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Kuperman, Julie M.

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Unmet postpartum sterilization demand
at a tertiary care center: associated factors
and alternate contraception one year postpartum

A thesis submitted in partial satisfaction
of the requirements for the degree of Master of Science
in Clinical Research

by

Julie M Kuperman

2016

ABSTRACT OF THE THESIS

Unmet postpartum sterilization demand
at a tertiary care center: associated factors
and alternate contraception one year postpartum

by

Julie M Kuperman

Master of Science in Clinical Research
University of California, Los Angeles, 2016
Professor Janet S. Sinsheimer, Chair

ABSTRACT

Objectives

Unmet demand for postpartum sterilization (PPBTL) is prevalent. We investigated predictors of unfulfilled PPBTL and alternate contraceptive method.

Methods

In this retrospective chart review, we identified women presenting for delivery to an urban tertiary center in New York City in 2011 that indicated a desire for PPBLT and

prenatally signed the mandatory state sterilization consent indicating a desire for PPBTL. We collected demographic and medical data, and, when sterilization was not performed, alternate contraception for one year postpartum.

Results

391 women met inclusion criteria and 63% received the desired PPBTL. Unfulfilled PPBTL (37%) was associated with being younger, having higher gravidity, receiving low-risk prenatal care, without prenatal complications, delivering vaginally, on a weekend or night shift, lower body mass index at admission and signing the sterilization consent later in pregnancy. Only mode of delivery was found to be significant when controlling for other factors with logistic regression. Women without PPBTL were not discharged home with highly effective reversible contraception; only eight were known to be using an intrauterine device by eight weeks postpartum, and 18 by six and 12 months. Twenty-four (16%) underwent interval sterilization, all by six months postpartum.

Conclusion

At this institution, PPBTL is less likely in women who delivered vaginally. Few women without desired PPBTL obtained interval sterilization or utilized highly effective reversible contraception. We thus recommend antepartum counseling include discussion of alternate effective contraceptives in case of unmet PPBTL and expedited referral for interval sterilization at discharge.

The thesis of Julie M Kuperman is approved.

Aparna Sridhar

David Elashoff

Katrina Mae Dipple

Janet S. Sinsheimer, Committee Chair

University of California, Los Angeles

2016

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BACKGROUND/OBJECTIVES:

Female sterilization is the second most commonly used contraceptive after oral contraceptive pills among reproductive-aged women (1). Over 10 million women rely on female sterilization as their method of contraception with 640,000 sterilization procedures performed annually. Nearly half of all sterilization procedures are performed in the postpartum period, following 8-9% of all births (2). Sterilization rates are at least two-fold higher than the national average in women who are African American, Latina, uninsured, low-income and who rely on public insurance and have a low level of education (3). Minority and low-income women have the highest rates of unmet demand for postpartum sterilization (PPBTL), ranging from 31 to 46% (4-5).

Factors consistently associated with unfulfilled PPBTL are lack of prenatal care or sterilization consent, vaginal delivery and nighttime delivery (4-8). Factors inconsistently associated with unfulfilled PPBTL or inconsistently studied, include younger age, African-American or Hispanic race, single status, public insurance coverage, legal immigrant status, higher gravidity and parity, higher body mass index, and obtaining the sterilization consent in the second rather than third trimester (4-8). Reasons accounting for unfulfilled sterilization include provider influence to a different contraceptive, lack of operating room and anesthesiologist, and maternal and neonatal complications (6, 7, 9). Patient-related factors include the patient changing her mind and fear of pain and anesthesia (7, 8).

Few prior studies focused on alternate postpartum contraception, receipt of an interval sterilization and subsequent pregnancy. Thurman and colleagues demonstrated that 47% of women who do not receive a requested PPBTL have a repeat pregnancy in the year following delivery. Sixty-four percent of women who did not obtain PPBTL were discharged from the hospital without contraception (10). We investigated clinical, patient and system-level factors leading to unmet demand for PPBTL at an urban medical center labor and delivery over one year. Additionally, we examined contraceptive methods provided to women who did not obtain PPBTL and rate of interval sterilization and pregnancy in the year following delivery.

METHODS:

We conducted a retrospective chart review of women at least 21 years old who signed a New York State sterilization consent during their antepartum course, delivered at New York Presbyterian Hospital – Columbia University Medical Center in 2011 and indicated a desire for PPBTL as documented in the last antepartum clinic, delivery hospitalization admission, or postpartum note. In New York State, the sterilization consent for postpartum sterilization must be signed 30 days before an anticipated delivery and 72 hours prior to a preterm delivery for Medicaid beneficiaries. The Institutional Review Board at Columbia University Medical Center approved this study and waived the need for informed consent.

The primary author screened the specified notes for all deliveries in 2011 to find patients who met the inclusion criteria. Two research assistants abstracted demographic, prenatal care, delivery and postpartum contraception data using a tool modified from a prior study at our institution (8) to include additional variables studied in previous research. For quality assurance, the single investigator reviewed 50% of the data collected and entered into a de-identified database by the research assistants. Demographic variables examined included age, race, ethnicity, primary language, marital status and insurance coverage. Prenatal variables included prenatal clinic location, whether private or associated with hospital, high-risk or low-risk care, gravidity, parity, time interval from last delivery, gestational age at entry to prenatal care and consent signing, and any prenatal complications. Delivery variables included body mass index (BMI) at admission, gestational age at delivery, type of delivery, day of the week and shift of delivery, delivering physician and nurse, and any delivery complications. Postpartum variables included whether the PPBTL was performed and indication if not, any postpartum complications, the physician, charge nurse and anesthesiologist present on the day after delivery, as well as hemoglobin, hematocrit, and platelet levels measured on the day after delivery, and how many postpartum clinic visits occurred up to eight weeks after delivery. If the PPBTL was not performed, we noted alternate contraceptive methods provided at time of discharge, at the postpartum visit, as well as six and twelve months postpartum. We categorized alternate contraceptive method using the WHO classification of effectiveness of family planning methods (11). The sample size was based on a convenience sample of all hospital deliveries in the study year.

We compared continuous variables with t-tests and categorical data with chi-square analyses using SPSS Version 21.0 (SPSS, Inc., Chicago, IL). We performed a bivariate analysis on the variables collected based on whether or not the desired PPBTL was performed and compared reasons for unfulfilled PPBTL while controlling for mode of delivery. Additionally, we performed logistic regression models to evaluate how demographic, prenatal, delivery and postpartum variables affected the primary outcome of obtaining the desired PPBTL using R Statistical Computing Environment Version 3.2.02 (R Core Team, Vienna, Austria). All variables examined at the bivariate level that were significantly associated with unfulfilled PPBTL at $P < 0.1$ as well as included in the classification and regression tree (CART) analysis, which is discussed in the Appendix A were entered into a multivariable logistic regression model and backwards-stepwise algorithm was applied (12).

RESULTS:

We screened 4382 charts and found 391 women seeking PPBTL per inclusion criteria. Nearly two-thirds (245, 63%) received the desired sterilization procedure. Table 1 details patient characteristics by PPBTL status. Patients who did not receive their desired PPBTL (146, 37%) were younger, had higher gravidity, received low-risk prenatal care, were less likely to have prenatal complications, delivered vaginally on a weekend or night shift, had lower BMI, and signed the sterilization consent later in pregnancy. Factors not associated with PPBTL included race, marital status, insurance coverage, primary language, history of abortion, parity, gestational age at entry into prenatal care,

time interval from last delivery, labor and delivery staffing, delivery and postpartum complications, admission to the intensive care maternal or neonatal unit, and postpartum anemia or thrombocytopenia.

For the logistic regression model, variables examined at the bivariate level that were significantly associated with unfulfilled PPBTL at $P < 0.1$ as well as those included in the classification and regression tree (CART) analysis, which is discussed in the Appendix A, were younger age at delivery, higher gravidity, receiving low-risk prenatal care, signing the sterilization consent earlier in the pregnancy, not having any prenatal complications reported, lower body mass index at delivery, vaginal delivery, weekend delivery, nighttime delivery, having any delivery or postpartum complications reported, history of prior abortions or more than two term deliveries, lower parity, not having a maternal intensive care admission and less than 50 month interval from last delivery. When the backwards-stepwise algorithm is applied, only vaginal delivery, nighttime delivery, any delivery complications reported and history of abortions remain in the model (Table 2).

For women who did not receive the desired PPBTL, reasons given include the patient changing her mind (29%), a medical complication (27%), issues with the state sterilization consent (17%), busy service (15%) or no reason stated (12%) (Table 3). The reasons for unfulfilled PPBTL differed by mode of delivery. Women after cesarean delivery were more likely to change their mind or have a medical complication lead to an unfulfilled PPBLT. Women after vaginal delivery were more likely to have busy service or no reason given for unfulfilled PPBTL.

Women who did not obtain PPBTL were not discharged home with a highly effective contraceptive method; only 12 were using one at eight weeks, and 42 by six and 12 months. Twenty-four underwent interval sterilization, all by six months postpartum (Table 4). Eight women experienced a subsequent pregnancy in the 12 months after delivery and presented to our medical system. One terminated spontaneously, two by induced abortion; one woman delivered at full term and obtained a postpartum sterilization after that pregnancy. Four women had ongoing pregnancies at the end of data collection. Of the eight women with subsequent pregnancies, four were discharged home with WHO Tier 2 contraceptive methods, while the other four received no contraception. One had received an interval copper intrauterine device, but it had expelled.

DISCUSSION:

In prior studies, age, race, gravidity, immigration status, BMI, trimester at request of sterilization, mode of delivery, time and day of week of delivery were associated with whether or not a desired PPBTL was obtained. In parallel with these prior findings, we found younger age, higher gravidity, signing the sterilization consent closer to delivery, lower BMI at admission, vaginal delivery, daytime delivery, and weekend status to be significantly associated with unfulfilled PPBTL in the bivariate analysis. With the exception of mode of delivery, these variables were not found significant in the logistic regression. Mode of delivery was the most notable variable found in our analysis with 85% of women in the cesarean group receiving the desired PPBTL, but only 15% of those delivering vaginally. We did not have the power to detect other differences between

the groups when controlling for mode of delivery. We did not look at immigration status, as it was not accessible by our chart review methods. We found race not to be a significant finding. The majority of patients who identified as Hispanic had listed Spanish as their primary language. Primary language did not affect likelihood of obtaining PPBTL. Additionally, the majority of our patients signed their state sterilization consent in the third trimester. Those with unfulfilled PPBTL signed it on average one week later than those who received the desired PPBTL. Signing the sterilization consent after 36 weeks gestation was associated with unfulfilled PPBTL as the state consent requires a signature 30 days prior to the delivery or the estimated due date in the case of preterm delivery.

Thurman and colleagues found lack of funding or consent form or both as major reasons for not obtaining a PPBTL. Other reasons were patient change of mind as well as severe anemia or obesity. In that study, no patient was denied a PPBTL based on anesthesia staffing or operating room availability (4). Zite and colleagues found that lack of valid consent, patient change of mind and medical conditions were the three most common reasons for unfulfilled PPBTL request. Other reasons included lack of operating room availability and physician discretion (5,6). Similarly to the findings of Zite and colleagues, the top ranking reasons for not obtaining the desired PPBTL in our study were patient change of mind, medical conditions and lack of valid consent. Lack of consent was the third reason rather than first likely because we excluded women who had not previously signed the state sterilization consent. Patients in our study who did not receive a PPBTL

due to issues with consent had endorsed signing the consent but it was either unavailable or signed too late. This reason accounted for 17% of women who had cesarean deliveries but did not obtain their desired PPBTL. Thus, despite having abdominal surgery and a convenient opportunity to obtain a highly effective permanent contraceptive method, these women remained at risk for undesired repeat pregnancy. As the sterilization consent is currently a barrier for a desired procedure rather than protection of patient autonomy, there is a call for redesigning the consent or replacing it with a decision-support tool, as well as shortening or eliminating the 30-day waiting period (13, 14). In a cost-effect model, researchers estimated that in one-year Medicaid-policy-related barriers to PPBTL lead to approximately 62,000 unfulfilled requests, resulting in an estimated 10,000 abortions and 19,000 unintended births in the subsequent year, at a public cost of \$215 million dollars (15).

Limitations of this study include the retrospective chart review design, which is subject to missing data, does not allow for direct clarification of information with the patient, and results in possible miscalculation of desire for PPBTL. We excluded women who did not sign their sterilization consent or for whom the consent was not mentioned in the notes reviewed during the screening process thus underestimating desire for PPBTL. Only eleven women who received prenatal care outside our system were included in our study, but many more were excluded due to lack of sterilization consent and lack of access to prenatal records. Conversely, it is possible that the desire for PPBTL could be overestimated for women who were unsure of whether they desired a PPBTL but signed the consent just in case. Additionally, we were unable to look at patient-centered reasons for unfulfilled PPBTL as was done in some prior qualitative studies. As our study took

place in one hospital, generalizability is another limitation. The patient population in our center, however, is quite diverse; including clinic and private patients, as well as those followed by generalists and high-risk obstetricians.

The rate of subsequent pregnancies we found was much lower than that of other studies. This is possibly due to the high number of clinics and hospitals in the New York area. Patients could elect to go to a different hospital for their next delivery, especially after they were not able to obtain a desired service with us. Additionally, as women in our study, on average entered prenatal care at twelve weeks gestation and it is possible that we are missing subsequent pregnancies due to a short follow up period. Many patients in the area obtain prenatal care with non-hospital affiliated clinics and transfer to hospital care later in the pregnancy. Thus, we likely underestimated the repeat pregnancy rate in our patients who did not obtain the desired PPBTL.

Strength of this study is location in a tertiary referral center, with a large and diverse patient population, providing services to women with low- and high-risk pregnancies, diverse array of medical problems and public as well as commercial insurance. A single investigator with experience working with the electronic medical record screened over 4000 charts. To provide quality assurance, the single investigator confirmed 50% of the data collection by the research assistants.

This data showing a large proportion of unfulfilled sterilization desire without alternative use of effective contraception supports the recent ACOG Committee Opinion that

recommends the obstetric community view PPBTL as an urgent surgical procedure rather than an elective one in (16). Removing obstacles to PPBTL would include prioritizing the procedure as well as changing the Medicaid-policy-related barriers. Additionally, for women seeking PPBTL, we recommend that antepartum counseling include a discussion regarding alternate contraception if a desired sterilization is not performed, especially equally-effective long acting reversible contraception methods that can be initiated immediately postpartum. For women who do not get sterilization and do not opt for a highly effective contraception, expedited referral for interval sterilization must happen at discharge.

Table 1: Characteristics of women desiring PPBTL (n=391), categorized by whether or not PPBTL was obtained.

Variable	PPBTL (n=245, 63%)	No PPBTL (n=146, 37%)	p-value
BASELINE DEMOGRAPHIC CHARACTERISTICS			
Age at delivery			0.04
≤ 30 years	59 (55%)	49 (45%)	
> 30 years	186 (66%)	97 (34%)	
Race/Ethnicity			0.7
White	46 (70%)	20 (30%)	
Black	24 (62%)	15 (38%)	
Hispanic	161 (61%)	103 (39%)	
Other	13 (65%)	7 (35%)	
Marital Status			0.2
Single	139 (60%)	92 (40%)	
Married	106 (66%)	54 (34%)	
Insurance			0.2
Medicaid/Medicare	152 (60%)	101 (40%)	

Private Insurance/Self-Pay	93 (67%)	45 (33%)	
Gravidity, mean \pm SD	4 \pm 2	5 \pm 2	0.04
Parity (living at baseline)			0.05
< 2	84 (70%)	36 (30%)	
\geq 2	161 (59%)	110 (41%)	

PRENATAL INFORMATION			
Hospital or private clinic			0.08
Hospital	155 (60%)	105 (40%)	
Private	90 (69%)	41 (31%)	
Low-risk or high-risk clinic			0.03
Low-risk	136 (56%)	97 (44%)	
High-risk	109 (69%)	49 (31%)	
Interval in months from last delivery, mean \pm SD	64 \pm 48	62 \pm 46	0.6
Gestational age in weeks at entry to prenatal care, mean \pm SD	12 \pm 6	13 \pm 8	0.3

Gestational age in weeks at consent signing			<0.001
< 36 weeks	241 (65%)	131 (35%)	
≥ 36 weeks	4 (21%)	15 (79%)	
Any prenatal complications reported	230 (94%) [£]	128 (88%) [£]	0.03
BMI at delivery, mean ± SD	33.6 ± 6.5	32.1 ± 6.0	0.02
Time interval between delivery and consent signing			0.01
< 4 weeks	23 (46%)	27 (54%)	
≥ 4 weeks	222 (65%)	119 (35%)	
Type of delivery			<0.001
Vaginal	37 (25%)	110 (75%)	
Cesarean	208 (85%)	36 (15%)	
Time of Delivery			<0.001
Day (7A – 7P)	184 (71%)	75 (29%)	
Night (7P – 7A)	61 (46%)	71 (54%)	
Weekday or weekend			0.03

Weekday	209 (65%)	112 (35%)	
Weekend	36 (51%)	34 (49%)	
Any delivery complications reported	58 (24%) [£]	44 (30%) [£]	0.2
Any postpartum complications reported	67 (27%) [£]	35 (24%) [£]	0.5
PPD 1 Hematocrit			0.2
< 28	55 (69%)	25 (31%)	
≥ 28	190 (61%)	121 (39%)	
PPD 1 Platelet			0.4
< 100	2 (40%)	3 (60%)	
≥ 100	243 (63%)	143 (37%)	

Data are n (%) except where indicated. Percentage given is %row, except where indicated by [£] indicating %column.

Table 2: Logistic Regression Model using backwards-stepwise algorithm following Akaike information criterion from variables that were associated with unfulfilled PPBTL at $p < 0.1$ on the bivariate analysis.

Variable	OR (95% CI)	p-value
Type of delivery		< 0.001
Vaginal	Reference	
Cesarean	0.05 (0.03-0.09)	
Time of Delivery		0.071
Day (7A – 7P)	Reference	
Night (7P – 7A)	1.66 (0.96-2.86)	
Any delivery complications reported	2.38 (1.3-4.44)	0.005
History of abortion	1.65 (0.97-2.85)	0.065

Table 3: Reason for unfulfilled PPBTL, categorized by mode of delivery.

	Total (n=146)	Vaginal Delivery (n=110, 75%)	Cesarean Delivery (n = 36, 25%)	p-value
Reason for unfulfilled PPBTL				0.003
Patient change of mind	42 (29%)	27 (25%)	15 (42%)	
Medical complications	40 (27%)	28 (25%)	12 (33%)	
Consent issues	25 (17%)	19 (17%)	6 (17%)	
Busy service	21 (15%)	21 (19%)	0	
No reason given	18 (12%)	15 (14%)	3 (8%)	

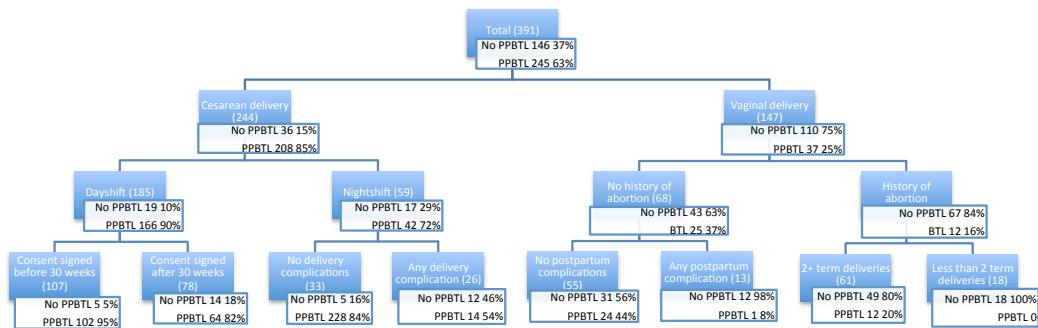
Data are n (% column).

Table 4: Alternate contraception collected for one year postpartum for patients with any follow up who did not receive a desired PPBTL (n=146).

Method of Contraception	At discharge	Up to 8 weeks postpartum	Up to 6 months postpartum	Up to 12 months postpartum
Patients with follow up	146 (100%)	102 (70%)	67 (46%)	60 (41%)
Tier 1	0	12 (12%)	42 (63%)	42 (70%)
Interval Sterilization	-	3 (3%)	24 (36%)	24 (40%)
Intrauterine Device	0	8 (8%)	18 (27%)	18 (30%)
Vasectomy	0	1 (1%)	0	0
Tier 2	62 (42%)	39 (38%)	16 (24%)	13 (22%)
Tier 3	13 (9%)	28 (27%)	4 (6%)	2 (3%)
None	71 (49%)	23 (23%)	5 (7)	3 (5%)

Data are n (%) and organized by WHO categories for typical effectiveness of contraceptive methods. Tier 2 includes injectable, oral, patch and ring contraceptives. Tier 3 includes barrier methods, fertility awareness and withdrawal.

Appendix A – Classification and regression tree (CART) analysis for whether a desired sterilization was performed or not.



Classification and regression tree (CART) analysis shows the most divisive variable for the outcome chosen, in this case, whether or not a desired postpartum sterilization (PPBTL) is performed. CART analysis is an alternative for a logistic regression as it compares all the possible variables when selecting a division point, thus taking the other variables into account. In this CART analysis, the most divisive variable for whether or not a desired PPBTL is performed is mode of delivery. 75% of women with vaginal delivery were unable to obtain their desired PPBTL compared to 15% of women who delivered via cesarean. For women who underwent cesarean delivery, the next most telling variable is the shift of delivery. 29% of women who delivered at nighttime were

unable to obtain their desired PPBTL as compared to only 10% of women who delivered during the day. Of those delivering by cesarean at night, having any delivery complications was associated with unfulfilled PPBTL. It is possible that women delivering by cesarean at night with delivery complications are more likely to be undergoing unplanned cesarean delivery, but there is insufficient data to make this conclusion. For women delivering via cesarean during the day, having signed the New York State sterilization consent after 30 weeks is correlated with higher rates of unfulfilled PPBTL, likely due to 30 day waiting period required by the consent. For emergency deliveries, the waiting period is only 72 hours, however, as long as the consent was signed 30 days prior to the estimated delivery date. For women who delivered vaginally, history of abortion was significantly correlated with unfulfilled PPBTL. Of women who delivered vaginally and had a history of abortion in the past, having less than two prior term deliveries was significantly correlated with unfulfilled PPBTL. For women who delivered vaginally and had no prior history of abortion, having any postpartum complications was correlated with higher rate of unfulfilled PPBTL. Delivery complications appear to be associated with unfulfilled PPBTL in the cesarean group, while postpartum complications play a role in the vaginal delivery group. This likely reflects the timing of PPBTL completion, which is during the delivery in the case of cesarean surgery as opposed to a day or two after a vaginal delivery.

Appendix B - Analysis by reason for unfulfilled sterilization request.

Variable	Medical condition (40)	Changed mind (42)	Consent (25)	Busy Service (21)	No reason given (18)	Obtained PPBTL (245%)	p-value
BASELINE DEMOGRAPHIC CHARACTERISTICS							
Age							0.27
≤ 30 years	12 (30%)	13 (31%)	11 (44%)	6 (29%)	7 (39%)	59 (24%)	
> 30 years	28 (70%)	29 (69%)	14 (56%)	15 (71%)	11 (61%)	186 (76%)	
Race/Ethnicity							0.27
White	6 (15%)	6 (14%)	1 (4%)	1 (5%)	6 (33%)	46 (19%)	
Black	7 (18%)	3 (7%)	2 (8%)	1 (5%)	2 (11%)	24 (10%)	
Hispanic	26 (65%)	29 (69%)	20 (80%)	19 (90%)	9 (50%)	161 (66%)	
Other	1 (2%)	4 (9%)	2 (8%)	0	1 (6%)	14 (6%)	
Marital Status							0.39
Single	23 (58%)	26 (62%)	16 (64%)	17 (81%)	10 (56%)	139 (57%)	
Married	17 (42%)	16 (38%)	9 (36%)	4 (19%)	8 (44%)	106 (43%)	
Insurance							0.046
Medicaid/ Medicare	28 (70%)	28 (67%)	18 (72%)	19 (90%)	8 (44%)	152 (62%)	
Private Insurance/ Self-Pay	12 (30%)	14 (33%)	72 (28%)	2 (10%)	10 (56%)	93 (38%)	
Gravidity mean ± SD	5 ± 2	5 ± 2	4 ± 2	5 ± 2	4 ± 1	4 ± 2	0.02
Parity (living at baseline)							0.2
< 2	6 (15%)	13 (31%)	8 (32%)	5 (24%)	4 (22%)	84 (34%)	
≥ 2	34 (85%)	29 (69%)	17 (68%)	16 (76%)	14 (78%)	161 (66%)	
PRENATAL INFORMATION							
Gestational age in weeks at consent signing							<0.0001
≥ 36 weeks	0	1 (2%)	13 (52%)	1 (5%)	0	4 (2%)	
Hospital or private clinic							0.002
Clinic	29 (72%)	28 (67%)	21	20	7	155	

			(84%)	(95%)	(39%)	(63%)	
Private	11 (28%)	14 (33%)	4 (16%)	1 (5%)	11 (61%)	90 (37%)	
Low risk or high risk clinic							0.17
Low risk	24 (60%)	26 (62%)	20 (80%)	14 (67%)	13 (72%)	136 (56%)	
High risk	16 (40%)	16 (38%)	5 (20%)	7 (33%)	5 (28%)	109 (44%)	
Prenatal comp reported	36 (90%)	34 (81%)	17 (68%)	15 (71%)	12 (67%)	217 (86%)	0.005
DELIVERY INFORMATION							
BMI at delivery, mean \pm SD	33.1 \pm 1.0	31.3 \pm 1.0	30.4 \pm 1.3	33.2 \pm 1.4	32.5 \pm 1.6	33.4 \pm 0.4	0.18
Time interval between delivery and consent signing							<0.0001
< 4 weeks	5 (12%)	4 (10%)	17 (68%)	1 (5%)	0	23 (9%)	
\geq 4 weeks	35 (88%)	38 (90%)	8 (32%)	20 (95%)	18 (100%)	222 (91%)	
Type of delivery							<0.0001
Vaginal	28 (70%)	27 (64%)	19 (76%)	21 (100%)	15 (83%)	37 (15%)	
Cesarean	12 (30%)	15 (36%)	6 (24%)	0	3 (17%)	208 (85%)	
Time of Delivery							<0.0001
Day (7A – 7P)	15 (38%)	23 (55%)	11 (44%)	13 (62%)	13 (72%)	184 (75%)	
Night (7P – 7A)	25 (62%)	19 (45%)	15 (56%)	8 (38%)	5 (28%)	61 (25%)	
Weekday or weekend							0.1
Weekday	34 (85%)	30 (71%)	19 (76%)	14 (67%)	15 (83%)	209 (85%)	
Weekend	6 (15%)	12 (29%)	6 (24%)	7 (33%)	3 (17%)	36 (15%)	
Delivery comp reported	21 (52%)	11 (27%)	4 (16%)	5 (24%)	3 (17%)	58 (24%)	0.004
Postpart comp reported	18 (45%)	10 (24%)	4 (16%)	1 (5%)	2 (11%)	67 (27%)	0.007
PPD 1 Hematocrit							0.01
< 28	14 (35%)	4 (10%)	4 (16%)	3 (14%)	0	55 (22%)	

≥ 28	26 (65%)	38 (90%)	21 (84%)	18 (86%)	18 (100%)	190 (78%)	
PPD 1 Platelet							0.2
< 100	2 (5%)	0	1 (4%)	0	0	2 (1%)	
≥ 100	38 (95%)	42 (100%)	24 (96%)	21 (100%)	18 (100%)	243 (99%)	

We repeated the bivariate analysis of patient characteristics and delivery details by reason for unfulfilled sterilization request. We compared continuous data with ANOVA analysis and categorical data with chi-squared analysis using JMP Version 12.0.1. (SAS Institute Inc., Cary, North Carolina).

Reasons collected by electronic chart review were categorized into 5 categories:

1. Medical conditions, which included current medical conditions, problems with anesthesia or adhesions that prevented sterilization completion, and plan for concurrent surgery.
2. Patient change of mind.
3. Issues with consent, including lack of consent or late consent signing.
4. Busy service
5. No reason given.

Women for whom busy service was stated as the reason for unfulfilled sterilization were more likely to have public insurance and receive prenatal care at the hospital-associated clinics. Women for whom no reason was given were more likely to have private insurance and had delivered vaginally. Women whose sterilizations were not completed due to the patient change of mind or busy service had higher numbers of previous

pregnancies. The majority of the patients for whom issues with consent were stated as the reason for unfulfilled sterilization had signed their state sterilization consents after 36 weeks of gestation and less than 4 weeks before delivery. 12% of the patients in this group had signed their consents less than 4 weeks before delivery but not before 36 weeks of gestation. In these cases, the consents were valid given that they were signed 30 days prior to the estimated due date, but the deliveries occurred prematurely. Either these consents were erroneously indicated as invalid or there were other consent related reason for the unfulfilled sterilization. Either way, the consent process remains a barrier for patient desired postpartum sterilization. Women for whom medical conditions were stated as the reason for unfulfilled sterilization were more likely to have prenatal and delivery complications, as well as postpartum anemia. Women for whom medical conditions and consent were given as reasons for unfulfilled sterilization were more likely to deliver at night, There were no statistically significant differences in age, race, marital status, number of children, prenatal care in a low- or high-risk clinic, body mass index at admission for delivery, weekday or weekend delivery, or platelet level on the day after delivery based on reason for unfulfilled sterilization.

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