also conducted a subanalysis of 381 women who met all inclusion criteria, with the exception of age at insertion, which ranged from 45–60 years (mean, 49.0 years; standard deviation, 3.3 years). Use of these devices by women in this age range likely represents use outside of the FDA-approved indication for contraceptive purposes. This subcohort of

patients had significantly higher rates of continuation beyond 2 years for both the levonorgestrel 52-mg IUD (85.7%) and the copper IUD (84.6%), but showed no difference in 2-year continuation of the implant (75.9%). There were no differences in the multivariable models when these women were included in the cohort, with the exception of strengthening the association of age on 2-year continuation.

Additionally, a single trained research nurse conducted a manual chart review of approximately 10% of the charts (n=942). We identified 2% of charts that had an element of exposure misclassification (coded for insertions but notes indicated that only counseling occurred) and 4% of charts that included continuation misclassifications (a noted removal that was not captured in the database query). Based on this information, we concluded that 5% would be the upper-bound estimate for misclassification.

Comment

In this cohort, the 2-year continuation rates were 77.8%, 73.1%, and 75.9% for the levonorgestrel 52-mg IUD, copper T380A IUD, and 68-mg etonogestrel implant, respectively. These data demonstrate a high rate of 2-year continuation of all 3 contraceptive devices that suggested user acceptability for extended use in a real-world setting. Differences by method type and patient characteristics were small and consistent with previous studies that have demonstrated long-acting reversible contraception acceptability (including IUD and contraceptive implant) across patient demographics.[15] With the use of regression models, levonorgestrel 52-mg IUD and implant users had a slightly higher IRR for 2-year continuous use compared with copper T380A IUD users, after control for potential confounding that included insurance status, Hispanic ethnicity, age, and year of insertion. These differences were small and, given the limitations regarding the structured data set, should be interpreted with caution. Additionally, no differences in 2-year continuation were detected between implant users and levonorgestrel 52-mg IUD users. Only insurance status at insertion was associated with continuation beyond 2 years. Device type, ethnicity, race, parity, and year of insertion were not associated with use beyond 2 years.

Consistent with other US studies that have reported on a contraceptive mix of IUDs and implants, the most commonly used was the levonorgestrel 52-mg IUD.[8,11] The device method mix reported for the CHOICE project, in which the total number of IUD and implant users is larger, closely approximates the method mix from this dataset. [9] Our data are reflective of that study, in that the continuation rate was lower for implant users relative to levonorgestrel 52-mg IUD users.[16,17] This study differed in that continuation rates for copper T380A users were lower than implant users. It is not surprising that the absolute rates of continuation for CHOICE are higher for all methods, because the participants in that study received extensive counseling that likely influenced participant satisfaction and continuation.[18]

Given the nature of the retrospective cohort study, systematic bias could occur. To address the potential for misclassification bias (removers that were misclassified as continuers), we conducted chart reviews to assess this potential bias and found that there was 96%

agreement between the database and actual charts when assessed for exposure and outcome (continuation). As with any retrospective data review, there is potential for unmeasured confounding, which includes limitations caused by imprecise measure of the exposure and outcome. The structured data reported here were obtained from billing and coding sources, which are not intended for research. Our review of individual electronic health record documents provides some protection against this source of imprecision, and these errors should not be different by device type. Imperfections in billing codes cannot be avoided and include cases in our data set in which the specific type of IUD was not reported and therefore was excluded from the final analysis. In addition, there may be cases in which device insertion was not coded at all. The UUHS dataset has limited ability to obtain information on expulsions, given there are no billing or procedure codes for this event. However, prospective studies of IUD use regularly show low expulsion rates (≤5%).[19] In our sample, there is also the possibility that people who had their IUD or implant inserted in the UUHS system may seek care elsewhere for removal. We are unable to account for these users, and missing data on discontinuation would bias results toward longer periods of use for these people. Although we obtained data on duration of use, we do not have information on the reason for discontinuation or for complications, because this was not the aim of the study.

A common concern of contraceptive research conducted in Utah is the potential limits of external validity that is derived from the population homogeneity and high fecundity. However, the similarity in diversity to other US regions seen here supports the applicability of these findings to other settings. Although our sample includes a mixed source of payers, it does not include a significant portion of uninsured women (3%), and these results may differ in that population. Another limitation to be considered is that only 40% of the sample could be linked to any pregnancy or obstetric history; thus, data on parity, gravidity, and number of living children were limited.

Strengths of the study include the large sample size from multiple clinic settings within a university healthcare system. To strengthen our confidence in the accuracy of the start and end dates of contraceptive use, we confirmed these dates by conducting chart reviews of a random selection of 10% of the charts. Overall, this data source represents actual use, which may differ significantly from prospective studies, such as phase III FDA trials[20] in which participants are reimbursed to continue participation, potentially increasing the continuation rate. The close approximation to other settings of the 2-year continuation rates seen here suggests that the results are generalizable. These data demonstrate a high rate of 2-year continuation of contraceptive devices in a mixed payer system that suggests user acceptability and confirms that a majority of users reach the point of cost neutrality, as demonstrated previously.[14]

Acknowledgments

The authors thank the Reed Barney and the Data Warehouse Team at the University of Utah who assisted with data acquisition and support; Amber Sowles, RN, BSN, CCRP (University of Utah), for her diligence in carrying out manual review of the medical charts, and Greg Stoddard, MStat, MPH (University of Utah), for his guidance and assistance with data analysis.

Supported by Bayer Healthcare.

The University of Utah Department of Obstetrics and Gynecology Program in Family Planning receives research funding from Bayer, Teva, Merck, Bioceptive, and Medicines 360. J.N.S. has no conflict of interest to report; L.M.G. has received an honorarium from Evofem; D.K.T. serves on advisory boards for Bayer, Teva, Pharmanest, and Actavis and is a consultant for Bioceptive and a speaker for Allergan and Medicines 360; A.L., L.W., and R.L. are employed by Bayer Healthcare Pharmaceuticals and own stock in the company; A.L. functions as Bayer's deputy director of the health economics and outcomes research (HEOR) and oversees study conduct; L.W. functions as the deputy director of US HEOR field-work, and R.L. is the study medical expert. The use of REDCap for chart reviews was provided by *Eunice Kennedy Shriver* National Institute of Child Health and Development grant (8UL1TR000105 (formerly UL1RR025764) NCATS/NIH).

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Appendix

International Classification of Diseases, 9th edition, codes were used to create a database of intrauterine device and implant use within Utah Healthcare System electronic health records

Intrauterine device	International Classification of Diseases, 9th edition, codes
Insertion	‘69.7’, ‘V25.1’, ‘V25.11’ CPT4: ‘58300’
Removal	‘97.71’, ‘V25.12’ CPT: ‘58301’
Removal and reinsertion	‘V25.13’ CPT: ‘58300’, ‘58301’
Contraceptive implant	
Insertion	‘V25.5’, CPT: ‘11981’
Removal	‘V25.43’, CPT: ‘11982’
Removal and reinsertion	‘V25.43’, CPT: ‘11983’

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Types of devices were determined with the use of hospital billing and physician billing devices with Current Procedural Terminology/Healthcare Common Procedure Coding System codes

Code	Device
J7300	T380A intrauterine copper contraceptive
J7302, S4989, S4981, J7297, J7298	Levonorgestrel-releasing intrauterine system 52 mg
J7307	Etonogestrel implant 68 mg

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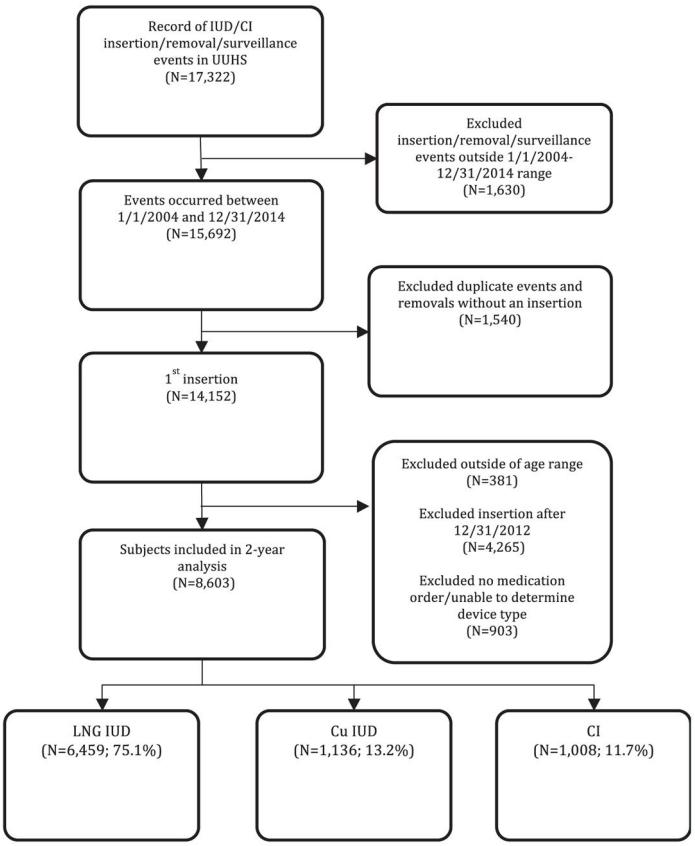

FIGURE. Flowchart of study inclusion

Levonorgestrel 52mg IUD (LNG IUD); copper T380A IUD (Cu IUD); 68mg etonogestrel contraceptive implant (CI)

Flowchart detailing the conditions discussed in this study.

CI, 68-mg etonogestrel contraceptive implant; *Cu IUD*, copper T380A intrauterine device; *IUD*, intrauterine device; *LNG IUD*, levonorgestrel 52-mg intrauterine device; *UUHS*, University of Utah Healthcare System.

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TABLE 1

Patient characteristics by device type

Characteristic	Levonorgestrel 52-mg intrauterine device (n=6459), n (%)	Copper T380A intrauterine device (n=1136), n (%)	68-mg Etonogestrel implant (n=1008), n (%)	Total (n=8603), n (%)	*P* value[a]
Age, y					.000
15–19	706 (10.9)	64 (5.6)	370 (36.7)	1140 (13.25)	
20–24	1645 (25.5)	261 (23.0)	286 (28.4)	2192 (25.5)	
25–29	1750 (27.1)	345 (30.4)	172 (17.1)	2267 (26.4)	
30–34	1243 (19.2)	244 (21.5)	101 (10.2)	1588 (18.5)	
35–39	723 (11.2)	150 (13.2)	47 (4.7)	920 (10.7)	
40–44	392 (6.1)	72 (6.3)	32 (3.2)	496 (5.8)	
Race					.000
White	4642 (76.7)	754 (72.2)	574 (59.3)	5970 (74.0)	
Other/multiracial	1411 (23.3)	291 (27.9)	394 (40.7)	2096 (26.0)	
Ethnicity					.000
Not Hispanic	4270 (81.7)	700 (80.0)	618 (70.2)	5588 (80.1)	
Hispanic	954 (18.3)	175 (20.0)	262 (29.8)	1391 (19.9)	
Obstetric history					.026
Nulliparous	273 (12.8)	39 (11.9)	65 (17.7)	377 (13.3)	
Parous	1869 (87.3)	289 (88.1)	302 (82.3)	2460 (86.7)	
Payer type at insertion					.000
None	180 (2.8)	27 (2.4)	36 (3.6)	243 (2.8)	
Public	1871 (29.0)	312 (27.5)	409 (40.9)	2592 (30.2)	
Private	4400 (68.2)	796 (70.1)	555 (55.5)	5751 (67.0)	
2-Year continuation, mo					.001
<24	1431 (22.2)	306 (26.9)	243 (24.1)	1980 (23.0)	
≥24	5028 (77.8)	830 (73.1)	765 (75.9)	6623 (77.0)	

[a]Chi-square.

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TABLE 2

Two-year continuation estimates using Poisson regression (non-imput data)

Variable	Unadjusted models incidence risk ratio[a]	95% Confidence interval	Adjusted model incidence risk ratio[a]	95% Confidence interval
Intrauterine device type				
Levonorgestrel 52 mg	1.07[b]	1.03–1.11	1.08[b]	1.03–1.13
Copper T380A	1	1–1	1	1–1
68-mg Etonogestrel contraceptive implant	1.04	0.99–1.09	1.08[c]	1.02–1.14
Insurance status				
Self-pay	1.14[b]	1.08–1.20	1.13[b]	1.06–1.20
Public	1.03[d]	1.01–1.06	1.04[d]	1.01–1.08
Private	1	1–1	1	1–1
Race				
Non-white/other	1	1–1		
White	1.01	0.98–1.04		
Ethnicity				
Not Hispanic	1	1–1	1	1–1
Hispanic	1.05[d]	1.01–1.08	1.04[c]	1.01–1.08
Parity				
Nulliparous	1	1–1		
Parous	1.02	0.96–1.08		
Continuous variables				
Age at insertion	1.00	1.01–1.08	1.00[d]	1.00–1.01
Year of insertion	1.00	1.00–1.01		

Adjusted model includes all variables with potential associations based on the bivariate model that includes device type insurance status, ethnicity, and age at insertion.

[a] Exponentiated coefficients;

[b] $P<.001$;

[c] $P<.05$;

[d] $P<.01$.

Sanders et al. Two-year continuation of intrauterine devices and implants. Am J Obstet Gynecol 2017.