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Endourology and Stones

Reducing Opioid Utilization After Ureteroscopy Without Compromising Patient Outcomes in a Statewide Quality Improvement Collaborative

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A B S T R A C T

Objective: To evaluate the impact on patient-reported outcomes of the efforts by the Michigan Urological Surgery Improvement Collaborative (MUSIC) Reducing Operative Complications from Kidney Stones (ROCKS) initiative to reduce postoperative opioid use after ureteroscopy.
Methods: We evaluated MUSIC ROCKS patients with complete prescription and PRO data. PROMIS pain intensity and interference scores were compared between opioid and non-opioid users using multivariable regression models. A sub-analysis compared opioid users discharged with multimodal therapy and then required rescue opioids versus those given opioid at discharge.
Results: Opioid prescription rates after ureteroscopy declined from 83% in 2016 to 13% in 2023. Of the 405 opioid-naïve ureteroscopy cases; 23% reported opioid use within 7-10 days post-op. At 7-10 days after surgery, patients taking opioids had worse pain intensity and pain interference than those who had not. However, there were no statistically significant differences in PROs between those prescribed opioid at discharge versus those who required rescue opioid. Multivariable predictors of both pain intensity and interference included postoperative opioid use at 7-10 days, postoperative stent placement and preoperative stent use.
Conclusion: Opioid use after ureteroscopy has declined sharply in Michigan. We did not see evidence that PROs differed between patients discharged opioid-free who later required rescue opioids and those discharged with opioids, supporting the use of multimodal regimens. Postoperative stent use, however, was a key predictor of pain, highlighting its modifiable impact on outcomes.

As the prevalence of nephrolithiasis continues to increase, ureteroscopy (URS) has rapidly become one of the most commonly performed procedures in urology.[1-3] While major postoperative complications are rare, the most common source of unplanned postoperative encounters is pain.[4,5] Claims based analyses suggest opioids are used in up to 43% of ureteroscopies and 1 in 16 opioid-naïve patients develop new persistent opioid use after URS.[6,7] Due to the deleterious sequelae of opioid dependence, there have been national efforts to reduce opioid utilization.[8,9] Since its inception in 2016, the Michigan Urological Surgery Improvement Collaborative (MUSIC) Reducing Operative Complications from Kidney Stones (ROCKS) initiative has implemented multifaceted efforts to reduce postoperative opioid utilization after URS, including patient education and standardized prescriber guidance for opioid-free multimodal pain management.

While these efforts may have met objective endpoints, the impact on real-world health-related quality of life as measured by patient-reported outcomes (PRO) has not been explored. Declining opioid prescription rates could, for example, lead to worse PRO due to inadequate pain control. Patient-reported outcomes are increasingly prioritized within clinical research and practice to provide insight into how treatment may impact patient quality of life and overall well-being. These may be especially relevant to patients with nephrolithiasis, a disease where symptom burden and functional outcomes are key and may not

Abbreviations: CCI, charlson comorbidity index; ICIQ-S, International Consultation on Incontinence Questionnaire – Satisfaction; LURN SI-10, Lower Urinary Tract dysfunction research network symptom index-10; MUSIC, Michigan Urological Surgery Improvement Collaborative; NSAID, non-steroidal anti-inflammatory drug; PRO, patient-reported outcomes; PROMIS, Patient-Reported Outcomes Measurement Information System; ROCKS, Reducing Operative Complications from Kidney Stones; URS, ureteroscopy; USSQ, ureteral stent symptom questionnaire

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correlate with conventional clinical outcomes such as stone-free rate.[10,11] In 2020, MUSIC ROCKS began to collect baseline (preoperative) and postoperative PRO at 7-10 days after URS in an automated and standardized fashion.

In this context, we performed a retrospective cohort analysis of patients in Michigan who underwent URS for treatment of nephrolithiasis who reported PRO data. We hypothesized that reductions in postoperative opioid prescription after URS have not led to worse PROs. The findings from this work aim to inform ongoing opioid stewardship initiatives and support the continued adoption of multimodal pain (MMP) strategies to optimize postoperative recovery.

MATERIALS AND METHODS

Data Source

MUSIC is a statewide quality improvement initiative that brings together a diverse network of community and academic urology practices across Michigan. Funded by Blue Cross Blue Shield of Michigan, MUSIC represents over 90% of practicing urologists in the state. The collaborative maintains a custom-built prospective clinical registry, with data entered by trained abstractors at each participating site. The data undergo rigorous validation through semi-annual site visits and chart audits. In 2016, MUSIC expanded its scope with the formation of MUSIC ROCKS, aimed at enhancing care quality for patients with urinary stone disease. The ROCKS registry captures comprehensive demographic, clinical, and procedural data for patients undergoing URS or shockwave lithotripsy for kidney stones. Patient data entry begins at the initial surgical intervention, and outcomes such as unplanned emergency department visits or hospitalizations are monitored for up to 60 days post-procedure. Throughout the study period, MUSIC has developed and distributed educational resources for both providers and patients to promote the safety and potential benefits of opioid-free pain management pathways (https://musicurology.com/programs/rocks). As a quality improvement initiative, this work was deemed to be exempt from institutional review board approval.

ROCKS PRO System

MUSIC ROCKS instituted its PRO program in December 2020, which included Patient-Reported Outcomes Measurement Information System (PROMIS) Pain Intensity and Pain Interference short forms,[12] International Consultation on Incontinence Questionnaire—Satisfaction (ICIQ-S),[13] and Lower Urinary Tract dysfunction research network symptom index-10 (LURN SI-10).[14,15] ROCKS PRO is automated and distributes questionnaires preoperatively and at 7-10 days following URS. In May 2023, the pain medication/opioids and PROMIS emotional distress (depression and anxiety)[15] were added to the PRO program as a part of a currently ongoing randomized controlled trial. The complete ROCKS PRO questionnaire is appended as Supplementary Figure 2.

While medications prescribed at discharge were captured by chart review, opioid use was defined by patient self-report on the PRO questionnaire 7-10 days after URS. Patients were then categorized by whether they did or did not take opioids and whether opioids were prescribed at the time of discharge or in the subsequent perioperative period. Patients who were not prescribed opioids at discharge but who then reported taking opiates by 7-10 days after URS were defined as having received rescue opioids.

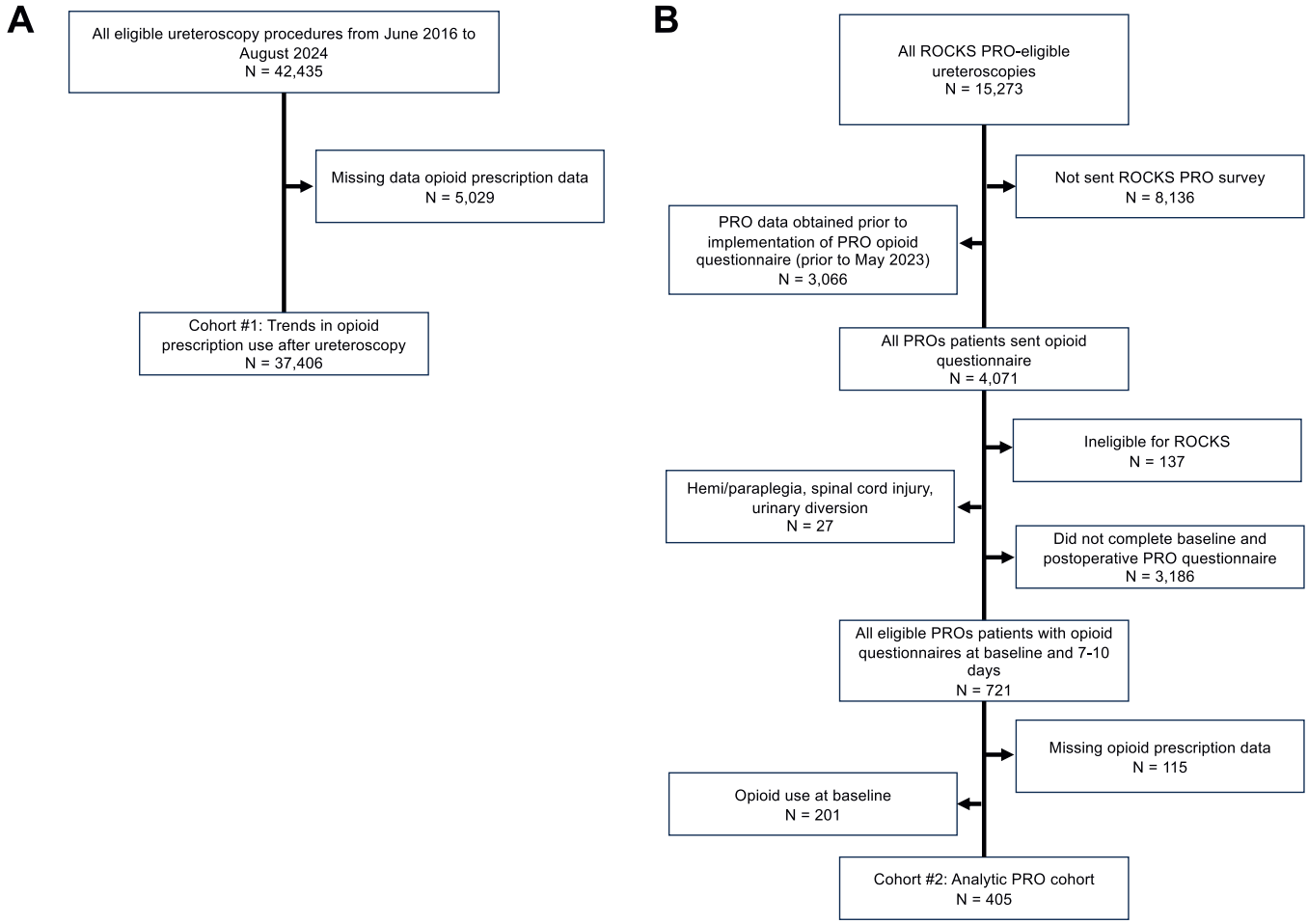

Figure 1. Cohort selection.

Table 1
Patient demographic, clinical characteristics, and discharge medication prescription.

	Opioid Not Taken	Opioid Taken	
	N = 297 (73%)	N = 108 (27%)	*P*-value
Age, median (IQR)	65 (54, 73)	62 (52, 69)	.044*
Race, n (%)			.24
White	267 (90)	104 (96)	
Non-white	19 (6.4)	3 (2.8)	
Unknown/refused	11 (3.7)	1 (0.93)	
BMI, median (IQR)	29.6 (26.0, 35.8)	28.7 (25.1, 34.0)	.12*
Missing	2	2	
Charlson comorbidity index, n (%)			.6**
0	166 (56)	62 (57)	
1	45 (15)	19 (18)	
2+	86 (29)	27 (25)	
Any Chronic Pain, n (%)	28 (9.4)	15 (14)	.2
Chronic pain disorder	9 (3.0)	10 (9.3)	.009
Chronic back pain	21 (7.1)	7 (6.5)	.8
Type 2 diabetes mellitus, n (%)	50 (17)	16 (15)	.6
Operative characteristics			
Stone size, median (IQR)	8.0 (6.0, 11.0)	8.0 (5.6, 10.0)	.6*
Missing	5	1	
Ureteral access sheath, n (%)	123 (42)	53 (49)	.19
Missing	2	0	
Preoperative stent, n (%)	89 (30)	15 (14)	.0011
Postoperative stent, n (%)	205 (69)	87 (81)	.022
Stent on string	113 (55)	47 (54)	.9
Discharge medication prescription, n (%)			
Opioid	17 (5.7)	26 (24)	< .0001
Any multimodal medication	270 (91)	95 (88)	.4
Acetaminophen	93 (31)	43 (40)	.11
Non-steroidal anti-inflammatory drug	178 (60)	54 (50)	.074
Alpha blocker	170 (57)	61 (56)	.6
Anticholinergic	89 (30)	44 (41)	.12
Pyridium	157 (53)	55 (51)	.7

P-values calculated from Chi-squared, Wilcoxon rank sum tests*, or Jonckheere-Terpstra tests**.

Registry

Patients over the age of 18 who underwent URS for urinary stones from June 2016 to August 2024 were identified using the ROCKS registry (n = 42,435). We created two cohorts from these data. Cohort #1 (Fig. 1A) was created with the intention of identifying annual trends in opioid prescriptions over time after URS. Patients with missing opioid data (n = 5029) were removed to create cohort #1 for a final analytic cohort #1 of n = 37,406.

Cohort #2 was created to evaluate PROs and opioid use (Fig. 1b). All ROCKS-PRO eligible ureteroscopies from December 2020 to August 2024 were identified (n = 15,273). Because sites were on-boarded in a stepwise fashion, not all patients were sent a ROCKS PRO survey during this timeframe (n = 8136). The opioid questionnaire was implemented in May 2023, so patients whose PRO data were obtained prior to this were similarly excluded (n = 3066). In addition, the following patients were excluded: those ineligible for ROCKS (n = 137); those who had history of paraplegia, spinal cord injury or urinary diversion as this could impact perception of pain in the postoperative period (n = 27); and those who did not complete both the baseline and postoperative questionnaires (n = 3186). Finally, those with missing opioid prescription data (n = 115 and those who reported opioid use at baseline (n = 201) were also excluded for a final analytic cohort #2 of n = 405.

Outcomes of Interest

The primary outcomes were 1) opioid prescription use over time, 2) measuring rescue opioid use, and 3) PROs including pain intensity and pain interference as measured by PROMIS measures, treatment satisfaction, emotion distress, and lower urinary tract symptoms, 4) identifying predictors of postoperative PROs and rescue opioid use.

Statistical Analysis

Demographic, clinical, procedural, and postoperative variables were compared between patients who reported taking opiates versus those who did not using Wilcoxon rank tests for continuous variables, χ^2 test or Fisher's exact test for categorical variables, and Jonckheere-Terpstra tests for ordinal variables. Demographic and clinical variables included age, race, body mass index (continuous), Charlson comorbidity index (categorical: 0, 1, 2+), any chronic pain (defined as chronic pain disorder or chronic back pain), and type 2 diabetes mellitus. Procedural factors in the analysis included stone size (continuous), use of access sheath, preoperative stent status, and postoperative stenting (including whether a tether was utilized). Lastly, postoperative factors included discharge medications (opioids, alpha blockers, anticholinergics, acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), and phenazopyridine hydrochloride. Use of an MMP regimen was defined as discharge with any of the non-opioid medications in combination.

Linear regression models were fit to assess the association between postoperative opioid prescription and use, and the outcomes of PROMIS pain intensity or interference at 7-10 days after surgery. These models were adjusted for age, BMI, chronic pain disorder, use of a ureteral access sheath, postoperative stent placement, and preoperative stent placement and included an interaction term between opioid prescription and use. Baseline and postoperative treatment satisfaction, patient-reported lower urinary tract symptoms, and emotional distress were compared between those who reported taking opioids in the first 7-10 days after surgery and those who did not using Wilcoxon rank tests. Logistic regression models were fit to identify factors associated with rescue opioid use in those who were not prescribed opioids at discharge. Variables included in the model were age, BMI, chronic pain disorder, use of a ureteral access sheath, postoperative stent placement, preoperative stent placement, and either baseline PROMIS pain intensity or pain interference, with an interaction term between preoperative and postoperative stent placement. Logistic models used Firth correction to account for low sample size and event rate in some groups. All analyses were performed on complete cases only. All analyses were performed using SAS version 9.4. We performed 2-sided significance testing with a 5% type I error rate..

RESULTS

Amongst the 16 practices and 93 surgeons included in the registry, 37,406 ureteroscopies were identified from 2016 to 2024. Rates of opioid prescription amongst MUSIC ROCKS urologists decreased from 86% in 2016 to 13% in 2023 (Supplementary Fig. 1). Of these cases, 15,273 cases were identified as ROCKS PRO eligible from December 2020 to August 2024, 4071 were sent the PRO opioid questionnaire, and 721 completed the PRO survey at baseline and 7-10 days (Fig. 1). Of these cases, 405 patients did not take opioids in the 30 days preoperatively and had complete PRO data and served as the analytic cohort (Fig. 1). At discharge, 43 (11%) patients were discharged with opioids and the remaining 362 patients were discharged with MMP only. By 7-10 days after surgery, 27% (n = 108) of patients reported taking opioids while the rest did not.

Patients who reported taking opioids were slightly younger (median 62 vs 65 years, P = .04) and had a higher proportion of chronic pain disorders (9% vs 3%, P = .009). Otherwise, demographic characteristics and past medical history were similar across both groups. Stone size and use of access sheaths were also similar across groups. Patients

Table 2
Comparison of preoperative and postoperative patient-reported outcomes by opioid utilization.

	Preoperative			At 7-10 days after ureteroscopy		
	Opioid not Taken (n = 297) Median (IQR)	Opioid Taken (n = 108) Median (IQR)	*P*-value*	Opioid not Taken (n = 297) Median (IQR)	Opioid Taken (n = 108) Median (IQR)	*P*-value*
PROMIS Pain Intensity	51.4 (36.3, 61.9)	51.4 (36.3, 61.9)	.9	54.8 (47.5, 61.9)	58.5 (54.8, 64.9)	< .001
Missing	0	0		1	0	
PROMIS Pain Interference	55.0 (41.0, 62.7)	54.4 (41.0, 61.8)	.7	56.1 (44.8, 65.0)	63.2 (57.1, 69.1)	< .001
Missing	0	0		1	0	
LURN SI-10	8.0 (5.0, 12.0)	7.0 (4.0, 10.0)	.2	21 (18, 23)	18 (13, 21)	< .001
Missing	0	0		7	6	
ICIQ-S	-	-		8 (5, 13)	10 (7, 15)	< .001
Missing				11	6	
Emotional Distress						
Anxiety	40.3 (40.3, 53.7)	40.3 (40.3, 53.7)	.7	41.0 (41.0, 51.8)	49.0 (41.0, 53.9)	< .001
Missing	6	5		14	8	
Depression	41.0 (41.0, 53.7)	41.0 (41.0, 51.8)	.2	40.3 (40.3, 51.2)	51.2 (40.3, 55.8)	< .001
Missing	6	5		14	8	

* *P*-values calculated from rank-sum tests

who took opioids were less often pre-stented (14% vs 30%, $P = .001$) and more often had postoperative stents (81% vs 69%, $P = .022$). At discharge, 90% of patients received multimodal medication and there were no statistically significant differences in multimodal medication receipt amongst these groups.

There were no statistically significant differences in baseline PROs across both groups (Table 2). At 7-10 days after surgery, however, patients who reported taking opioids had worse pain intensity and pain interference. In addition, patients taking opioids had worse scores on the LURN SI-10, ICIQ-S, and PROMIS Emotional Distress.

Of the patients discharged with a MMP regimen alone, 23% (n = 82) required rescue opioid. Conversely, of the 43 patients discharged with an opioid prescription, 40% (n = 17) reported not taking their opioid prescription. In a sub-analysis of patients who reported taking opioids comparing those prescribed opioid at discharge versus those who required rescue opioid, there were no differences in PROs (supplementary table 1) at either baseline or at 7-10 days after discharge.

From the linear regression models, patient-reported opioid use within 7-10 days after surgery was significantly associated with higher PROMIS pain intensity and interference at 7-10 days after surgery, adjusting for covariates ($\beta = 5.25$, 95% CI: (3.08, 7.41), $P = .013$ for pain intensity and $\beta = 6.44$, 95% CI: (3.96, 8.92), $P = .014$ for pain interference). However, opioid prescription at discharge (ie, provider prescription) was not significantly associated with PROMIS pain intensity or interference at 7-10 days after surgery ($\beta = 3.41$, $P = .23$ and $\beta = 3.37$, $P = .5$, for intensity and interference, respectively). The effect of opioid use on pain intensity and interference at 7-10 days did not differ significantly between those who were and were not prescribed opioids at discharge ($P = .3$ and .16). Baseline pain intensity and interference predicted 7-10 day intensity and interference, respectively Predictors of both pain intensity and interference at 7-10 days included postoperative opioid use, postoperative stent placement, and preoperative stent use whether a tether was used or not (Table 3). From the logistic regression models, neither baseline pain interference nor intensity was associated with rescue opioid use ($P = .8$ and .9, respectively) (supplementary table 2).

DISCUSSION

Our work has 3 principal findings. First, opioid prescriptions after URS amongst MUSIC urologists decreased from 86% to 13% from 2016 to 2023. Second, while 23% of patients discharged with a MMP regimen required rescue opioid prescriptions within 7-10 days from surgery, this did not compromise their postoperative PROs as there were no statistically significant differences regardless of whether patients were discharged with opioids or required rescue opioid. Third, predictors of

Table 3
Multivariable linear regression predicting pain intensity and pain interference at 7-10 days after ureteroscopy.

	Model 1: Pain Intensity			Model 2: Pain Interference		
	β	95% CI	*P*-value	β	95% CI	*P*-value
Baseline PROMIS Pain Intensity (1 unit increase)	0.26	0.19-0.34	< .001	-	-	
Baseline PROMIS Pain Interference (1 unit increase)	-	-		0.36	0.27-0.45	< .001
Opioids taken within 7-10 days after surgery	5.25	3.08-7.41	.013	6.44	3.96-8.92	.014
Opioids prescribed at discharge	3.41	−0.85 to 7.67	.23	3.37	−1.48 to 8.23	.5
Opioids taken within 7-10 days *Opioids prescribed at discharge	−3.24	−8.9 to 2.43	.3	−4.65	−11.12 to 1.81	.13
Age (per 5 years)	−0.38	−0.7 to −0.05	.02	−0.29	−0.66 to 0.08	.16
BMI (per 1 unit increase)	0.02	−0.09 to 0.13	.7	−0.02	−0.15 to 0.1	.7
Chronic Pain	0.78	−1.99 to 3.55	.6	1.64	−1.55 to 4.83	.3
Ureteral Access Sheath	−0.66	−2.48 to 1.16	.5	−0.51	−2.59 to 1.57	.6
Post-op Stent			< .001		-	< .001
Stent omission	ref	ref		ref	ref	
Stent, no tether	3.09	0.72-5.47		3.67	0.95-6.38	
Stent with tether	3.57	1.27-5.87		5.27	2.64-7.9	
Pre-op Stent	−4.77	−6.93 to −2.62	< .001	−4.61	−7.09 to −2.13	< .001

worse 7-10 day pain interference and intensity included not only opioid use but also postoperative stent placement. Preoperative stent placement was protective. Collectively, these findings support the use of rising and widespread use of MMP instead of opioids, though a subset of patients still experience worse postoperative pain.

URS has low rates of severe complications, however, postoperative pain is common and a significant cause of unplanned healthcare utilization. The discomfort associated with URS appears to be unique as, in comparison to other urologic procedures, URS has a 2.5-fold higher risk of having a pain-related encounter[16] leading to kidney stone procedures having the highest rates of postoperative opioid dependence.[17] In one report, two-thirds of patients after URS had an unplanned healthcare encounter, 80% of which were due to pain.[16] As a result, opioids were commonly prescribed for analgesia. In a retrospective cohort study, despite 61% of patients already being prescribed opioids preoperatively, 12% required an additional opioid prescription postoperatively, and 7% continued these medications for more than 60 days postoperatively.[18] Opioid use though has fallen nationally in the postoperative setting over the last decade largely due to increase emphasis on opioid stewardship and state- and payer-based policies on prescribing for acute pain.[8,9] Our data support this trend even after a procedure uniquely predisposed to postoperative pain, as rates amongst MUSIC Urologists have decreased to 13%.

Multimodal pain regimens were developed as alternatives to opioid medications to address the challenges associated with postoperative pain after URS. Our group has previously reported that providing a multimodal pain regimen is not associated with increased unanticipated healthcare utilization[19] which also has been reported in two randomized trials.[20,21] Patient-reported outcomes, as measured by the ureteral stent symptom questionnaire (USSQ) pain index, have also been shown to be similar between MMP and opioid cohorts.[20,21] Implementation of an opioid-free enhanced recovery after surgery protocol reduced opioid prescriptions by 90% and did not increase postoperative healthcare utilization at a tertiary care center.[22] Nonetheless, a subset of patients requires rescue opioids despite an initial attempt at a MMP regimen. We report an opioid-free failure rate of 23% which is similar to previous reported rates of 16%[23] and 24%.[24] However, amongst patients who took opioids, there were no statistically significant differences in postoperative PROs regardless of whether patients were discharged with opioids or required rescue opioid (supplementary table 1). We additionally did not identify predictors for rescue opioid use which is an arena for further investigation. Nonetheless, our findings suggest that failure of multimodal-only discharge does not result in worse patient-reported outcomes compared to discharge with opioid prescriptions, supporting the continued use of multimodal-only strategies.

Our findings do highlight the critical impact that ureteral stent utilization has on postoperative pain. Predictors of worse postoperative PROMIS pain intensity and interference scores included postoperative stent placement, while preoperative stent placement was protective. Stents are associated with detrimental effects on patient health-related quality of life and result in flank pain, hematuria, and other bothersome lower urinary tract symptoms lead to a large impact on PROs, including pain intensity, interference, and urinary symptoms.[25-28] The ongoing Stent Omission after Ureteroscopy and Lithotripsy study[29], a pragmatic randomized controlled trial, may shed further light on the impact MMP regimens and stent use have on PROs.

Our work has several important limitations. First, we did not have PRO data prior to implementation of our opioid reduction initiatives as PRO data collection started in December 2020, four years after the collaborative was formed. In addition, it is possible that patients who received opioids in our MUSIC ROCKS cohort had uncaptured sources of chronic pain which made them less sensitive to an opioid-free regimen. We did, however, adjust for patients with documented chronic pain and if this were to be biased, we would expect PROs to be skewed towards more pain intensity which we did not observe. Our cohort was racially homogenous with 90% reporting as white, which may limit national generalizability, however, the collaborative does collect data from a range of practices from community to academic across Michigan. Finally, we did not capture all unanticipated healthcare encounters such as clinic phone calls or outpatient electronic messages, though we have previously demonstrated that an opioid-free approach does not increase emergency department visits.[19]

Collaborative, large-scale quality improvement initiatives bring together diverse stakeholders, including healthcare providers, administrators, and patients, to design and implement comprehensive strategies to improve patient outcomes on a broad scale. Our work shows the impact that such a quality improvement initiative has had on opioid prescription rates after URS, decreasing from 86% at its conception to 13% in 2023. Provider and patient-facing documents created by our group encouraging the use of MPP, likely contributed to opioid reduction over time. In addition, these findings reiterate the importance that ureteral stent use has on PROs. While we did not identify predictors of rescue opioid use, this may be attributable in part to the limited sample size, particularly given the recent implementation of the opioid questionnaire. As we continue to expand our PRO infrastructure and accrue more data, future efforts will focus on phenotyping patients to identify subgroups at increased risk for poor postoperative experiences.

CONCLUSION

Postoperative opioid utilization after URS has decreased in the state of Michigan to 13%. MMP regimens commonly utilized though up to 23% of patients prescribed such regimens required postoperative rescue opioids for pain control. Despite this, they did not report worse PRO compared to those discharged with opioids, suggesting PROs are not compromised by these strategies. Ureteral stent use was associated with opioid-free failure and PROMIS pain interference and intensity. Further research around postoperative pain management should further evaluate the role of stent omission, an effort actively under investigation in our group.

Ethical Declarations

As a quality improvement initiative, this work was deemed to be exempt from institutional review board approval (HUM00054438).

Disclosures

K.R.G. is a consultant for Boston Scientific, Olympus, Storz, Coloplast, and Ambu. Investigator funding from Boston Scientific, Coloplast, and Blue Cross Blue Shield of Michigan. C.A.D. is a consultant for Boston Scientific, Cook Medical. Investigator funding from Blue Cross Blue Shield of Michigan. W.S. is a consultation for Boston Scientific and Storz.

CRediT Authorship Contribution Statement

Wilson Sui: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Suprita Krishna:** Visualization, Resources, Methodology, Investigation, Data curation. **Russell Becker:** Writing – original draft, Visualization, Investigation, Data curation, Conceptualization. **Andrew M. Higgins:** Writing – original draft, Validation, Investigation, Data curation, Conceptualization. **Caitlin Seibel:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Stephanie Daignault-Newton:** Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation. **Golena Fernandez Moncaleano:** Writing – review & editing, Investigation, Conceptualization. **Hector Pimentel:** Writing – review & editing, Investigation, Conceptualization. **Brian D. Seifman:** Writing – review & editing, Investigation, Conceptualization. **David L. Wenzler:** Writing – review & editing, Investigation, Conceptualization. **Karla Witzke:**

Writing – review & editing, Investigation. **Khurshid R. Ghani:** Writing – review & editing, Supervision, Funding acquisition, Data curation, Conceptualization. **Casey Dauw:** Writing – review & editing, Writing – original draft, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of Competing Interest

The authors have no conflict of interest to declare.

Appendix A. Supporting Information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.urology.2025.12.044.

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