Post-Operative Urinary Tract Infection Reduction: Discharge Bundle Implementation in Outpatient Urogynecology Patients

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Abstract

Introduction/Background

Post-operative urinary tract infections (UTIs) are a common, costly and potentially serious post-surgical complication amongst urogynecology patients undergoing surgical pelvic procedures. A Maryland hospital's urogynecology program had post-operative UTI incidence rates above the American College of Surgeons quality improvement program's nationally desired metric (NSQIP), and previous interventions proved ineffective.

Aims

The purpose of this project was to incorporate a standardized, evidence-based discharge care bundle, aimed at reducing UTI rates by at least 50% in post-surgical urogynecology patients. The intervention was a discharge care bundle which included non-prescription, pharmacologic supplements (cranberry & probiotic supplements) taken by patients for 30 days post-operatively.

Methods

Patients who had surgical procedures during the months of October 2019 through December 2019, received education and after surgical care instructions encouraging intake of a standard 30 day supply of cranberry tablets and lactobacillus acidophilus chewable wafers, along with instructions for 32 ounces of daily water intake for 30 days post-operatively. Patient follow up at 2, 4 and 6 weeks, assessed for compliance and UTI symptom development. Baseline UTI data was then compared to post intervention data.

Results

NSQIP UTI rates for the 3-months, post-bundle implementation, were favorable at 0%. Following bundle implementation, the NSQIP UTI rate for the urogynecology cohort remained below the expected rate of <4%, and dropped 6% from the clinic's 3-month pre-implementation rate. There was only one documented UTI for all patients who opted to take the recommended supplements, compared to eight documented UTIs for patients who did not opt to take the recommended supplements. High compliance rates among those who followed the discharge bundle recommendations were also noted.

Conclusions

A decrease in UTI rates was seen after implementation of an evidence based UTI discharge bundle within a selected urogynecology cohort. This intervention demonstrates the potential for effective use of supplements to avoid post-operative UTIs for patients undergoing urogynecology procedures.

Overview

Background

Urinary tract infections (UTIs) are the most common morbidity in patients following surgery for stress incontinence or pelvic organ prolapse surgeries (Sutkin et al., 2010). According to the Centers for Disease Control and Prevention (2019), urinary tract infections (UTIs) are the fourth most common healthcare associated infection. Post-operative UTIs affect both morbidity and mortality, and may potentially cause significant systemic and costly complications in patients (Sutkin et al. 2010). The risk for UTI development is especially increased in post-surgical urogynecology patients who have received pelvic surgeries. It is reported that forty-five percent of women who have undergone obliterative pelvic surgery for prolapse, develop a UTI within three months, and more than thirty-three percent of women undergoing sling procedures, developed a subsequent UTI within three months (Sutkin, Alperin, Meyn, Wiesenfeld, Ellison, & Zyczynski, 2010).

Prophylactic antibiotics have proven to effectively reduced the incidence of UTIs by 50%, if given at the time of catheter removal following pelvic surgery. There is however growing evidence showing increased antibiotic resistance among various bacterial isolates, making this a potentially less than ideal approach (Foxman et al., 2015). In addition, multiple doses of prophylactic antibiotics used to prevent UTIs are associated with increased resistance rates and unwanted side effects. Therefore, the use of non-antibiotic interventions to reduce UTI occurrence may offer the desired outcome of UTI prevention without untoward effects.

The American College of Surgeons' National Surgical Quality Improvement Program collects surgical quality data 30 days postoperatively to help surgeons and hospitals understand their quality of care in comparison to similar populations at various hospitals throughout the

country (American College of Surgeons, 2019). This organization has set a standardized goal of <4% of post-operative patients developing UTIs within 30 days following a surgical intervention. Prior to project implementation, the urogynecology program within the Maryland hospital system of focus for this project, reported rates above the National Surgical Quality Improvement's desired metric, and previous interventions were not effective. The goal of this project was therefore to develop and implement a standardized discharge care bundle utilizing non-prescription, pharmacologic supplements in post-operative urogynecology surgical patients, to reduce the rates of post-operative urinary tract infections and improve clinical and patient safety outcomes in the context of antibiotic stewardship.

Theoretical Framework

The Knowledge to Action Framework (2006) along with Jack Mezirow's Transformative Learning Theory (1991) were used to guide this quality improvement project. Jack Mezirow's Transformative Learning Theory is based on the transformative nature of adult learning, and specifically describes how individual learners use prior pre-existing attitudes, beliefs, concepts and values to develop "frames of reference" that are interpreted and re-interpreted to facilitate autonomous learning and future action (Mezirow, 1997). Mezirow defines "frames of reference" as the structure of assumptions in which an individual understands experiences (Mezirow, 1997). Frames of reference are broken down into two aspects: "habits of mind" and "point of view". Both aspects influence an individual's perspective and ability to learn. Per Mezirow (1997), there are two types of learning that can transform a person's frame of reference: instrumental and communicative learning; both of which direct the transformation of the meaning of ideas and structures, and guide the process of critical reflection that is needed for autonomous thinking and transformative learning (Mezirow, 1997).

The Transformative Learning Theory helped to explain and understand the transformation of adult learning and points of views that were found during the planning, implementation and evaluation phases of this quality improvement project. The previously established post-surgical discharge process, provider's preventative prescribing practices, and patient's post-operative care knowledge all underwent a transformative change through the addition of interventions found within the discharge bundle. Use of aspects found within the Transformative Learning Theory, helped to direct the successful development and implementation of the bundle into practice. Aspects of the theory were also used to guide application of effective patient educational materials, development of effective staff and provider training materials, and the distribution and development of pre and post-implementation surveys given to staff and providers to assess their transformation of knowledge from the beginning to the end of project implementation.

Another model used to guide this quality improvement project was Ian Graham's Knowledge to Action Framework. This framework was utilized to influence effective knowledge translation into clinical practice. Implementation of this care bundle into the discharge process, required a change in behavioral habits and an incorporation of new processes for staff as well as patients. Project implementation was based on continued feedback and close work alongside a multi-disciplinary stakeholder team within the department. Nurses, staff and providers were educated on the effectiveness of alternative evidenced-based methods used for UTI prevention, and were encouraged to utilize these methods within the clinical practice. In addition, knowledge use and sustainability were monitored throughout the project with regular compliance checks, feedback and evaluations to assess and evaluate outcomes.

Literature Review

An extensive literature review was conducted to evaluate the effectiveness of non-prescription pharmacologic methods to reduce post-operative UTIs, and supported the development and incorporation of a standardized discharge bundle, utilizing these methods. The literature review was completed through a literature search of SCOPUS, PubMed and the University of Maryland's OneSearch databases. Four randomized controlled trials (RCTs), three meta-analysis/systemic review searches, a double-blind placebo-controlled trial, and a prospective trial were reviewed. Each of these studies reviewed pre and postmenopausal patients with recent pelvic surgery and/or catheter placement, women with recurrent UTIs, or individuals at higher risk for UTI development. The evidence strength of each of the reviewed articles ranged from levels 1 to 3, based on Melnyk Levels of Evidence scale.

Overall, the use of cranberry supplements as a prophylaxis for post-operative UTIs was shown to be effective in the majority of articles reviewed. Six articles reported statistically significant findings supporting the use of cranberry supplements to reduce UTIs. Foxman, Cronenwett, Spino, Berger, & Morgan (2015), studied 160 patients who were undergoing elective benign gynecological surgery involving urinary catherization. Each of these patients were randomized into two groups who either received two cranberry capsules twice a day for six weeks after surgery, or the placebo. Researchers found the occurrence of UTI was significantly lower in the cranberry treatment group (19%) when compared to that of the placebo (38%) (Foxman et al., 2015). Another randomized double blind placebo controlled trial reported similar results, where there was an overall reduction of UTIs by half following cranberry prophylaxis (Dieter, 2015). A prospective trial also found similar supporting evidence of the use of prophylactic cranberry usage in the prevention of urinary tract infections after catheter

placement. In this study, 31 patients with a "double J catheter" were given cranberry tablets (120 mg) as routine prophylactic therapy following surgery. Alternatively, 31 patients were given the standard therapy. Researchers found the overall UTI percentage rate was lower in the cranberry supplemented patient group than that of those who received standard therapy (Barnoiu et al., 2015).

Regarding probiotic use, there were few trials specifically based on the use of probiotics in urology or urogynecology patients, however according to the literature, lactobacilli can prevent the adherence, growth and colonization of uropathogenic bacteria which can have inhibitory effects on e. coli, especially in women with recurrent UTIs or who are more prone to UTIs (Akgul & Karakan, 2018). In a review of 5 studies (n=294) which focused only on premenopausal women with a current UTI or history of UTI; selected lactobacillus strains were found to prevent recurrent UTIs in pre-menopausal women (Brubaker et al., 2018). According to Borchert et al., 2008, "probiotics can be regarded as the single most powerful alternative option under clinical development for the prevention and treatment of chronic infection" (Bochert et al. 2008) There is also mention of the effectiveness of probiotics in UTI reduction seen in a meta-analysis of five studies which showed vaginally administered probiotics were safe and effective in preventing recurrent UTIs in women (Akgul & Karakan, 2018). A randomized double-blind phase 2 trial found, Lactin-V, an intravaginal probiotic, reduced the rate of recurrent UTIs in UTI prone women by almost half (Stapleton et al., 2015). There has also been convincing support of the use of probiotics to reduce UTI rates when used in alternative therapy or multi-drug treatment plans.

Finally, the use of increased water intake to reduce post-operative UTIs was supported through a randomized open label-controlled trial which found a significant effect of increased water intake as an anti-microbial strategy (Hooton, Vecchio, & Iroz, 2018).

Methods

All surgical patients who received urogynecology surgeries from October 9, 2019 through December 20, 2019 were encouraged to utilize the instructions given through the discharge bundle intervention. The discharge bundle instructions advised intake of a standard cranberry tablet, lactobacillus acidophilus wafers, and 32 ounces of daily water to be taken by each patient for 30 days post-operatively. Patients receiving active chemotherapy, patients taking warfarin, and any patients with documented allergies to Cranberry or Lactobacillus Acidophilus were excluded from the intervention. In addition, thirty patients were offered these supplements free of charge through a partnership with a local community-based pharmacy, the hospital's employee pharmacy, and unit-based financial support obtained through a designated hospital fund.

Post-operative UTI prevention discharge instructions were added to the previously existing "After Surgery Care Instructions" discharge packet. This packet was reviewed and distributed by medical assistants during each patient's pre-operative visit. Components of the discharge bundle that were added to the discharge packet included: a standardized patient education handout discussing UTI prevention utilizing the evidence-based supplements and supplement information, post-operative UTI risks, supplement intake instructions, and a patient log to document supplement intake. The two outcome measures were: number of post-operative UTIs within the urogynecology cohort pre and post intervention, and patient compliance with the bundle. Two weeks following surgery, each patient was contacted via phone by the clinic RN to

assess for supplement compliance, UTI symptom development, and to determine if the patient had been evaluated or treated at any outside location for UTI symptoms. If a patient reported a UTI symptom concern, they were then referred to a designated lab facility for urine collection. The results were then analyzed and tracked for UTI confirmation, documentation and follow up treatment was provided as clinically appropriate. Compliance status was documented in the patient's chart by calculating a percentage of number of supplements taken by the total number of supplements distributed. An additional four week follow up call was completed by the DNP student and/or clinic nurse to assess patient compliance with supplement intake, UTI symptom development or patient concerns with care bundle. Continued compliance with the discharge bundle was documented in the patient's chart at the four week follow up call. Similar to the prior follow up at 2 weeks, if a patient reported UTI symptoms, they were referred to a designated lab facility for urine collection. The results were then analyzed and tracked for UTI confirmation, documentation and follow up treatment as clinically appropriate by the designated provider within the clinic. At the six week follow up visit, the patient supplement logs were collected and a final follow up was completed and documented by one of the clinic providers or surgeons.

Results

Retrospective NSQIP data was used to evaluate the outcomes of this project. This data was compiled monthly by the hospital's surgical quality committee, which was a sample of 25% of all surgeries within the urogynecology cohort for each month. This information was reported in a monthly "Urogynecology UTI tracker", and was compiled and reported by the hospital's surgical quality analyst. This report included the number of surgical cases, number of UTIs, and the UTI rate for each month. After bundle implementation, the NSQIP UTI rate for the urogynecology cohort during all three months of the intervention (October through December

2019) was 0% with zero reported UTIs for the NSQIP sample (n=32). The NSQIP UTI rate dropped from a 6% average for the three months pre implementation (July through September 2019), to 0% post-bundle implementation. These results can be seen in Figure 1.

Overall, there were 85 urogynecology surgeries from October 11, 2019 through December 20, 2019. Twenty-one patients (25%) obtained supplements, and 96% of these patients (n=20) were compliant with taking at least 75% of the supplements. One patient did not complete the supplements due to other post-surgical complications. Only one patient who took the recommended supplements developed a UTI. Eight patients who did not take supplements developed UTIs. There were no adverse reactions reported from taking the supplements.

Discussion

After bundle implementation, the project goal to decrease the NSQIP UTI rate for this cohort was achieved. Of the patients who received supplements through this quality improvement intervention, there was only one post-operative UTI. The NSQIP UTI rate for the urogynecology cohort remained at 0% for all three months following project implementation, which is well below the expected rate of <4%. In addition, there was a 6% overall drop in the average NSQIP UTI for the urogynecology cohort post-implementation of the discharge bundle with a high compliance rate noted in patients who took recommended supplements.

One limiting factor for this project was the low overall participation in the intervention, which could potentially limit the generalizability of these results. Although all patients were encouraged to take supplements during project implementation, cost and availability of supplements both were potential reasons for low patient participation, as there were only thirty supplement packs, supplied free of charge, to patients within the clinic. The average per patient cost of a 30 day supply of supplements was approximately $30, and was not covered by most

commercial insurance carriers leading to additional out of patient costs, which can potential create a financial barrier for some patients, and subsequently affect their ability to obtain recommended supplements.

Another barrier identified during project implementation was staffing changes. The noted staff and leadership changes within the clinic, during the planning and implementation period affected training, teaching and patient education. Just prior to the project implementation date, the clinic director, who was the project champion, lead surgeon, and an essential stakeholder, resigned. This sudden change in leadership had an initial effect on clinic culture, project funding and the implementation process. Despite this challenge, a new project champion was immediately and successfully identified, who was able to effectively assist with successful project translation throughout the remainder of the implementation period.

Further suggestions for improvements to the overall UTI rate reduction in this practice include: the inclusion of more participants through continued staff and patient engagement, continued education and encouragement of staff in providing pre-operative patients information on the use of supplements as a means of UTI prevention, and expanded funding to provide additional supplements free of charge, or at a significantly reduced rate for more patients. Additionally, it is recommended that there remain a continued relationship between the community-based pharmacy and the urogynecology clinic to offer the recommended supplements at a discounted rate for all urogynecology surgical patients. This may significantly help to increase participation of patients and project sustainability, when free supplies are no longer available.

Conclusions

A decrease in UTI rates was seen in patients who opted to take recommended supplements within a standardized, evidence-based discharge bundle. This intervention demonstrates the potential for cost-effective use of supplements to prevent post-operative UTIs for patients undergoing urogynecology procedures. There was a consistent UTI rate reduction noted after bundle implementation. NSQIP UTI rates for all three months of bundle implementation were favorable at 0%; which is below the expected rate of <4%, and a drop from the previous 3 month UTI rate average of 6%. Implementation of this intervention allowed staff to educate and engage patients on non-antibiotic UTI prevention strategies and post-operative care. Further evaluation of economically efficient ways to provide recommended supplements to patients at a low or no cost, to encourage more patient participation is needed for sustainability.

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Appendix A – Evidence Review Table

Author, year	Study objective/intervention or exposures compared	Design	Sample (N)	Outcomes Studied (how measured)	Results	Level and Quality of Rating
Barnoiu,Sequeira-Garcia, Sanchez-Martinez, Diaz-Molina, Flores-Sirvent, &Baena-Gonzalez (2015)	To compare the UTI rate of American cranberry (120 mg)	*Prospective trial*	62 patients	A trial comparing UTI rate (positive urine culture) among 31 patients with double J catheter and adding American cranberry (120 mg) to routine prophylactic therapy	UTI percentage was lower in cranberry supplemented patient group (12.9 compared to 38.7% [P=.04]).	III (A)
Brubaker, Carberry, Nardos, Carter-Brooks, & Lowder (2018)	American Urogynecologic Society's establishment of current best practice for recurrent UTI diagnosis and the management of UTIs in post- surgical patients for stress urinary incontinence and/or pelvic organ prolapse	*Meta-analysis/Clinical Practice Guidelines*	N/A	Review of the current literature	-3 first line antibiotics for UTI treatment are recommended: nitrofurantoin, trimethoprim-sulfamethoxazole and Fosfomycin -After a single UTI, 30% to 44% of women will have a recurrent UTI, 50% will have a third episode if they have had 2 UTIs in 6 months. **Probiotics** -Probiotics: there is no strong evidence supporting the role of probiotics in rUTI prevention. -Systemic review of 5 studies (n=294) focusing only on	I (A)

					premenopausal women with current UTI or history of UTI showed that using selected lactobacillus strains that achieve vaginal colonization could prevent rUTI. -Larger Cochrane review included 9 probiotic intervention studies (n=735) with variable controls in healthy premenopausal and postmenopausal women found no significant reduction in rUTI in the probiotic group **Cranberry** -Cranberry majority of evidence does not support routine use of cranberry products in the care of women with rUTI. -One systemic review of 10 trials comparing cranberry products to placebo or non-placebo control in susceptible population concluded that cranberry products reduced risk of UTI in various subpopulations including women with rUTIs -A larger Cochrane review (n=4473) of placebo and non-placebo-controlled trials using various cranberry products in men, women and children with a history of at least 2 UTIs in the previous 12 months did not show a reduction in symptomatic UTI except in children -A more recent clinical trial of 185	

					elderly women randomized to cranberry capsules (72 mg, equivalent to 20 oz of cranberry juice) vs placebo showed no significant difference in bacteriuria plus pyuria; the study was not powered to detect differences in symptomatic UTI	
Dieter, A.A. (2015)	- To investigate whether cranberry (2 capsules two times per day, equivalent to two 8 oz servings of cranberry juice) taken for approximately 6 weeks after gynecological surgery reduces post-operative UTI.	*Randomized double-blind placebo-controlled trial*	160 participants were randomized (80 cranberry and 80 placebo). Over 90% of participants completed one follow up and 46% completed all three follow up visits. Randomization was stratified by age (<60 vs >/= 60) and participants and providers were masked to treatment allocation.	-Primary outcome was UTI treatment within 6 weeks of surgery. -Secondary outcome were incidence of e. coli UTI and time from randomization to UTI.	-Overall, 28% (45/160) of participants had a UTI, 77-80% of which were confirmed by urine culture. -Cranberry prophylaxis reduced UTI by half (19% (15/80) cranberry vs 38% (30/80) placebo; OR=0.38 (95% CI 0.19 to 0.79); p=0.008) -Median time to UTI was 18 days in cranberry vs. 8.5 days in placebo (p<0.001) - RCT found that women taking cranberry capsules two times per day for an average of 38 days following benign gynecological surgery involving intraoperative catherization had a 50% reduction in risk of UTI compared with placebo.	II (A)
Foxman, Cronenwett, Spino, Berger, & Morgan (2015)	To determine the therapeutic efficacy of cranberry juice capsules in preventing UTI in women undergoing elective gynecological surgery during which a catheter is placed	*Randomized, double-blind, placebo-controlled trial*	160 patients	-Women were randomized to receive 2 cranberry juice capsules twice daily for six weeks or	- The occurrence of UTI was significantly lower in the cranberry treatment group compared with the placebo group (15 of 80 [19%] vs 30 of 80 [38%]; odds ratio, 0.38; 95% confidence	II (A)

				matching placebo. -Primary outcome was to measure the proportion of participants who experienced clinically diagnosed UTI with or without a positive urine culture post-intervention	interval, 0.19-0.79; P = .008).	
Hooton, Vecchio, Iroz (2018)	-To assess the effectiveness of increased daily water intake to prevent recurrent cystitis in premenopausal women	*Randomized, open-label controlled, 12-month trial*	163 healthy women with recurrent cystitis drinking less than 1.5 L of fluid daily -23 were excluded and 140 assigned to water or control group	The primary outcome was the frequency of recurrent cystitis over 12 months. -Secondary outcomes were number of antimicrobial regimens used, mean time interval between cystitis episodes, and 24-hour urinary hydration measurements	-Increased water intake is an effective antimicrobial-sparing strategy to prevent recurrent cystitis in premenopausal women	II(A)
Maki, Kaspar, Khoo, Derrig, Schild, Gupta (2016)	-To assess the effects of the consumption of a cranberry beverage on episodes of clinical UTIs	*Randomized, double blind, placebo-controlled, multicenter clinical trial*	373 women (n=185; 240-mL serving of cranberry beverage vs. n=188; placebo) for 24 weeks	The primary outcome was the clinical UTI incidence density, which was defined as the total number of clinical UTI events (including multiple	-39 investigator-diagnosed episodes of clinical UTI in the cranberry group vs. 67 episodes in the placebo group (antibiotic use-adjusted incidence rate ratio? 0.61; 95% CI: 0.41, 0.91; P=0.016) -Clinical UTI with pyuria was significantly reduced	II(A)

				events per subject when applicable) per unit of observation time.	-Cranberry juice beverage lowered the number of clinical UTI episodes in women with recent history of UTI	
Schwenger, Tejani, Loewen (2015)	-To review the efficacy of prophylactic probiotic therapy in the prevention of UTIs compared to placebo or no therapy in terms of morbidity and mortality in susceptible patient populations	*Meta-analysis and systemic evidence search of randomized controlled trials*	9 studies that involved 735 people; 4 studies compared probiotic with placebo, two compared probiotics to no treatment, and two compared probiotics with antibiotics in patients with UTI; one study compared probiotic vs. placebo in healthy women	The overall primary outcome was to measure the differences in rates of recurrent UTI	-No significant benefit was demonstrated for probiotics compared with placebo or no treatment, but a benefit cannot be ruled out as the data were few, and derived from small studies -Evidence cannot rule out a reduction or increase in recurrent UTI in women who use prophylactic probiotics	I (B)
Stapleton et al. (2015)	-To evaluate the effectiveness of a lactobacillus crispatus intravaginal suppository probiotic for prevention of recurrent UTI in premenopausal women	*Double blind placebo-controlled trial*	100 women with history of recurrent UTI received either Lactin-V or placebo daily then once weekly for 10 weeks and were followed up at 1 week and 10 weeks post intervention and assessed for UTIs via urine culture	Overall outcome was to compare probiotic Lactin V to placebo	Recurrent UTI occurred in 7/48 15% of women receiving Lactin-V compared with 13/48 27% of women receiving placebo. High level vaginal colonization of l. crispatus was associated with significant reduction in UTI only for Lactin-V	I (A)
Wang, Fang, Chen, Liu, Yu, Wu, Chen, Lee, & Chen (2012)	-To evaluate cranberry-containing products for the prevention of UTI and exam the factors influencing their effectiveness	*Meta-analysis and systemic review search*	13 trials, including 1616 subjects – for qualitative synthesis & 1494 subjects were analyzed for quantitative synthesis	A search was completed of MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials, that compared prevention of UTIs in users of	-A subgroup analysis, cranberry-containing products seemed to be more effective in several subgroups, including women with recurrent UTIs (RR, 0.53; 95% CI, 0.33-0.83) (I(2) = 0%), female populations (RR, 0.49; 95% CI, 0.34-0.73) (I(2) = 34%), children (RR, 0.33; 95% CI, 0.16-0.69) (I(2) = 0%), cranberry juice	I (A)

				cranberry-containing products vs. placebo or non-placebo controls	drinkers (RR, 0.47; 95% CI, 0.30-0.72) (I(2) = 2%), and subjects using cranberry-containing products more than twice daily (RR, 0.58; 95% CI, 0.40-0.84) (I(2) = 18%). -Cranberry containing products are associated with protective effects against UTIs	

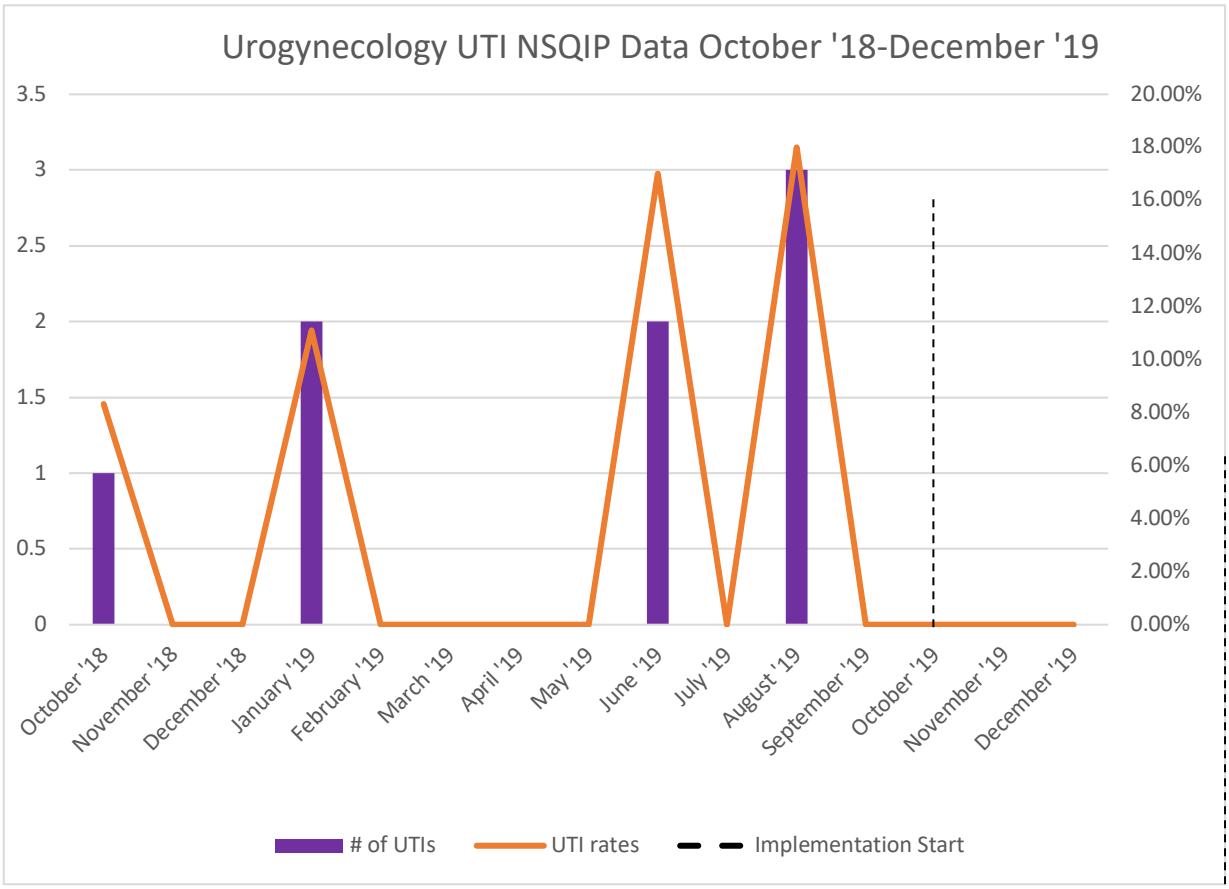

Figure 1. Urogynecology UTI NSQIP Data October 2018-December 2019