Section Editors: Theresa Wicklin Gillespie and Constance Visovsky

QUALITY IMPROVEMENT

The Effect of Pelvic Floor Rehabilitation on Low Anterior Resection Syndrome After Colorectal Cancer Treatment

SHELBY JONES,[1,2] DNP, CCRN, ALISON EDIE,[2] DNP, EMILY TROOP,[1] DPT, JOSHUA S. HILL,[1] MD, and JULIE A. THOMPSON,[2] PhD

From [1]Atrium Health Levine Cancer Institute, Charlotte, North Carolina; [2]Duke University School of Nursing, Durham, North Carolina

Authors' disclosures of conflicts of interest are found at the end of this article.

Correspondence to: Shelby Jones DNP, CCRN, 1021 Morehead Medical Drive, Charlotte, NC 28204
E-mail: shelby.agacnp@gmail.com

https://doi.org/10.6004/jadpro.2024.15.8.4

Abstract

Purpose: Low anterior resection (LAR) is the preferred surgical treatment of rectosigmoid or rectal cancers. However, it is often associated with bowel dysfunction, which is termed low anterior resection syndrome (LARS). Daily bowel dysfunction symptoms have a detrimental effect on quality of life (QOL). Pelvic floor rehabilitation (PFR) can improve pelvic floor function and QOL among patients with LARS. This quality improvement (QI) project seeks to assess the prevalence of LARS and develop and incorporate PFR for the treatment and prevention of LARS. **Methods:** A convenience sample of 20 patients met project inclusion. Thirteen patients participated. Individuals were categorized by diagnostic risk: low risk, high risk, and established. The intervention included 1-hour PFR sessions with the physical therapist (PT) and 5 minutes of daily self-led pelvic floor muscle exercises. Outcomes questionnaires included the LARS Score and Fecal Incontinence Quality of Life (FIQOL) Scale. Data were collected both pre- and post–colorectal cancer treatment. **Results:** The overall prevalence of LARS was 76.9%, which was significantly higher than the retrospective cohort comparison rate of 21.8% ($p < .001$). The prevalence of major LARS was 89%, 83%, and 50% at the initial, second, and third sessions, respectively, representing a 44% relative decrease. Embarrassment was significantly affected among individuals with major LARS, although ongoing PFR facilitated improvement. **Conclusion:** PFR is a valuable adjunct therapy for LARS, with continued sessions decreasing the overall prevalence among the cohort. Major LARS negatively impacts QOL measures early on in treatment but improves with continued PFR.

Colorectal cancer (CRC) is the third most commonly diagnosed cancer worldwide, accounting for 153,020 newly diagnosed cancer cases within the United States in 2023 (American Cancer Society, 2022). Treatment is multimodal, including chemotherapy, radiation therapy, and surgery. Low anterior resection (LAR)

is performed for the surgical management of rectal cancer and involves total mesorectal excision and either colorectal or coloanal anastomosis, preserving the anorectal sphincter and allowing for bowel continuity and the natural elimination of stool per rectum via a newly shortened bowel transit.

Unfortunately, bowel dysfunction characterized by fecal incontinence, urgency, frequency, and fragmentation (clustering of stools) is common months to years after surgery as sequelae of surgical resection (Qin et al., 2017). This constellation of symptoms has been named low anterior resection syndrome (LARS). The incidence of LARS in the US ranges from 19% to 90% (Badic et al., 2018; Croese et al., 2018; Hung et al., 2016; Juul et al., 2015; Keane et al., 2017; Lin et al., 2016; Nishigori et al., 2018; Trenti et al., 2018). Daily bowel dysfunction can impact quality of life, be burdensome, and carry a social stigma for patients. Over 80% of patients with LARS feel the condition negatively impacts their quality of life (QOL; Bohlok et al., 2020).

Adjuvant chemoradiation or radiation therapy, tumor height, mesorectal excision, female gender, anastomotic type, and duration of defunctioning stoma prior to reversal are associated with a significant impact to bowel function, termed "major LARS" (Badic et al., 2018; Bernard et al., 2016; Bregendahl et al., 2013; Croese et al., 2018; Juul et al., 2015; Qin et al., 2017; Tan et al., 2019; Trenti et al., 2018). Combined chemoradiation therapy compared with chemotherapy alone causes poorer functional outcomes and is associated with major LARS (Qin et al., 2017; Tan et al., 2019). Although radiation treatment alone has unfavorable effects to pelvic floor muscle structure and function, a synergistic effect with chemoradiation negatively affects bowel function to a greater degree than either therapy alone (Bernard et al., 2016).

Treatment is largely symptom focused, including dietary modifications, antidiarrheal medications, supplemental bulking agents, and bowel training; however, the efficacy of these treatments varies. Growing evidence supports pelvic floor rehabilitation (PFR) as an effective therapy (Sakr et al., 2020). Pelvic floor rehabilitation is a safe, effective, and noninvasive therapy for fecal incontinence. It is gaining momentum in rehabilitation medicine as an adjunct therapy for LARS. It combines diagnostic and therapeutic strategies to isolate and strengthen pelvic floor muscles by repeated contraction, generating awareness of sensation, control, and engagement (Nishigori et al., 2018).

Bowel dysfunction following LAR can develop immediately or later; there is no absolute association between time from treatment and the development of LARS (Hung et al., 2016; Qin et al., 2017). There are ample studies evaluating LARS 1 year or more after treatment but few evaluating it within the first year. At project inception, only three studies assessed PFR for LARS and QOL measures within the first year of surgery (Hung et al., 2016; Lin et al., 2016; Tan et al., 2019). Evaluation of LARS, its effect on QOL, and potential treatment strategies within the first 12 months from surgery should be emphasized to improve functional outcomes and QOL, and lessen patient anxiety related to bowel changes. This builds on previous studies reporting gainful benefit in bowel function and QOL when therapy is introduced within 12 months of surgery (Hung et al., 2016; Lin et al., 2016; Tan et al., 2019).

Systematic reviews show no association between prolonged symptom duration and the efficacy of PFR; symptoms and QOL measures can improve significantly with symptom duration greater than 24 months (Chan et al., 2021; Dulskas et al., 2018). Regardless of timing, PFR may have a positive impact, although evidence suggests PFR is more impactful on bowel function and QOL when introduced within 12 months of CRC treatment. There is no literature evaluating PFR as a preventative strategy for LARS by integrating PFR into patient care prior to treatment. In fact, there is no primary report or discussion on using PFR to prevent LARS.

Gastrointestinal (GI) surgical oncologists at the Atrium Health Levine Cancer Institute performed 55 LAR surgeries in 2020; a retrospective review revealed a 21% prevalence of LARS among these patients within 1 year after surgery. The diagnosis was defined by identifying the following within the patient's medical record: a diagnosis of "bowel dysfunction" (ICD-10 code K59.9); prescription antidiarrheal or antispasmodic medications or bulking agents following LAR; or electronic medical record documentation of bowel dysfunction post LAR. A retrospective review

showed LARS was primarily treated with dietary modification and pharmacologic support.

The purpose of the quality improvement (QI) project was to assess the prevalence of LARS among the institute's patient population and the effect of PFR in treating and preventing LARS. The aims were to (1) Develop and implement a protocol using PFR as an adjunct treatment for LARS, (2) Lower the prevalence of major LARS by 25% among patients at least 2 weeks postoperative from surgery throughout the intervention timeline, and (3) Incorporate PFR as a preventative treatment for at least 50% of patients undergoing LAR prior to definitive cancer treatment.

METHODS

Implementation Context and Setting

This QI project took place from June 2021 to October 2021 in the department of GI Surgical Oncology and Oncology Rehabilitation at a single, large, tertiary cancer care institution in the Southeast. The department includes surgical oncologists, medical oncologists, radiation oncologists, nurse practitioners, physical therapists (PTs), nurses, nursing assistants, and dieticians. In the department of GI Surgical Oncology, an average of 50 to 55 new patients are seen annually for CRC treatment and LAR surgery. During project development, over 30 established CRC patients with LARS continued their cancer surveillance with the practice. The facility Institutional Review Board (IRB) approved this project and deemed it a QI initiative. A Model for Change to Evidence-Based Practice by Rosswurm and Larrabee (1999) was used to guide development and implementation.

Interventions

A convenience sample was used for this QI project. The target population was adult patients with either rectosigmoid or rectal cancer and a surgical treatment plan for LAR, or any patient 0 to 24 months postoperative from LAR or post-LAR ostomy closure with existing LARS. The severity of LARS and QOL can be improved early on during the symptom course but may take up to 24 months; thus, this criterion was used as a reference point for this QI project.

Patients were categorized into three groups: low risk, high risk, and established. For newly diagnosed CRC patients, the surgeons discussed the QI project at initial consultation, capturing the low-risk and high-risk patients. A fact sheet detailing a brief overview of LARS, PFR intervention, project aims, and contact information was provided at consultation. The project lead then contacted individual patients to gauge interest. "Established" patients were captured by both the nurse practitioner and surgeons during regularly scheduled surveillance visits or when LARS was diagnosed. All patients received the same fact sheet reviewing project details and LARS. The high- and low-risk groups had initial PFR intervention pre-CRC treatment, exploring PFR as a preventative measure for LARS. The "established" group had PFR intervention following CRC treatment and LAR surgery, exploring the use of PFR to treat LARS.

The intervention included 1-hour PFR physical therapy sessions with the pelvic physical therapist and a patient-led pelvic floor muscle exercise session for 5 minutes per day. A digital assessment of pelvic floor muscle engagement called the PERFECT (power, endurance, repetitions, fast contractions, and every contraction timed) Scheme was performed by the PT at each session to guide patients on exercise technique and inform future goals. The PERECT Scheme has high inter-examiner reliability ($p < .001$), test-retest reliability ($p < .001$), and validity ($p = .001$; Laycock & Jerwood, 2001). Patient-reported outcome questionnaires included the LARS Score and Fecal Incontinence Quality of Life (FIQOL) Scale, which were completed before most PFR sessions and at the 3-month follow-up appointment with the clinician.

The collection of outcome measurements varied (Table 1). The low-risk and high-risk groups did not receive the FIQOL Scale pre-PFR, as it was not expected these patients would have impaired QOL related to fecal incontinence prior to treatment. Differences in treatment for locally advanced and low-risk rectal cancer, rectosigmoid, and sigmoid colon cancer informed the number of sessions for each group. The justification for this approach is the aim to use PFR as a preventative measure prior to CRC treatment in both high- and low-risk groups.

The clinical staff vital to project promotion and progress were SJ (nurse practitioner, project

Table 1. Treatment Intervention Timeline

Group description		Session 1	Session 2	Session 3	Session 4	Session 5
Low risk	Treatment timeline	2 weeks pre-op	2 weeks post-op	6 weeks post-op	3 months post-op	–
	Intervention[a]	X	X	X	–	–
	Outcome measures[b]	X[c]	X	X	X	–
High risk	Treatment timeline	2 weeks pre-radiation	2 weeks pre-op (LAR)	2 weeks post-op[d]	6 weeks post-op[d]	3 months post-op[d]
	Intervention[a]	X	X	X	X	–
	Outcome measures[b]	X[c]	X	X	X	X
Established	Treatment timeline	Initial evaluation[e]	2 weeks after initial evaluation	6 weeks after initial evaluation	3 months after initial evaluation	–
	Intervention[a]	X	X	X	–	–
	Outcome measures[b]	X	X	X	X	–

Note. Patients were categorized into three groups: low risk (rectosigmoid colon cancer or T1/T2 N0 rectal cancer), high risk (locally advanced T3/T4 or N-positive rectal cancer with surgical plan for LAR, or any T any N-positive rectal cancer patient treated with neoadjuvant radiation with surgical plan for LAR), and established (patient post-LAR surgery or ostomy closure after previous LAR surgery with existing LARS). X = intervention or outcome measure collection; – = no intervention or data collection per project protocol.
[a]1-hour session of PFR with physical therapist.
[b]LARS Score and FiQOL Scale.
[c]LARS Score only.
[d]Post-LAR ostomy closure or post-op LAR if no ostomy.
[e]When diagnosed with LARS.

lead) and ET (pelvic physical therapist). Three key clinical nursing staff (SO, BG, and KZ) issued the fact sheet to patients and informed the project lead of potential patients after the initial consult or follow-up visit. The project lead assumed the primary role for data import into the data warehouse. The three surgeons helped capture appropriate patients in initial consultation and define treatment algorithms.

Study of the Interventions

Patients often use a multitherapy approach for LARS treatment. Strong evidence supports PFR as a treatment for LARS compared with other therapies irrespective of the timing of bowel continuity or symptom duration (Chan et al., 2021). There is no literature describing PFR as a preventative strategy for LARS prior to definitive CRC treatment. Establishing a protocol, identifying the prevalence of LARS, and incorporating PFR as a preventative measure and treatment offers strong potential to enhance patient care and improve outcomes.

Measures

A number of instruments are used to assess bowel dysfunction, such as the Wexner Fecal Incontinence Score, the Fecal Incontinence Severity Index, and Pescatori Anal Incontinence Score; however, these focus on a single component of the condition and do not evaluate QOL (Keane et al., 2017; Nishigori et al., 2018). The LARS Score is a 5-question patient-reported outcome instrument that categorizes LARS based on severity on a binomial scale of either minor or major LARS; it is validated in English and has strong convergent validity in QOL ($p < .01$) and discriminative validity ($p < .02$), and high test-retest reliability (intraclass correlation coefficient 0.83; Juul et al., 2015; Tan et al., 2019). The LARS Score assesses five different bowel dysfunction symptoms, including fecal incontinence, frequency, urgency, clustering, and indiscrimination of gas vs. stool.

The FIQOL Scale is commonly used to evaluate QOL due to fecal incontinence, a hallmark symptom of LARS. It includes 29 questions measuring QOL in four domains, including lifestyle,

coping/behavior, depression/self-perception, and embarrassment. Scores range from 1 to 5, with higher scores indicating better quality of life. Psychometric evaluation shows both tools produce reliable and valid measurements (Hung et al., 2016; Juul et al., 2015; Tan et al., 2019).

Analysis

A power analysis revealed a sample size of 30 would provide adequate effect. Data analyses were conducted via IBM SPSS Statistics 27 software. Descriptive statistics were used to summarize demographic and diagnostic data, evaluate patient acceptance, and summarize reasons for opting out. Chi-squared and Fisher's exact tests were used to evaluate categorical data among groups. Fisher's exact test of retrospective data was used to compare the prevalence of LARS among groups. Kruskal-Wallis tests were used to examine the change in QOL median scores among LARS severity at various timepoints. A $p < .05$ was considered statistically significant. This manuscript was written per SQUIRE 2.0 Guidelines (Ogrinc et al., 2020).

Ethical Considerations

This project was performed in accordance with the Declaration of Helsinki. Approval was granted by facility IRB and determined to be a quality improvement project. No direct or indirect ethical considerations of project development or implementation were identified.

RESULTS

Demographic and Clinical Characteristics

Male and female representation was similar (45% female, 55% male). Half were younger than 55 years of age (50%), with the remaining half either between 56 to 64 years of age or 65 years of age or older (25% each group). Rectal and rectosigmoid cancer were the most common diagnoses (40% and 35%, respectively). Previously tried therapies varied highly among groups. The majority of individuals received no neoadjuvant therapy (60%; Table 2).

Of 20 patients who met the criteria, 15 accepted. Of those 15, 13 completed at least one PFR session. Two individuals opted out prior to the first PFR session. Five eligible patients declined inclusion for reasons including no desire for PFR

Table 2. Patient characteristics

Variable	*n* (%)
Gender	
Female	9 (45)
Male	11 (55)
Age	
40-55	10 (50)
56-64	5 (25)
65+	5 (25)
Race	
Black	3 (15)
Middle Eastern or North African	2 (10)
White/Caucasian	14 (75)
Not specified	1 (5)
Diagnosis	
Rectosigmoid cancer	7 (35)
Sigmoid cancer	3 (15)
Rectal cancer	8 (40)
Ovarian cancer (metastatic to colon or rectum)	2 (10)
Previous therapies tried	
None	5 (16)
Dietary modifications	8 (26)
Toilet training	4 (13)
Bulking agents	5 (16)
Antidiarrheal agents (loperamide, diphenoxylate-atropine)	4 (13)
Antispasmodics (dicycloverine)	4 (13)
Other	1 (3)
Type/sequence of neoadjuvant therapy	
Standard: conventional radiation with 5-FU analog	1 (5)
Standard: conventional radiation with capecitabine	1 (5)
Standard: other	3 (15)
TNT[a] agent/chemotherapy: single agent	1 (5)
TNT agent/chemotherapy: multiagent	1 (5)
TNT agent/radiation: conventional radiation	1 (5)
None	12 (60)

Note. 5-FU = fluorouracil.
[a]Total neoadjuvant therapy consists of the combination of chemoradiation followed by chemotherapy followed by surgery, or chemotherapy followed by chemoradiation followed by surgery.

(33%), did not want added visits (22%), transportation issues (22%), and satisfied with bowel function (22%; Figure 1). There were no associations between gender and therapies tried, nor diagnosis and therapies tried (all $p > .05$; Table 3).

LARS Prevalence

Retrospective data analysis revealed LARS incidence in 12 out of 55 patients who had LAR surgery in 2020 (21.8%). This QI project found the overall prevalence of LARS at the time of the last PFR session to be 76.9% (10 out of 13, $p < .001$). Evaluating the prevalence of major LARS among groups at each session revealed 89% of individuals reporting major LARS at the initial intervention session, 83% at the second session, and 50% at the third session, resulting in a 44% relative decrease from the initial session (Figure 2). For participants with minor or major LARS who completed at least 2 weeks of PFR ($n = 6$), two saw reduced LARS severity by the end of their last session (33.3%) and four had LARS severity that remained unchanged (66.7%). Six participants had only one session, thus a matched reduction could not be appraised. Two participants reported no LARS at initiation; of these, one had not yet had surgery and the other was 1 month postoperative from ileostomy reversal. Only one participant had 3 months of PFR, and this individual continued to report significant LARS throughout therapy.

Quality of Life

Due to small sample sizes and deviations from normality for domain scores, nonparametric Kruskal-Wallis tests were used to examine changes in FIQOL median scores among LARS severity levels after sessions 1, 2, and 3, with higher scores indicating better QOL. At the initial intervention session (session 1), there were no statistically significant differences between LARS severity in any quality-of-life domains (lifestyle $p = .114$; coping $p = .118$; depression $p = .120$; embarrassment $p = .115$). After 2 weeks of PFR therapy (session 2), there was a significant difference in embarrassment ($p = .047$) but not lifestyle ($p = .051$), coping ($p = .053$), or depression ($p = .051$). After 6 weeks of PFR (session 3), there were no differences among any of the domains (lifestyle $p = .165$; coping $p = .165$; depression $p = .223$; embarrassment $p = .135$; Figure 3).

After 6 weeks of PFR consisting of daily self-led PFR exercises and at least three 1-hour PFR therapy sessions with the PT, all subscale scores among individuals with major LARS improved (lifestyle from 2.3 to 2.5; embarrassment from 2.7 to 3.3; and coping from 2.1 to 2.4), except the depression subscale, which declined from 3.3 to 3.0.

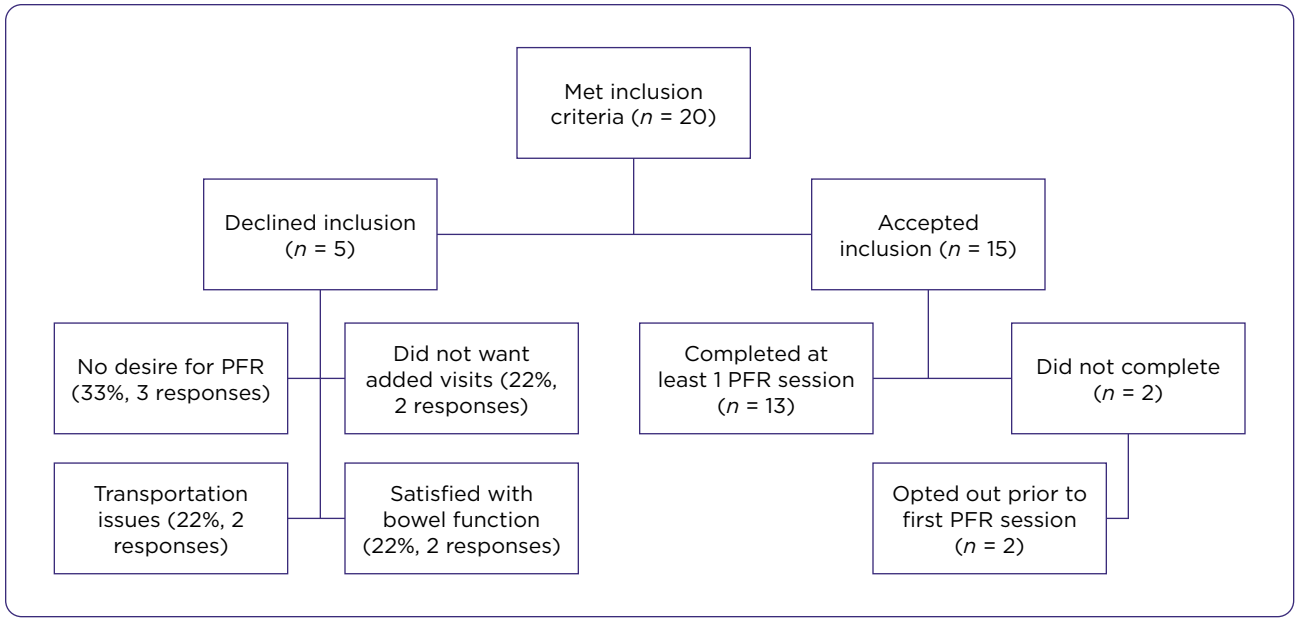

Figure 1. Flowchart of participants. Patients could choose more than one reason for not accepting inclusion. PFR = pelvic floor rehabilitation.

Table 3. Association Between Gender and Diagnosis With Previous Therapies Tried

	Gender (*N* = 15)			Diagnosis (*N* = 15)				
Previous therapy	**Male (*n* = 6)**	**Female (*n* = 9)**	***p*[a]**	**Rectosigmoid cancer (*n* = 6)**	**Sigmoid cancer (*n* = 2)**	**Rectal cancer (*n* = 6)**	**Ovarian cancer[b] (*n* = 1)**	***p***
None	2 (33)	3 (33)	.999	1 (17)	1 (50)	3 (50)	0 (0)	.522
Dietary modifications	2 (33)	6 (67)	.315	4 (67)	1 (50)	3 (50)	0 (0)	.658
Toilet training	2 (33)	2 (22)	.999	3 (50)	0 (0)	0 (0)	1 (100)	.062
Bulking agents	3 (50)	2 (22)	.329	3 (50)	0 (0)	2 (33)	0 (0)	.522
Antidiarrheal agents	1 (17)	3 (33)	.604	2 (33)	0 (0)	2 (33)	0 (0)	.714
Antispasmodics	1 (17)	3 (33)	.604	1 (17)	0 (0	3 (50)	0 (0)	.381
Binding agents	0 (0)	0 (0)	–	0 (0)	0 (0)	0 (0)	0 (0)	–
Other: PFR	1 (17)	0 (0)	.400	1 (17)	0 (0)	0 (0)	0 (0)	.658

Note. – = not computed due to no data.
[a]Fisher's exact test *p* value reported due to no 2 x 2 comparison.
[b]Metastatic to the colon or rectum.

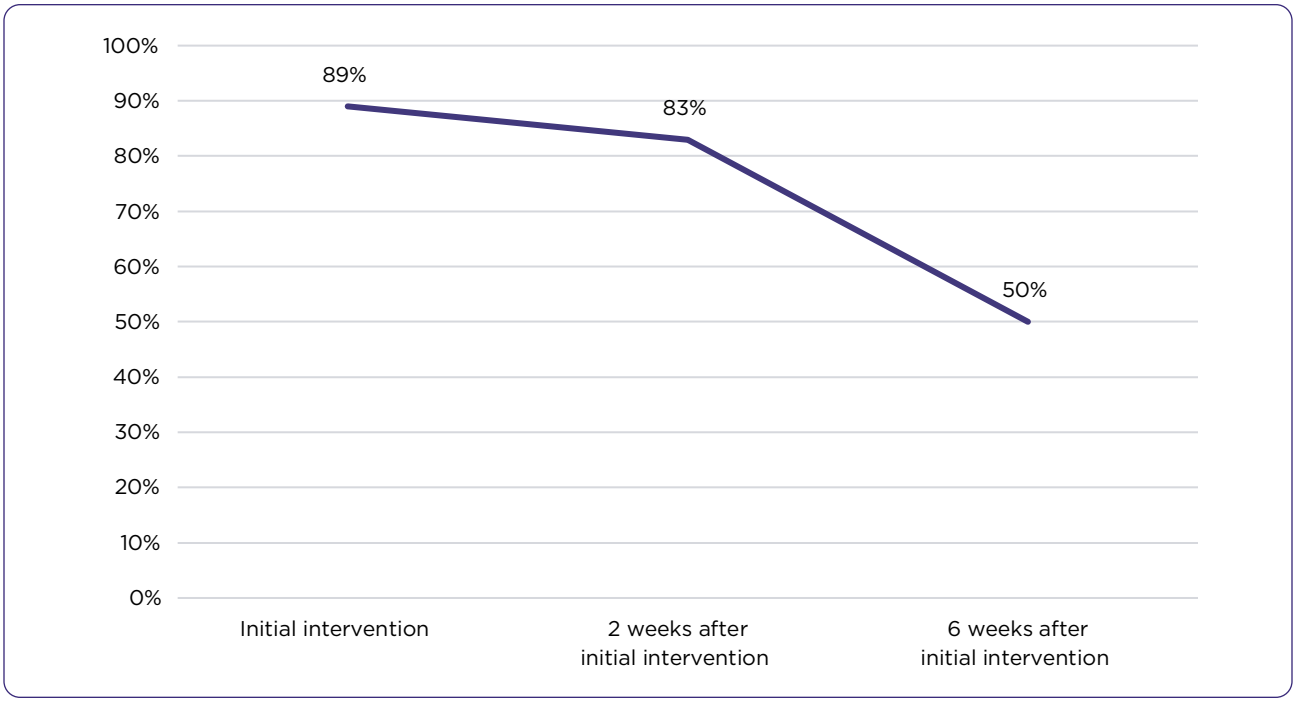

Figure 2. Prevalence of major lower anterior resection syndrome (LARS). At 6 weeks, there was a 44% decline in major LARS prevalence from initial intervention.

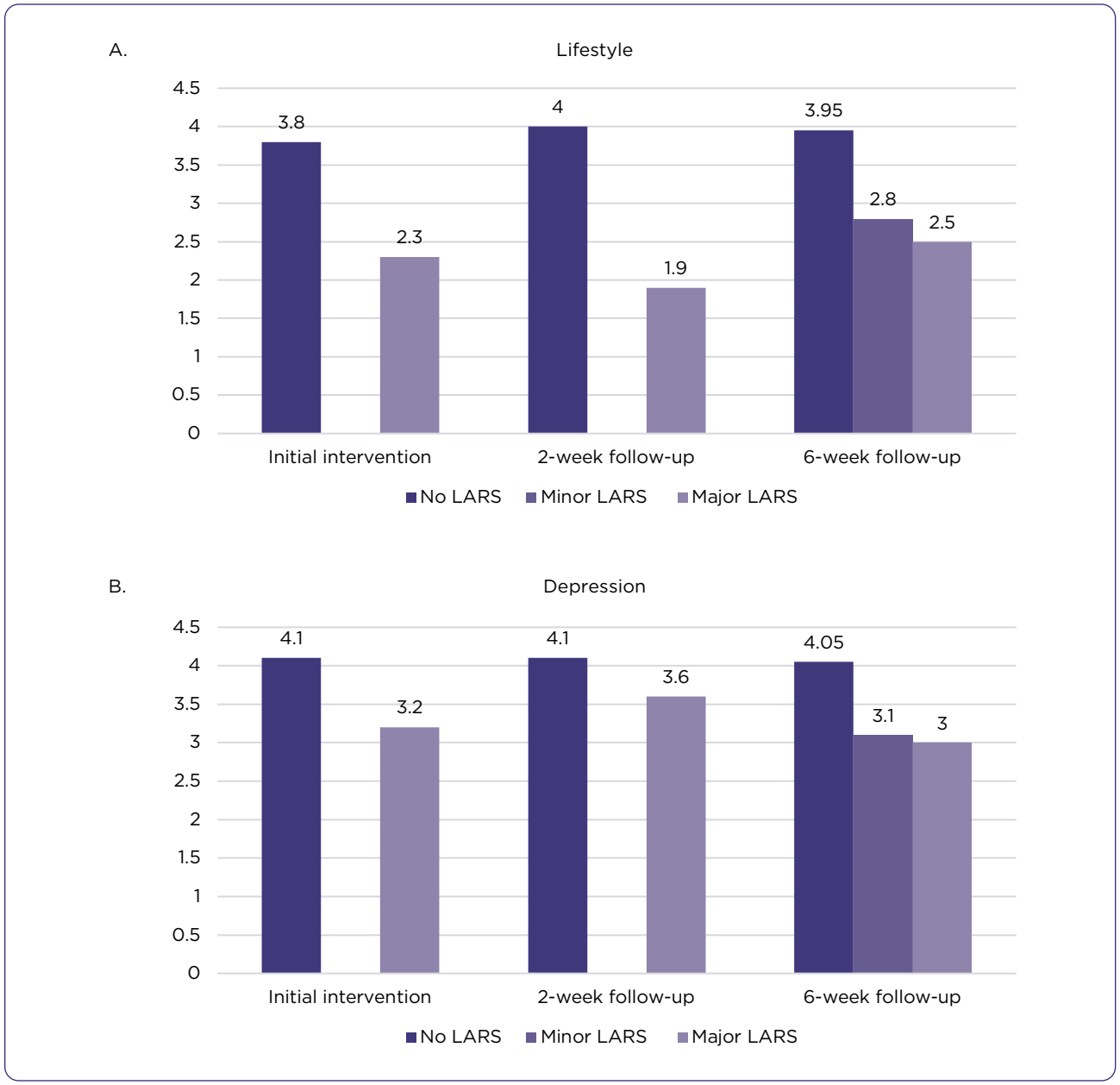

Figure 3. LARS severity and FIQOL median scores (A) Lifestyle, (B) Depression, (C) Embarrassment, (D) Coping.
[a]Significant value ($p < .05$).

There were no reports of minor LARS at session 1 or 2, and therefore comparisons were unattainable. Individuals reporting no LARS throughout had the highest QOL scores among all subscales.

DISCUSSION

Summary and Interpretation

This QI project was designed to assess the incidence of LARS and effect of PFR as both a preventative and treatment strategy. It also appraised the effect of LARS on QOL. The sample size was smaller than the calculated effect size largely due to an abbreviated data collection timeframe. Thus, the analysis was adjusted to account for small sample size and generated inferential results.

Risk factors of LARS include chemoradiation therapy, radiation therapy, duration of defunctioning stoma, tumor height, and female gender.

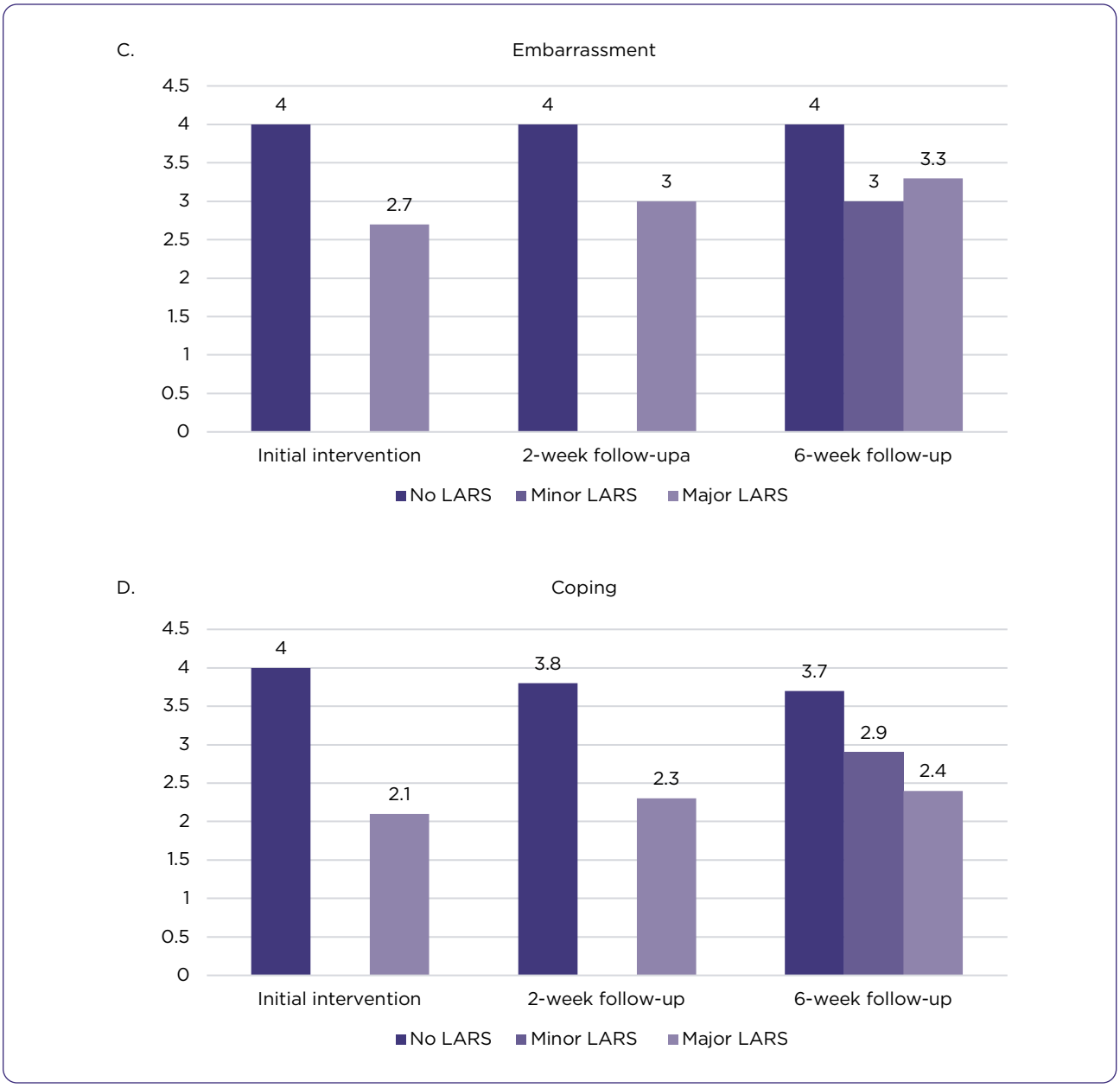

Figure 3. LARS severity and FIQOL median scores (A) Lifestyle, (B) Depression, (C) Embarrassment, (D) Coping.
[a]Significant value ($p < .05$).

Combination chemoradiation therapy compared with monotherapy increases the risk of LARS (Bregendahl et al., 2013; Croese et al., 2018). A systematic review of the effects of radiation therapy on pelvic floor muscle structure and function assessed four high-quality studies involving rectal cancer patients showing significantly decreased muscle tone at rest ($p = .003$), maximum squeeze pressure ($p = .013$), contractile response ($p = .007$), and spontaneous activity ($p = .001$; Bernard et al., 2016). Long-term evaluations of bowel function outcomes post-CRC treatment identify combined radiation therapy and surgery causing a two-fold increased risk of bowel dysfunction compared with surgery alone (Bregendahl et al., 2013). This study found similar results; of patients reporting LARS at the last PFR session, 60% received either chemoradiation or radiation

therapy. It was not found to be more prevalent among females in this cohort.

Patients in the retrospective cohort were an average of 16 months from surgery, whereas the study cohort was an average of 8 months postoperative from either LAR surgery or ileostomy closure. Previous studies observed optimal bowel physiology recovery in approximately 6 to 24 months, with extended time for maximum restoration if tissues were irradiated (Bernard et al., 2016; Bulfone et al., 2020; Lin et al., 2016; Nishigori et al., 2018). Evaluating bowel function early in physiologic restoration may lead to false-negative assessments of expected restorative potential; however, this may explain the increased prevalence found in this QI project. Ongoing PFR provided meaningful benefit for participants and lowered major LARS prevalence, with a 44% relative decrease by the 6-week follow-up session compared with the initial session.

At project conception, this project was the first in the literature that evaluated PFR as a preventative measure for LARS among CRC patients. The American Society of Colon and Rectal Surgeons advises against "preventative" PFR prior to abdominopelvic surgery, given the lack of substantial evidence in the literature, but recommends its use in the treatment of bowel dysfunction (Paquette et al., 2015). Conversely, preventative PFR is widely used in obstetric medicine to obviate postnatal pelvic floor dysfunction. A systematic review of preventative PFR showed lasting reduction of urinary incontinence after delivery among women who incorporated antenatal PFR in late pregnancy and postpartum (Romeikienė & Bartkevičienė, 2021). The National Institute of Health and Care Excellence recommends all women over 12 years of age incorporate PFR to prevent pelvic floor dysfunction (National Institute for Health and Care Excellence, 2021). Preventative PFR has been used extensively outside of colorectal medicine. Since the conclusion of this project, a literature review has revealed one randomized clinical trial pilot study looking at PFR as a preventative therapy for LARS (Sacomori et al., 2021).

This project's aims were met by incorporating PFR prior to CRC treatment in 80% of individuals. In the pretreatment preventative PFR group (low-risk group), there were no reports of LARS by the last session; however, this included only one individual. This individual's results were clinically impactful as the pre-PFR LARS Score was 22 (mild LARS), and the post-PFR LARS Score was 9 (no LARS) by the last session of PFR. Pretreatment group findings were limited due to the small sample size; therefore, it was not possible to meaningfully assess the effect of PFR as a prevention for LARS.

Quality of Life

There were statistically significant lower scores of embarrassment with major LARS (p = .47) at the 2-week follow-up but improved scores with ongoing PFR. Hung and colleagues (2016) found significant embarrassment scores among patients early in the post-treatment phase, lasting up until 2 months following surgery. However, this domain improved with ongoing PFR. The authors found QOL scores significantly improved throughout all subscales, although their study had 9 months of PFR, and improvements were not derived until 6 months after (Hung et al., 2016). As such, these researchers recommend instituting PFR at least up to 6 months postoperatively to maximize the benefit to QOL. This QI project's findings of increased embarrassment earlier in PFR therapy are likely due to more awareness of dysfunctional bowel condition and associated struggles dealing with a new health condition. Pelvic floor rehabilitation training increased QOL scores among all subscales except depression.

Unsurprisingly, QOL scores were highest among individuals who reported no LARS. After 6 weeks of PFR, depression was the only unimproved subscale, implying ongoing despair due to bowel dysfunction symptoms despite improvement in other areas of life such as embarrassment, lifestyle, and coping. Early embarrassment scores were significantly lower among those with major LARS, which is expected considering the necessary time for optimal bowel restoration and timing from index treatment. Gainful benefit in bowel function may take upwards of 24 months. Hence, the appraisal of bowel dysfunction earlier in bowel restoration may not reflect potential natural improvement.

LIMITATIONS

This project's primary limitation was small sample size, restricting the generalizability and overall implicit power. Due to the standard CRC treatment timeline and data collection combined with patient population at the time of implementation, some groups' accrual was less than anticipated, further contributing to the small sample size. Only one pelvic PT was available for project involvement. Personal life circumstances and necessary time away from work resulted in the rescheduling of patients and some attrition. Additionally, fidelity in conducting daily self-led PFR exercises among patients was not assessed, which may contribute to potentially improved outcomes among those who participated in daily PFR exercise compared with those who did not.

According to QI philosophy, confounders were not accounted for; patients did not cease existing therapies. This increases the difficulty in fully discerning the benefit derived solely from ongoing PFR. This project was conducted in a single department of a large tertiary hospital. Many patients travel hours to receive care and are unlikely to travel long distances for therapy sessions (two individuals opted out for this reason). Furthermore, the institution's department of colorectal surgery patient population was not included in this program, primarily because most LAR surgeries performed by this department are done for benign conditions. This was a limitation, as more patients may have met the inclusion criteria and derived benefit from the program. Due to nuances in recommended treatment duration and timeline, the high-risk group was inadequately captured throughout intervention and data collection. Broadening the data collection window would easily rectify this issue.

CONCLUSIONS

Low anterior resection syndrome is widely prevalent among CRC survivors. Evaluation should include the LARS Score and QOL measurement tools with good psychometric scores evaluating symptoms. Evidence shows that LARS occurs immediately following surgery, although bowel dysfunction can be present at the time of diagnosis. Although risk factors of LARS vary, multimodal therapy is a leading cause (Croese et al., 2018; Qin et al., 2017). Pelvic floor rehabilitation is a viable option for LARS treatment and maximally beneficial within 6 months post treatment, although perceivable benefits have been gained as early as 6 weeks post treatment and years beyond index CRC treatment.

Pelvic floor rehabilitation has been used as a viable preventative strategy in pelvic health medicine, but this study found its use as a pretreatment option to optimize pelvic floor function among CRC patients unclear. There was an important relative decrease in major LARS among individuals with ongoing daily PFR. By incorporating this QI project, the authors identified both the prevalence of LARs among patients in the study and improved outcomes. This QI project shed light on PFR usefulness and efficacy, allowing this therapy to be adopted within clinical practice and potentially among other departments with similar patients.

Acknowledgment

The clinical site for this project is Atrium Health Levine Cancer Institute, Charlotte, North Carolina, USA. The authors would like to acknowledge Elena Turner, Editorial Advisor, Duke University, Durham, North Carolina, for editorial advisement services in manuscript drafting.

Disclosure

The authors have no conflicts of interest to disclose.

References

American Cancer Society. (2022). Colorectal Cancer Facts & Figures 2023-2025. https://www.cancer.org/research/cancer-facts-statistics/colorectal-cancer-facts-figures.html

Badic, B., Joumond, A., Thereaux, J., Gancel, C. H., & Bail, J. P. (2018). Long-term functional and oncological results after sphincter-saving resection for rectal cancer - cohort study. *International Journal of Surgery, 52*, 1–6. https://doi.org/10.1016/j.ijsu.2018.02.003

Bernard, S., Ouellet, M.-P., Moffet, H., Roy, J.-S., & Dumoulin, C. (2016). Effects of radiation therapy on the structure and function of the pelvic floor muscles of patients with cancer in the pelvic area: A systematic review. *Journal of Cancer Survivorship, 10*(2), 351–362. https://doi.org/10.1007/s11764-015-0481-8

Bohlok, A., Mercier, C., Bouazza, F., Galdon, M. G., Moretti, L., Donckier, V.,...Liberale, G. (2020). The burden of low anterior resection syndrome on quality of life in patients with mid or low rectal cancer. *Supportive Care in Cancer, 28*(3), 1199–1206. https://doi.org/10.1007/s00520-019-04901-2

Bregendahl, S., Emmertsen, K. J., Lous, J., & Laurberg, S.

(2013). Bowel dysfunction after low anterior resection with and without neoadjuvant therapy for rectal cancer: A population-based cross-sectional study. *Colorectal disease, 15*(9), 1130–1139. https://doi.org/10.1111/codi.12244

Bulfone, G., Del Negro, F., Del Medico, E., Cadorin, L., Bressan, V., & Stevanin, S. (2020). Rehabilitation strategies for low anterior resection syndrome. A systematic review. *Annali Dell'Istituto Superiore Di Sanità, 56*(1), 38–47. https://doi.org/10.4415/ANN_20_01_07

Chan, K. Y., Suen, M., Coulson, S., & Vardy, J. L. (2021). Efficacy of pelvic floor rehabilitation for bowel dysfunction after anterior resection for colorectal cancer: A systematic review. *Supportive Care in Cancer, 29*(4), 1795–1809. https://doi.org/10.1007/s00520-020-05832-z

Croese, A. D., Lonie, J. M., Trollope, A. F., Vangaveti, V. N., & Ho, Y.-H. (2018). A meta-analysis of the prevalence of low anterior resection syndrome and systematic review of risk factors. *International Journal of Surgery, 56*, 234–241. https://doi.org/10.1016/j.ijsu.2018.06.031

Dulskas, A., Smolskas, E., Kildusiene, I., & Samalavicius, N. E. (2018). Treatment possibilities for low anterior resection syndrome: A review of the literature. *International Journal of Colorectal Disease, 33*(3), 251–260. https://doi.org/10.1007/s00384-017-2954-x

Hung, S.-L., Lin, Y.-H., Yang, H.-Y., Kao, C.-C., Tung, H.-Y., & Wei, L.-H. (2016). Pelvic floor muscle exercise for fecal incontinence quality of life after coloanal anastomosis. *Journal of Clinical Nursing, 25*(17–18), 2658–2668. https://doi.org/10.1111/jocn.13314

Juul, T., Battersby, N. J., Christensen, P., Janjua, A. Z., Branagan, G., Laurberg, S., Emmertsen, K. J., & Moran, B. (2015). Validation of the English translation of the low anterior resection syndrome score. *Colorectal Disease, 17*(10), 908–916. https://doi.org/10.1111/codi.12952

Keane, C., Wells, C., O'Grady, G., & Bissett, I. P. (2017). Defining low anterior resection syndrome: A systematic review of the literature. *Colorectal Disease, 19*(8), 713–722. https://doi.org/10.1111/codi.13767

Laycock, J., & Jerwood, D. (2001). Pelvic floor muscle assessment: The perfect scheme. *Physiotherapy, 87*(12), 631–642. https://doi.org/10.1016/s0031-9406(05)61108-x

Lin, Y.-H., Yang, H.-Y., Hung, S.-L., Chen, H.-P., Liu, K.-W., Chen, T.-B., & Chi, S.-C. (2016). Effects of pelvic floor muscle exercise on faecal incontinence in rectal cancer patients after stoma closure. *European Journal of Cancer Care, 25*(3), 449–457. https://doi.org/10.1111/ecc.12292

National Institute for Health and Care Excellence. (2021). Recommendations: Pelvic floor dysfunction: Prevention and non-surgical management: Guidance. NICE. https://www.nice.org.uk/guidance/ng210/chapter/Recommendations

Nishigori, H., Ishii, M., Kokado, Y., Fujimoto, K., & Higashiyama, H. (2018). Effectiveness of pelvic floor rehabilitation for bowel dysfunction after intersphincteric resection for lower rectal cancer. *World Journal of Surgery, 42*(10), 3415–3421. https://doi.org/10.1007/s00268-018-4596-8

Ogrinc, G., Davies, L., Goodman, D., Batalden, P., Davidoff, F., & Stevens, D. (2020). Squire 2.0 guidelines. SQUIRE. http://www.squire-statement.org/index.cfm?fuseaction=page.viewpage&pageid=471

Paquette, I. M., Varma, M. G., Kaiser, A. M., Steele, S. R., & Rafferty, J. F. (2015). The American Society of Colon and Rectal Surgeons' clinical practice guideline for the treatment of fecal incontinence. *Diseases of the Colon & Rectum, 58*(7), 623–636. https://doi.org/10.1097/dcr.0000000000000397

Qin, Q., Huang, B., Cao, W., Zhou, J., Ma, T., Zhou, Z.,...Wang, L. (2017). Bowel dysfunction after low anterior resection with neoadjuvant chemoradiotherapy or chemotherapy alone for rectal cancer: A cross-sectional study from China. *Diseases of the Colon & Rectum, 60*(7), 697–705. https://doi.org/10.1097/dcr.0000000000000801

Romeikienė, K. E., & Bartkevičienė, D. (2021). Pelvic-floor dysfunction prevention in prepartum and postpartum periods. *Medicina, 57*(4), 387. https://doi.org/10.3390/medicina57040387

Rosswurm, M. A., & Larrabee, J. H. (1999). A model for change to evidence-based practice. *Image: The Journal of Nursing Scholarship, 31*(4), 317–322. https://doi.org/10.1111/j.1547-5069.1999.tb00510.x

Sacomori, C., Lorca, L. A., Martinez-Mardones, M., Salas-Ocaranza, R. I., Reyes-Reyes, G. P., Pizarro-Hinojosa, M. N., & Plasser-Troncoso, J. (2021). A randomized clinical trial to assess the effectiveness of pre- and post-surgical pelvic floor physiotherapy for bowel symptoms, pelvic floor function, and quality of life of patients with rectal cancer: Carret Protocol. *Trials, 22*(1), 448. https://doi.org/10.1186/s13063-021-05396-1

Sakr, A., Sauri, F., Alessa, M., Zakarnah, E., Alawfi, H., Torky, R.,...Kim, N. K. (2020). Assessment and management of low anterior resection syndrome after sphincter preserving surgery for rectal cancer. *Chinese Medical Journal, 133*(15), 1824–1833. https://doi.org/10.1097/cm9.0000000000000852

Tan, S. H., Liao, Y. M., Lee, K. C., Ko, Y. L., & Lin, P. C. (2019). Exploring bowel dysfunction of patients following colorectal surgery: A cohort study. *Journal of Clinical Nursing, 28*(9-10), 1577–1584. https://doi.org/10.1111/jocn.14757

Trenti, L., Galvez, A., Biondo, S., Solis, A., Vallribera-Valls, F., Espin-Basany, E.,...Kreisler, E. (2018). Quality of life and anterior resection syndrome after surgery for mid to low rectal cancer: A cross-sectional study. *European Journal of Surgical Oncology, 44*(7), 1031–1039. https://doi.org/10.1016/j.ejso.2018.03.025