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Research Paper

"Impact of regional data reporting and feedback on rectal cancer surgery quality metrics in the Surgical Care Outcomes Assessment Program (SCOAP)"

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HIGHLIGHTS

- Rectal cancer surgical care is complex, and defined metrics are used to assess quality.
- Achievement of quality metrics is variable on individual and institutional levels.
- SCOAP gathers quality data on all rectal cancer resections at participating sites.
- SCOAP provides continuous and interval in-depth feedback for directed improvement.
- In-depth feedback is associated with improved metric achievement.

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ABSTRACT

Background: Management of rectal cancer is increasingly complex. Leading societies describe metrics of high-quality perioperative rectal cancer care with the goal of reducing variation in practice and improving outcomes. This study was designed to describe the impact of targeted feedback at the institutional level on improving achievement of rectal cancer quality metrics.

Methods: Adult elective rectal cancer resections performed at institutions that continuously participated in SCOAP between 2011 and 2022 were included for analysis. Quality metrics evaluated were preoperative MRI (MRI), determination of tumor location (TL), use of neoadjuvant chemoradiation (NAC), performance of a total mesorectal excision (TME), 12+ lymph nodes resected (LN), and composite negative margins (NM). In-depth feedback on these metrics was provided by SCOAP at the end of 2015 and 2019. Achievement of the metrics was evaluated before (2011–2016), between (2017–2019), and after (2020−2022) feedback events to determine effect on achievement.

Results: 1962 resections were performed at 19 institutions. There were statistically significant increases in MRI (2011–2016 = 32 %, 2017–2019 = 88 %, 2020–2022 = 92 %;$p < 0.01$), TME(47 %, 68 %, 80 %;$p < 0.01$), and LN(76 %, 86 %, 86 %;$p < 0.01$) after one or both feedback events. TL(67 %, 69 %, 70 %;$p = 0.558$), NAC(62 %, 63 %, 67 %;$p = 0.124$), and NM(98 %, 97 %, 96 %;$p = 0.39$) were not significantly different. Mean composite score for metrics increased after each feedback (2011–2016 = 3.8±1.4; 2017–2019 = 4.3±1.4; 2020–2022 = 4.5 ±1.5;$p < 0.01$).

Conclusion: Interval, in-depth feedback on rectal cancer quality process metrics was associated with increased achievement of several metrics and overall number of metrics achieved. Broader implementation of this feedback method could further advance the quality of rectal cancer surgical care.

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Introduction

Colon and rectal cancers are the second leading cause of cancer related deaths in the United States with an estimated 53,000 deaths to be attributed to colorectal cancer in 2024. Rectal cancer incidence is expected to be >45,000 in 2024 (1) with trends suggesting a rise in incident cases in younger patients (1). Rectal cancer survival is consistently lower than colon cancer stage for stage worldwide (2). There is a notable distinction in the workup and management of colon as compared to rectal primary cancers, with rectal cancer typically being more complex in both requiring a multidisciplinary approach to care and the need to keep pace with continuously evolving evidence. To this effect, experts and societies have created consensus guidelines to improve outcomes in rectal cancer surgery. Several studies have shown that adherence to these guidelines significantly improves rectal cancer associated morbidity (3). Adherence to these recommendations is overseen by regulatory boards such as the National Accreditation Program for Rectal Cancer (NAPRC), though many hospitals where rectal cancer resections are performed are not accredited (4). Adoption and achievement of rectal cancer care standards are variable, likely due to several factors including resource disparities, challenges in the feasibility of rectal cancer care regionalization to high volume centers, and lack of internal and/or external quality control.

Strategies to best implement and prioritize rectal cancer surgery standards in the United States have not been well described. Publications describing audits of cancer care have shown to increase adherence to guidelines and improved outcomes (5–8). However, audits must be intentional and are expensive, time consuming, and require buy-in from administration. In particular, a given institution may have several, competing quality initiatives and allocation of resources can be a challenge. One avenue for obtaining data on quality of care is through participation in quality consortiums. Many hospitals, both large and small, participate in some form of quality consortium. However, programs report variable information in different ways, and it is often up to the individual hospital to identify deficiencies and act based on these data. As of yet, the effect of organized, continuous and in-depth feedback on the adherence to rectal cancer surgery care guidelines in a standardized fashion has not been studied.

Therefore, we aimed to describe the impact of the continuous feedback and benchmarking from a large regional quality improvement consortium on achievement of several rectal cancer surgery quality metrics based on societal guidelines. We hypothesized that sites continuously involved in the initiative would see steady improvement in both individual and composite metrics.

Materials and methods

This study was exempted from human subjects review by the Institutional Review Board at Benaroya Research Institute of Virginia Mason Medical Center.

Data source and population

A retrospective cohort of all adult (age 18+ years) elective rectal cancer resections performed at 19 hospitals that participated in the Surgical Care Outcomes Assessment Program (SCOAP, Foundation for Health Care Quality, Seattle, WA, USA) for each year from 2011 to 2022 was compiled. A total of 43 institutions participated in SCOAP for at least a portion of the study period, with a total of 2890 elective rectal cancer resections occurring at these sites. However, only 19 institutions contributed data to the SCOAP rectal cancer database every year between 2011 and 2022 and were ultimately included.

SCOAP is a quality improvement initiative of the Foundation for Health Care Quality based in the Pacific Northwest region of the United States. The participating sites include community, academic, teaching, and critical access hospitals. The collaborative, abstraction process, and details on feedback delivery have been previously described (9–12). At participating sites, all colon and rectal operations are reviewed and abstracted by dedicated coders. This distinguishes the data source from other databases that may only sample a representative portion of operations. A list of metrics and data dictionary are available on request from www.qualityhealth.org/scoap. Metrics on various initiatives are agreed upon by advisory panels involving surgeons and representatives from participating sites.

Definitions and outcomes

In addition to continuous access to data for internal evaluation, SCOAP periodically provides systematic and individualized feedback to participating institution on quality metric data obtained providing benchmarks for improvement. These “deep dive” feedback events for the rectal cancer module occurred at the end of 2015 and end of 2019. By evaluating the rate at which these metrics were achieved before, between and after two feedback events, associations between feedback and improvement can be determined on an inclusive regional scale.

Elective operations were defined based on the operating surgeon's documentation and hospital-specific case acuity per SCOAP definition. Included operations performed for rectal cancer were, total colectomy, low anterior resection (LAR), ileal pouch anal anastomosis (IPAA), and abdominoperineal resection (APR). Surgical approach was categorized as “Open”, “Laparoscopic” for laparoscopic and laparoscopic/hand-assisted approaches, and “Robotic” for the robotic-assisted approach. Likewise, combined adverse effects are defined as any need for additional intervention or re-operation within 30 days of index operation or in-hospital death.

Six perioperative metrics of high-quality rectal cancer care were built into the SCOAP rectal cancer module based on feedback from the clinical advisory board. Metrics were established prior to 2011 when the study period begins. These six metrics were specifically included in the targeted benchmarking and feedback provided continuously and during the “deep dive” events and included performance of preoperative MRI for staging (MRI), endoscopic determination of the location of the primary tumor as referenced from the anal verge (TL), the delivery of neoadjuvant chemoradiation (NAC), whether or not a total mesorectal excision was completed at the time of operation (TME), 12 or more lymph nodes were harvested at the time of excision (LN), and whether or not negative margins were achieved (NM), with the last three abstracted from pathology reports. Negative margins is a composite of distal and radial margins.

Composite score as defined in this manuscript is a score developed post-hoc to assess from another perspective. It was calculated by tallying the number of metrics achieved for each resection (0–6). This score was then averaged for each of the three time periods of the study and compared to evaluation correlation between feedback events and improved metric achievement.

Statistical analysis

Descriptive statistics were provided to characterize the cohort. The completion rates of the described quality metrics were compared based on when the resections were performed, separated into before (2011–2016), between (2017–2019) or after (2020–2022) feedback events delivered by SCOAP. The rate of completion of each of the six described metrics for each resection was compared between these time periods using Pearson χ^2 statistical analysis. Composite score (0–6) for each resection was calculated and means were compared between time periods using analysis of variance (ANOVA). The rate of completion of five or more metrics for each resection was calculated and compared with ANOVA. All statistical analyses were conducted using STATA software, version 15 (College Station, Texas, USA) with statistical significance considered at a 2-sided alpha value of 0.05.

Results

A final cohort of 1962 resections (mean age = 61.1 years, 39.5 % female) were included in this analysis (Table 1). The number of resections performed at each of these institutions over the study period ranged from 9 to 322. MIS use increased yearly over the study period (Fig. 1), with increasing utilization of robotic assistance (2011 = 0 %, 2022 = 67.3 %, $p < 0.001$).

The rate of utilization of preoperative MRI for staging increased significantly after the first feedback event from 31.7 % to 87.6 % and further to 91.7 % ($p < 0.01$) after the second feedback event (Fig. 2). Likewise, the rate of TME performed (2011–2016 = 46.6 %, 2017–2019 = 68.3 %, 2020–2022 = 79.8 %; $p < 0.01$), adequate lymph node harvest (2011–2016 = 76.6 %, 2017–2019 = 86.2 %, 2020–2022 = 85.6 %; $p < 0.01$) also increased by a statistically significant margin. The implementation of neoadjuvant chemoradiation (2011–2016 = 61.7 %, 2017–2019 = 63.2 %, 2020–2022 = 67.4 %; $p = 0.142$) and determination of tumor location in relation to the anal verge (2011–2016 = 67.1 %, 2017–2019 = 68.8 %, 2020–2022 = 70.0 %; $p = 0.558$) increased after each feedback but were not statistically significant. Clear margins were obtained in the vast majority of resections no matter the time period (2011–2016 = 97.5 %, 2017–2019 = 96.8, 2020–2022 = 96.1 %; $p = 0.39$).

The mean composite score for rectal cancer quality metrics (Fig. 3) increased significantly during each time period (2011–2016 = 3.8±1.4; 2017–2019 = 4.3±1.4; 2020–2022 = 4.5±1.5; $p < 0.01$). Similarly, the proportion of resections for which 5 or more metrics were achieved also increased across each feedback event (2011–2016 = 33 %, 2017–2019 = 52 %, 2020–2022 = 60 %; $p < 0.01$).

Discussion

In this cohort of hospitals continuously participating in the SCOAP network, we found an increased achievement of use of pre-operative MRI for staging, reporting of tumor location, completion of TME during resection, rate of harvesting at least 12 lymph nodes, and, importantly, an increase in the average number of quality metrics achieved per case after each feedback session. This suggests that there may be an association between feedback and increased achievement of rectal cancer quality metrics. There are several potential explanations for these findings.

The increased achievement of quality metrics may be related to increased awareness of rectal cancer guidelines over time, or perhaps an increased access to technologies. Since the start of this study, there have been focused efforts by NSQIP and the formation of the NAPRC in 2017 to improve rectal cancer care nationally. The success of these initiatives has been mixed. There are studies that show improvement in outcomes when compliance is achieved at accredited hospitals (13). However, this same study notes poor compliance reporting. Additional review of the data from the NAPRC note that the benefit of accreditation may be greater for low volume institutions that do not have the resources for multidisciplinary care (14). Even then, it is resource intensive to achieve accreditation. Notably none of the hospitals in the present study were accredited during the study period (three potentially eligible hospitals have since achieved accreditation – one that remains included in the data, and two that have accreditation but were excluded from this study because they did not continuously participate in SCOAP during the study period).

An example of access to technology over time leading to increased metric achievement would be the observed large increase in pre-operative MRI use for staging between 2011 and 2016 and 2017–2020 as seen in Fig. 2. The use of MRI became more feasible and affordable over that time frame. Reviews on MRI use for staging from around 2011 note several challenges including cost and early technologic challenges with the use of endorectal coils (15). As these issues resolved with time, it stands to reason that adoption of MRI for staging would increase.

Table 1
Patient, cancer, operative characteristics and outcomes, stratified by time periods before and after feedback on metrics.

	2011–2016 ($n = 929$)	2017–2019 ($n = 639$)	2020–2021 ($n = 394$)	*P*-value
Patient demographics				
Mean age (years)	61.3	60.9	61.1	
Age > 65 (%)	38.5	40.7	41.9	$p = 0.466$
Male (%)	59.4	59.9	64	$p = 0.239$
Female (%)	40.6	40.1	36	
White race (%)	83.1	85	81	p = 0.239
Private insurance	69.4	73.9	67.8	$p = 0.067$
Mean BMI	27.2	27.6	27.6	
BMI > 30 (%)	40.8	38.3	27.7	**$p < 0.005$**
ASA Category (%)				**$p < 0.005$**
I	3.8	2.5	0.8	
II	57.3	51.4	45.9	
III	37.9	43.7	52	
IV	1.1	2.4	5	
Cancer staging				
Clinical T Stage (%)				**p < 0.005**
T1	5.9	2.8	5.5	
T2	9.2	12.6	14.7	
T3	35.4	35.5	38	
T4	7.4	8.1	13.2	
Tx	41.6	39.8	28.2	
Pathologic T Stage (%)				**p < 0.005**
T0	11.5	10.4	13.3	
Tis	0.3	2.4	2.3	
T1	10.5	8.8	8	
T2	23.1	23.8	25	
T3	37.4	40.6	40.1	
T4	6.2	7.5	6.1	
Tx	10.1	7.5	6.6	
Pathologic N Stage (%)				$p = 0.363$
N0	57.6	62.4	63	
N1	23.7	21.9	24.2	
N2	10.4	8.6	6.6	
N3	0.2	0	0	
Nx	8	7.1	6.1	
Pathologic M Stage (%)				**p < 0.005**
M0	21.8	11.3	15.9	
M1	3.5	5.1	4.1	
Mx	74.7	83.6	80	
Operative details				
Approach				**p < 0.005**
Open (%)	51.1	18.6	18	
Laparoscopic (%)	40.3	42.4	26.4	
Robot assisted (%)	8.6	39	55.6	
Operation				
APR[a] (%)	27.9	25.8	26.1	$p = 0.623$
LAR[b] (%)	66.5	64.3	61.9	$p = 0.260$
TPC[c] (%)	0.9	3	2.3	$p = 0.007$
Short term outcomes				
Discharge to home (%)	91.8	93.3	93.4	$p = 0.446$
Combined adverse events[d] (%)	31.4	25.8	31.7	$p = 0.035$

Bolded p values indicate statistical significance with an alpha value of 0.05 used as threshold.

[a] Abdominoperineal resection.
[b] Low anterior resection.
[c] Total proctocolectomy.
[d] Combined adverse events is defined as the need for reintervention, reoperation, or in-hospital death.

However, it is promising that the rate of achievement of "MRI use" increased significantly after each feedback event, suggesting there was attributable benefit of the "deep-dive" feedback beyond the expected, gradual growth over time.

One important consideration of this work is that the trends noted in achievement of metrics may be related to the continuous data reporting provided by SCOAP. It is likely that some of the improvement seen over time is related to this readily available data, effectively Hawthorne effect (16). This, when compounded with one-off audits on cancer quality care, may have a dramatic effect (5–8).The "deep-dive" feedback events by SCOAP serve as something like a program or system wide audit and likely had a similar effect. The notable difference between the findings here and other studies is that the effect persists with additional or multiple feedback events. Effectively in SCOAP, these feedback events act as benchmarks, and perhaps the generalizability to the hospitals throughout the region make it particularly relatable for improvement.

Another important consideration for this study is the exclusion of

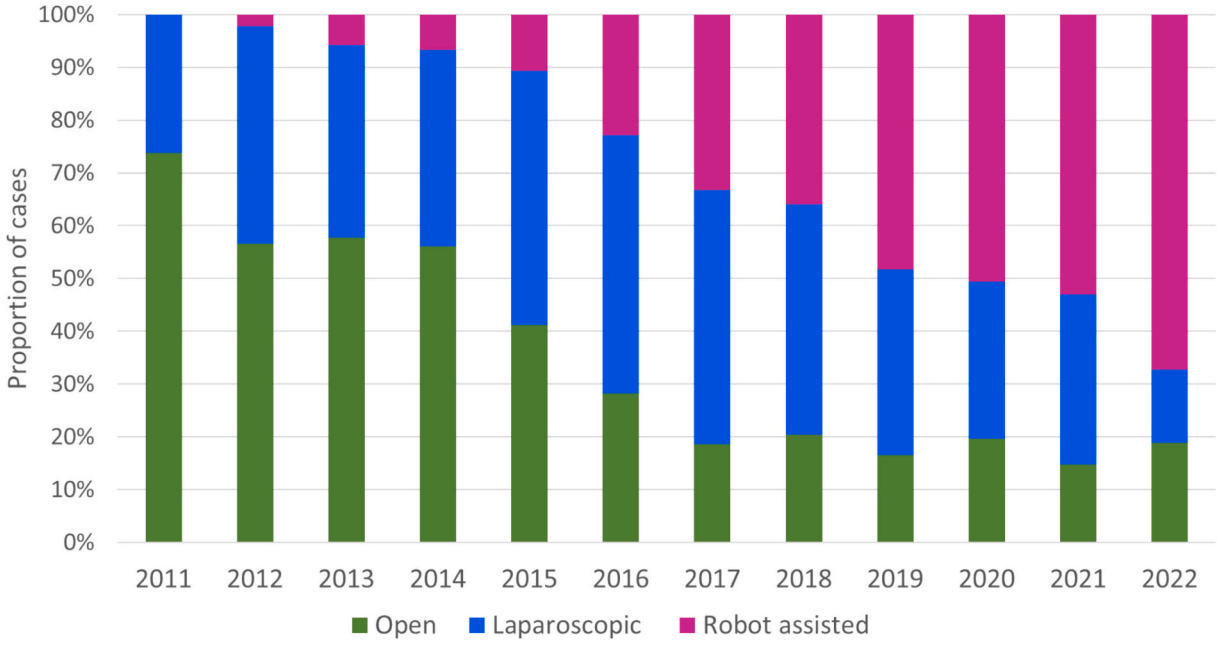

Fig. 1. Proportion of elective rectal cancer resections approached open, laparoscopic, and robotic between 2011 and 2022.

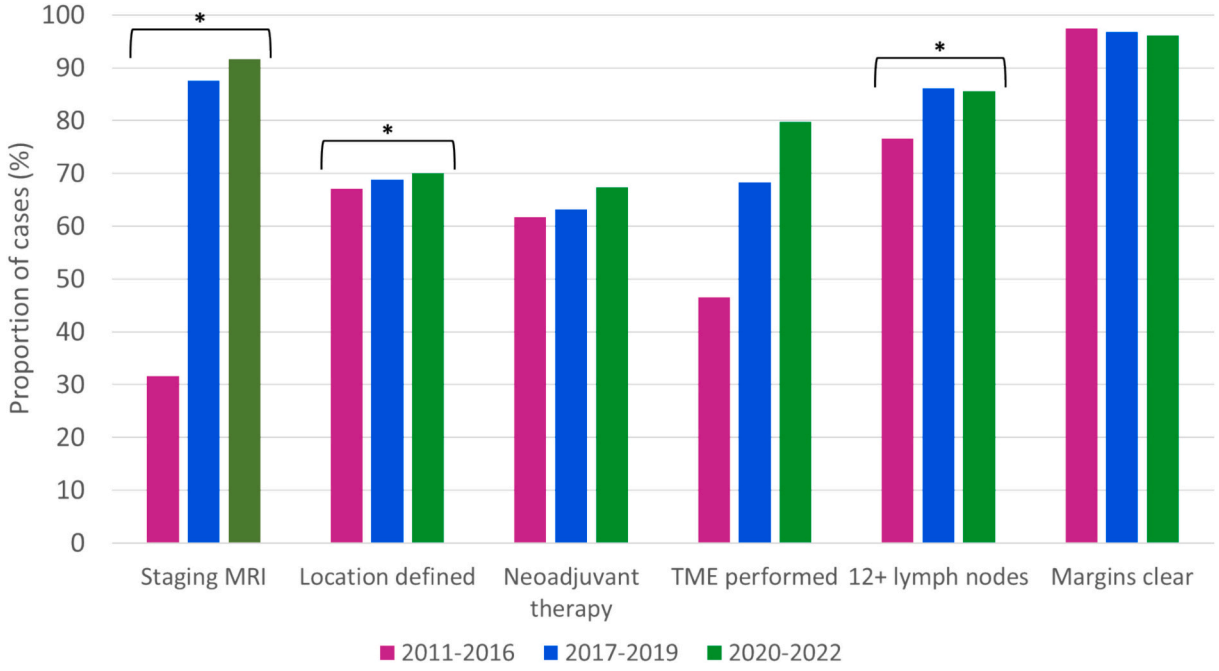

Fig. 2. Mean proportion of achievement of quality measures comparing time periods of 2011–2016, 2017–2019, and 2020–2022
Statistically significant; $\alpha = 0.05$.

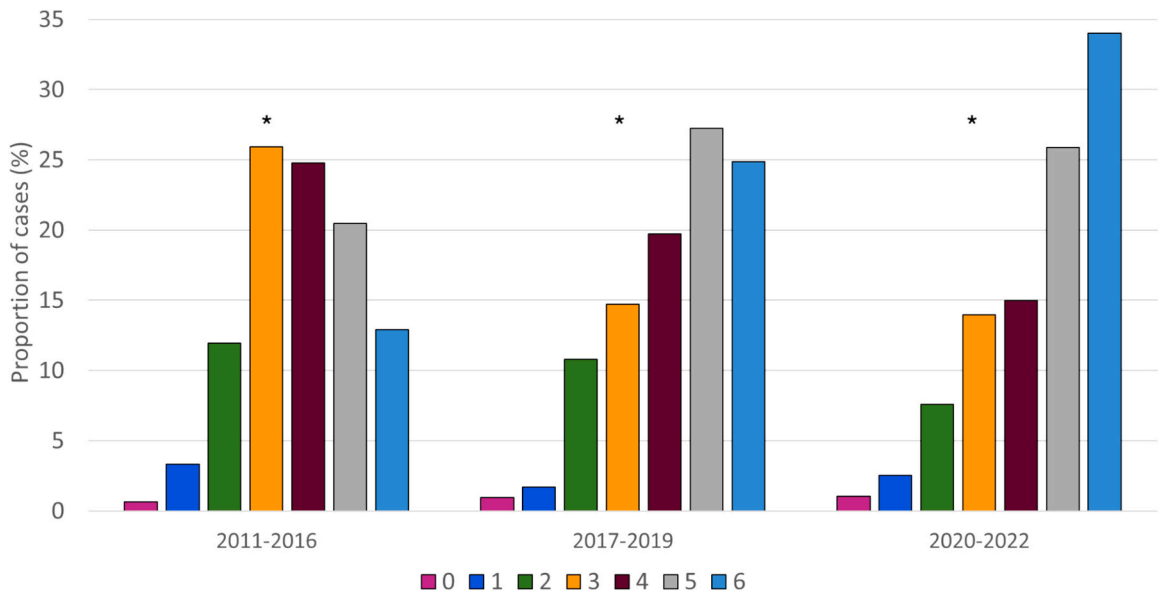

Fig. 3. Proportion of cases achieving composite score (1–6) during the time periods of 2011–2016, 2017–2019, and 2020–2022
* = statistically significant mean composite score difference; α = 0.05.

hospitals that did not continuously contribute data during this long study period. The ideal way to evaluate whether or not "deep-dive" feedback was the driver behind the improvement seen would be to evaluate the metrics from this study for those hospitals that participated in SCOAP for a time but dropped out prior to one or both feedback events in 2017 and 2019 and comparing these data to that presented here. The reasons for institutions leaving the initiative are not available. However, we postulate that reasons could be related to cost of participation, especially in light of the COVID pandemic occurring during the study period when many hospitals struggled financially. In addition, some higher volume institutions received NAPRC accreditation or developed internal auditing systems for rectal cancer care which may have led to dropping out of participation. While it's encouraging that those hospitals included in the study showed improvement across overall (composite) rectal cancer metrics, it's not clear how different this change is compared with non-included sites.

An important limitation is that by including facilities that participated in SCOAP for the entirety of the study period, we are introducing a certain amount of selection bias to this data. It is possible that sites that were in SCOAP for the entire study likely valued the feedback on quality metrics, and were more likely to implement the data into policy and practice. It may be that these sites are rectal cancer referral centers, who are similarly receiving referrals and adopting the highest quality metrics, but improving secondary to local culture, not necessarily the SCOAP deep dives.

Secondly, the study period includes the time surrounding the COVID19 pandemic. Healthcare delivery was altered and access to care involved increased nuance, no doubt affecting adherence to healthcare metrics. Specifically during this period we would expect a higher clinical stage at presentation (17,18). Nonetheless, there was a general increase in achievement of metrics during this time immediately following feedback events.

Furthermore, data collected by SCOAP are subject to heterogeneity in reporting. For example, in Table 1, there are a relatively high percentage of cases reported to be clinical stage "x". It has been previously hypothesized that missing data such as this is a useful measure for quality improvement in non-cancer cases (19). The missing data in this case is due to abstractors relying on specific phrasing in documentation for collection. It would be expected with the increased use of MRI for staging seen in the data that clinical T stage would be reported at a similarly high rate. However, MRI reports are not standardized and many times do not explicitly include the T stage. There have been efforts to standardize reporting per NAPRC standards (20), and some institutions have transitioned to synoptic type MRI reporting for rectal cancer as they work to improve their care quality. There is a decrease in the percentage of cases categorized as "Tx" across time intervals (2011–2016 = 41.6 %, 2017–2019 = 39.8 %, 2020–2021 = 28.2 %), possibly reflecting this change. While this was not the focus of the study, it remains a limitation of the data and presents an avenue for further improvement.

Finally, the dataset used is not comprehensive. Data used in this study from rectal cancer resections only. Because of this, specific data on variables such as initial stage, neoadjuvant therapy, and response to such therapies are not available. While it would certainly be interesting to subset the data based on clinical variables to determine stage specific metric achievement, in the case of this study, it would lead to misclassification. For example, the data do not specify the type of neoadjuvant treatment for an individual lesion nor the response to the treatment. Decisions to proceed with resection may depend on these data and thus would introduce misclassification bias into the results. The data for pathologic stage are available as surgical specimens are included. While not an ideal surrogate for clinical stage, as stage can be downgraded with neoadjuvant treatment, similar rates of locally advanced disease are seen in each time period of the study. Another potential discrepancy in the data lay in the relatively poor achievement of TME early in the study while proportions of cases achieving adequate LN harvest and negative margins are high throughout. On the surface, this may seem inaccurate. However, there are many clinical nuances that may influence lymph node harvest and positive margins including operations occurring after neoadjuvant therapy, tumor specific TME, and the fact that negative margins and harvesting 12 or more lymph nodes is achievable without a formal TME. Ultimately, the data to parse out the effect of TME on lymph node harvest or margins is not available through SCOAP. As mentioned prior, SCOAP is not meant to replace data reported in other registries that may offer information on cancer stage and quality of the operations. These are reported elsewhere. Importantly, there is no conclusion to draw on mortality and survival outcomes of these cases. However, the metrics may serve as a surrogate for these.

Conclusions

To our understanding, this is the first study of this size to evaluate the

effect of feedback on quality metrics in rectal cancer care by continually tracking them in the same network over 11 years. We have not been able to identify any other studies that evaluate the effect of feedback on quality metric achievement with the exception of evaluating NAPRC feedback (21). NAPRC accreditation and participation is resource intensive and not realistically achievable for small and many medium volume centers. This study adds value in highlighting the positive effect of directed feedback on specific metrics at many institutions over a decade of time.

The use of directed feedback by independent quality consortiums is not the norm. This study highlights the value of such feedback in rectal cancer care quality. The implementation of this form of feedback is associated with higher quality and should be considered more widely.

CRediT authorship contribution statement

Alex J. Charboneau: Writing – review & editing, Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Chad Cragle:** Writing – review & editing, Visualization, Conceptualization. **Joseph Frankhouse:** Writing – review & editing, Investigation, Conceptualization. **Shalini Kanneganti:** Writing – review & editing, Methodology, Conceptualization. **Jenny A. Kaplan:** Writing – review & editing, Methodology, Data curation. **Ravi Moonka:** Writing – review & editing, Data curation. **Laila Rashidi:** Writing – review & editing, Data curation. **Vlad V. Simianu:** Writing – review & editing, Writing – original draft, Supervision, Software, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

Ethics approval

This study was exempted from human subjects review by the Institutional Review Board at Benaroya Research Institute of Virginia Mason Medical Center.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr. Vlad V. Simianu serves as the Associate Medical Director for the Colorectal arm of the Surgical Care Outcomes Assessment Program. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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