APPENDIX A. CITATION OF INCLUDED RCTS AND CCTS IN PRIOR SYSTEMATIC REVIEWS OF ENHANCED RECOVERY IN COLORECTAL SURGERY (2011-2017)

	SYSTEMATIC REVIEWS (See Footnotes for Detailed Inclusion Criteria)												
	Open or Open and Laparoscopic Surgery										Laparoscopic Surgery Only		
	Adamina 2011[5]	Rawlinson 2011[13]	Spanjers-berg 2011[14]	Lv 2012[12]	Zhuang 2013[17]	Bagnall 2014[a6]	Greco 2014[8]	Grant 2017[7]	Lau 2017[9]	Launay-Savary 2017[a10]	Li 2013[11]	Tan 2014[15]	Zhao 2014[16]
RCTs Only	ü		ü	ü	ü		ü	ü	ü		ü	ü	
Required number of components	ü	ü	ü		ü				ü		ü		ü
Multiple languages allowed	ü	NR	ü	ü	ü	NR	ü			ü		ü	
OPEN SURGERY STUDIES													
Feng 2016[23]													
Pappalardo 2016[31]													
Jia 2014[a27]						ü			ü	ü			
Nanavati 2014[30]									ü				
Gouvas 2012[25] (CCT)[b]													ü
Ren 2012[32]					ü		ü		ü				
Wang 2012[b35]							ü		ü		ü		ü
Yang 2012[37]					ü		ü		ü				
Vlug 2011[b34]				ü	ü		ü		ü		ü	ü	ü
Wang 2011[36]							ü		ü		ü		

	SYSTEMATIC REVIEWS (See Footnotes for Detailed Inclusion Criteria)												
	Open or Open and Laparoscopic Surgery										Laparoscopic Surgery Only		
	Adamina 2011[5]	Rawlinson 2011[13]	Spanjersberg 2011[14]	Lv 2012[12]	Zhuang 2013[17]	Bagnall 2014[a6]	Greco 2014[8]	Grant 2017[7]	Lau 2017[9]	Launay-Savary 2017[a10]	Li 2013[11]	Tan 2014[15]	Zhao 2014[16]
Ionescu 2009[26]					ü		ü		ü				
Muller 2009[29]	ü	ü	ü	ü	ü		ü		ü				
Šerclová 2009[33]	ü	ü	ü	ü	ü		ü		ü				
Khoo 2007[28]	ü	ü	ü	ü	ü		ü		ü				
Gatt 2005[24]	ü	ü	ü	ü	ü		ü		ü				
Anderson 2003[22]	ü	ü	ü	ü	ü		ü		ü				
LAPAROSCOPIC SURGERY STUDIES													
Ota 2017[42] (CCT)													
Scioscia 2017[43]													
Mari 2016[40]													
Wang 2015[45] (CCT)													
Feng 2014[38]									ü				ü
Mari 2014[41]									ü				
Gouvas 2012[25] (CCT)[b]													ü
Wang 2012[b35]							ü				ü		ü
Wang 2012[44]					ü		ü		ü			ü	
Wang 2012[a46]					ü	ü	ü			ü	ü	ü	ü
Vlug 2011[b34]				ü	ü		ü				ü	ü	ü

	SYSTEMATIC REVIEWS (See Footnotes for Detailed Inclusion Criteria)												
	Open or Open and Laparoscopic Surgery										Laparoscopic Surgery Only		
	Adamina 2011[5]	Rawlinson 2011[13]	Spanjersberg 2011[14]	Lv 2012[12]	Zhuang 2013[17]	Bagnall 2014[a6]	Greco 2014[8]	Grant 2017[7]	Lau 2017[9]	Launay-Savary 2017[a10]	Li 2013[11]	Tan 2014[15]	Zhao 2014[16]
MIXED OPEN AND LAPAROSCOPIC SURGERY STUDIES													
Forsmo 2016[50]													

CCT=controlled clinical trial; RCT=randomized controlled clinical trial

[a] Elderly (≥65 years)

[b] 4-arm study: open surgery with enhanced recovery, open surgery with usual care, laparoscopic surgery with enhanced recovery, and laparoscopic surgery with usual care

Systematic Review Inclusion Criteria (Literature Search Dates)

Adamina 2011 (Search 1966 – June 2010): RCT comparing ERP with traditional care (any indication for colorectal surgery); adult population; minimum 30 day follow-up; documented compliance to ≥4 of 5 key components a) patient information, b) preservation of gastrointestinal function, c) minimizing organ dysfunction; d) active pain control; e) promotion of patient's autonomy); publication in English, German, French, Spanish, or Danish

Rawlinson 2011 (Search to February 2011): RCT or CCT with prospective intervention group that compared enhanced recovery perioperative program with traditional care; open or laparoscopic elective colorectal surgery (any indication); adult population; documented protocol with at least 4 components of enhanced recovery covering pre-, intra-, and post-operative periods); reporting at least one outcome of interest (length of stay, complications, readmission rates, mortality); language limitation not reported

Spanjersberg 2011 (Search 1990 – 2009): RCT comparing any type of enhanced recovery strategy for resections in colorectal disease to conventional recovery strategies; open or laparoscopic surgery; at least 7 enhanced recovery items in the intervention group and no more than 2 enhanced recovery items in the conventional care group; any language

Lv 2012 (Search 1966 – April 2012): RCTs comparing enhanced recovery with conventional perioperative care in major colorectal surgery (resection); minimum 30 day follow-up; any language

Zhuang 2013 (1966 – July 2012): RCTS comparing enhanced recovery with traditional care for elective colorectal surgery; open or laparoscopic surgery; malignant or benign disease; enhanced recovery program should include at least 7 of 20 components; adult population; reporting at least one outcome of interest (length of stay, readmission rates, complications, mortality); any language

Bagnall 2014 (1947 – February 2014): any study design; evaluating enhanced recovery program in elderly (65 years or older) population undergoing colorectal surgery (or with elderly cohort as a subgroup analysis); language limitation not reported

Greco 2014 (Search to June 2012): RCTs comparing enhanced recovery to standard treatment in colorectal surgery; no restriction on primary or secondary outcomes; any language

Grant 2017 (Search to June 2015): RCTs comparing enhanced recovery to standard care for perioperative care in adults undergoing general anesthesia for abdominal and pelvic surgery; reporting healthcare-associated infection; English language

Lau 2017 (1966 – February 2016): RCTs comparing enhanced recovery to standard care; age range not specified; any surgery (site or approach); enhanced recovery program included at least 4 components; reporting primary clinical outcomes (length of stay, 30-day readmission, 30-day mortality, total costs); English language abstract and/or full text

Launey-Savary 2017 (2000 – 2015): any study design; comparing feasibility of enhanced recovery in elderly (65 years or older) to younger population or to traditional management; elective colorectal surgery; reporting main endpoints (feasibility, efficacy, compliance); English or French

Li 2013 (Search to May 2013): RCTs (including abstracts) comparing laparoscopic colorectal surgery with enhanced recovery to laparoscopic colorectal surgery with conventional care; adult population; at least 7 of 17 enhanced recovery components; one month follow-up for complications and readmissions; reported at least one outcome of interest; English language
Tan 2014 (Search 1991 – February 2013): RCTs comparing enhanced recovery to traditional care in elective laparoscopic colorectal surgery; any language
Zhao 2014 (Search to April 2014): RCTs or CCTs comparing enhanced recovery with conventional care in laparoscopic colorectal cancer surgery; clear description of enhanced recovery protocol; applied at least 6 enhanced recovery components; reporting at least one outcome of interest (length of stay, time to first flatus, time of first bowel movement, complications, readmissions, mortality); English language

APPENDIX B. SEARCH STRATEGIES

MEDLINE (Ovid)

1	((fast and track) or fast-track or ERAS or ERP).mp.
2	(enhanced and recovery and surg$).mp.
3	(enhanced and recovery and program$).mp.
4	((multimodal or enhanced or accelerated) and (optimization or management or rehabilitation or protocol or package or program or pathway)).mp.
5	1 or 2 or 3 or 4
6	(resection or surgical or surgically or surgery or laparo$ or procedure).mp.
7	exp Colon/
8	exp Rectum/
9	exp Colon, Sigmoid/
10	(bowel or rectal or colonic or colon or colorectal or rectum or sigmoid).mp.
11	7 or 8 or 9 or 10
12	6 and 11
13	exp Colorectal Surgery/
14	exp Rectum/su [Surgery]
15	exp Colon/su [Surgery]
16	13 or 14 or 15
17	5 and 12
18	5 and 16
19	17 or 18
20	limit 19 to (english language and yr="2011 -Current")

CINAHL

S1	TX (fast and track) OR fast-track OR ERAS OR ERP OR (enhanced AND recovery AND (surg* OR program*)) OR ((multimodal OR enhanced OR accelerated) AND (optimization OR management OR rehabilitation OR protocol OR program OR pathway))
S2	TX (resection OR surg* OR laparo* OR procedure)
S3	TX (bowel OR rectal OR colonic OR colon OR colorectal OR rectum OR sigmoid)
S4	S3 AND S3
S5	S1 AND S4
S6	S1 AND S4 (Published Date: 20110101-20161231)
S7	S6 (English language)

APPENDIX C. PEER REVIEW COMMENTS/AUTHOR RESPONSES

Question	Reviewer's Response	Author's Responses
Are the objectives, scope, and methods for this review clearly described?	Yes	Thank you
	Yes	
	Yes	
	Yes	
	Yes	
	Yes	
Is there any indication of bias in our synthesis of the evidence?	No	Thank you
	No	
	No	
	No	
	No	
	No	
Are there any published or unpublished studies that we may have overlooked?	No	Thank you
	No	
	No	
	No	
	No	
	No	
Additional suggestions or comments can be provided below. If applicable, please indicate the page and line numbers from the draft report.	None	Thank you
	Spelling: should read Morbidity on page 32 line 4	This has been corrected.
	This is a well done systematic review of ERAS and colorectal surgery. Unfortunately most of the studies were of poor quality so the conclusions are weak. One element that is important to consider is the idea of 'bundling' and standardization and the benefit that this component of ERAS may have -- it was included in the HICPAC guidelines.	Thank you. We agree with the reviewer's comment about the quality of the studies. We added the concept of "bundling" to the "Implications for Practice" section.
	This might not be appropriate for the purpose of this paper: My only suggestion would be that the VA could exploit the advantages of being a large system and come up with templated preadmission educational materials, CPRS notes/order sets and ways to facilitate obtaining CHO drinks preop for patients to facilitate adoption of this. These are items that I am currently working on-- could be adopted and edited by facilities as needed, but would help overcome a lot of the time barriers that we encounter.	Thank you for the suggestion. As the reviewer suspected, specific strategies for implementation are outside the scope of the review.

APPENDIX D. EVIDENCE TABLES

Table 1. Study Characteristics

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
Open Surgery Studies				
Feng 2016[23] China Government funding	Inclusion: age 18-70 years; histological diagnosis of colorectal cancer; no radiotherapy or chemotherapy treatment; no severe diarrhea, liver and kidney function failure, or cardiopulmonary insufficiency; ASA I-III; BMI 18.5-30; abdominal CT with no obvious lymph node or distant metastasis Exclusion: history of abdominal surgery; endocrine or immune system dysfunction (*eg,* diabetes, thyroid disease, multiple sclerosis, rheumatoid arthritis); recent blood transfusions; preoperative treatment with opioids, hormones, non-steroidal anti-inflammatory drugs, or other immunomodulatory substances; contraindications for epidural anesthesia	Intervention: fast-track surgery (n=121) Control: traditional care (n=120) Follow-up: 30 days Compliance: NR	N=241 (data for 230) Colorectal conditions (%): 44 colon, 56 rectum Procedures (%): NR Age (mean): 58 Gender (% male): 56 BMI: 24 Comorbidity status: ASA I (27), ASA II (50), ASA III (23)	Sequence generation: NR Allocation concealment: unclear Blinding: unclear; treatment team and patient/family not blinded; data collectors were not involved in patient management Incomplete outcome data: adequate (5% excluded from analysis due to non-compliance, ostomy surgery) Selective outcome reporting: no *Risk of bias:* medium
Pappalardo 2016[31] Italy No funding indicated	Inclusion: extraperitoneal tumor location (within 12 cm above anal verge); cT2-T4 tumors with or without positive lymph nodes, elective procedure; neoadjuvant therapy where indicated Exclusion: tumor >12 cm above anal verge, cT1 or M1, urgent procedure, ASA >3, operated on with abdominoperineal resection or Hartmann's procedure, refusing neoadjuvant therapy where indicated, refusing or unable to follow fast-	Intervention: fast-track protocol (n=25) Control: traditional care (n=25) Follow-up: 30 days Compliance: NR	N=50 Colorectal conditions (%): 100% rectal cancer Procedures (%): anterior resection (62), ultra-low anterior resection (36) Castrini technique (4) Age (mean): 67 Gender (% male): 52	Sequence generation: NR Allocation concealment: NR Blinding: adequate (outcome assessors) Incomplete outcome data: yes (mean data not reported) Selective outcome reporting: yes (data not reported at time points identified in methods)

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
	track protocol, coagulation disorder contraindicating epidural catheter insertion NOTE: 56% of fast-track and 52% of traditional care groups received neoadjuvant therapy		BMI: 38% <25; 20% >30 Comorbidity status: ASA I (10), ASA II (42), ASA III (48)	*Risk of bias:* high
Jia 2014[27] China No funding indicated	Inclusion: elderly patients with colorectal carcinoma admitted for open curative resection Exclusion: history of dementia, Parkinson's disease, alcohol intake of ≥250 g/day, long-term use of sleeping pills or anxiolytics, and those who received anesthesia within the past 30 days	Intervention: fast-track surgery (n=120) Control: traditional care (n=120) Follow-up: NR, perioperative period Compliance: NR	N=240 (all elderly, ages 70-88) (data for 233) Colorectal conditions (%): colon cancer (49); rectal cancer (51) Procedures (%): colectomy (45); Dixon (32), Miles (23) Age (mean): 75 Gender (% male): 63 BMI: NR Comorbidity status: NR	Sequence generation: adequate Allocation concealment: NR Blinding: NR Incomplete outcome data: 3% (n=7, including 3 who went to ICU) not included in analyses Selective outcome reporting: no *Risk of bias:* medium
Nanavati 2014[30] India No funding indicated	Inclusion: age 16-66 years, undergoing anastomosis anywhere distal to the ileum Exclusion: uncontrolled comorbid conditions (*eg,* diabetes mellitus, hypertension) and emergency bowel surgeries	Intervention: fast-track peri-operative care (n=30) Control: traditional perioperative care (n=30) Follow-up: 30 days Compliance: NR	N=60 Colorectal conditions (%): ileostomy closure 42 colostomy closure 28 abdominal pain 13 ileocolostomy closure 8 other 9 Age (mean): 34 Gender (% male): 53 BMI: NR Comorbidity status: NR	Sequence generation: NR Allocation concealment: unclear Blinding: NR Incomplete outcome data: no loss to follow-up Selective outcome reporting: no *Risk of bias:* unclear

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
Gouvas 2012[25] CCT Greece No funding indicated 2 X 2 study (open vs laparoscopic and fast track vs usual care)	Inclusion: diagnosed with adenocarcinoma of lower 2/3 of rectum Exclusion: emergency cases, tumor other than adenocarcinoma, distant metastases, neuromuscular disability, unsuitable for epidural anesthesia; ASA IV, refusal to consent to fast-track care or laparoscopy, different operation performed than originally scheduled	Intervention: open surgery combined with fast track (n=36) Control: open surgery usual care (n=45) Follow-up: 30 days Compliance: NR	N=81 Colorectal conditions (%): rectal cancer (100) Age (mean): 64 Gender (% male): 67 (fast track 53% vs 78% usual care, P=.001 across groups) BMI: 28 Comorbidity status (%): ASA I (42); ASA II (46), ASA III (12)	Sequence generation: NA (CCT) Allocation concealment: NA, grouped according to surgeon's preference Blinding: NR Incomplete outcome data: no Selective outcome reporting: no *Risk of bias:* high
Ren 2011[32] China Government funding	Inclusion: age 20-80 years, single colorectal lesion, medically eligible for radical colorectal surgery Exclusion: emergency surgery, synchronous resection of other organs, past abdominopelvic surgical history, affliction with a disease that would affect recovery	Intervention: ERAS group (n=299) Control: usual care (n=298) Follow-up: 30 days Compliance: NR	N= 676 (Data for 597) Procedures (%): right hemicolectomy (28), left hemicolectomy (6), low anterior resection (44), abdominoperineal resection (13), other (9) Age (median): 59 (ERAS), 61 (control) Gender (% male): 62 BMI (median): 22.5 Comorbidity status: ASA (mean) Control 1.4 (0.4) ERAS 1.4 (0.3)	Sequence generation: adequate Allocation concealment: NR Blinding: adequate (outcomes assessment) Incomplete outcome data: 0% (79 were randomized but then found to not meet inclusion criteria) Selective outcome reporting: no *Risk of bias:* low
Wang 2012[35] China	Inclusion: no disease of immune system, no pre-operative radiotherapy or chemotherapy, no history of operation on abdominal and distant metastases, ASA	Intervention: open surgery combined with fast track (n=42)	N=86 (data for 83) Colorectal conditions (%): colon cancer 100	Sequence generation: NR Allocation concealment: adequate

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
No funding indicated 2 X 2 study (open vs laparoscopic and fast track vs usual care)	score I–III, and self-care function prior to hospitalization Exclusion: association with other organ resection, conversion from laparoscopic operation to laparotomy, inability to place an epidural catheter, inability to infuse drugs, need for a stoma, and emergency operation	Control: open surgery usual care (n=44) Follow-up: 30 days Compliance: NR	Age (median): 55 (fast track), 57 (usual care) Gender (% male): 59 BMI: 22.5 Comorbidity status (%): ASA I (40), ASA II (46), ASA III (14)	Blinding: NR Incomplete outcome data: 3% (n=3) excluded from analyses Selective outcome reporting: no *Risk of bias:* unclear
Yang 2012[37] China No funding indicated	Inclusion: age 18-80, diagnosed with colorectal carcinoma, no preoperative chemotherapy or radiotherapy, ASA score I-II, BMI 17.5-27.5, preoperative serum albumin ≥30g/L, elective open colorectal resection with tracheal intubation and general anesthesia Exclusion: immune-related disease, primary diabetes mellitus or impaired glucose tolerance, hiatus hernia, gastroesophageal reflux disease (GERD), pregnancy, bowel obstruction, difficult airway access, drug intake that may affect bowel movement and function, failure of thoracic epidural catheter insertion, intraoperative blood transfusion, stoma requirement, unresectable carcinoma	Intervention: fast-track group (n=35) Control: conventional care (n=35) Follow-up: 30 days Compliance: Use of checklists to maintain compliance. Did not report results of checklists	N= 70 (data for 62) Procedures (%): right hemicolectomy (21), left hemicolectomy (8); sigmoidectomy (21), Dixon operation (50) Age (median): 57 (fast track), 60 (usual care) Gender (% male): 68 BMI (median): 22 Comorbidity status: NR	Sequence generation: adequate Allocation concealment: adequate Blinding: adequate (outcome assessment) Incomplete outcome data: 11% (n=8) not included in analysis Selective outcome reporting: no *Risk of bias:* low
Vlug 2011[34] *LAFA-study* The Netherlands (multisite) Industry 2 X 2 study (open vs laparoscopic	Inclusion: ages 40-80 years; ASA I, II, or III; elective segmental colectomy for histologically confirmed adenocarcinoma or adenoma; without evidence of metastatic disease Exclusion: prior midline laparotomy, unavailability of a laparoscopic surgeon, emergency surgery, or a planned stoma	Intervention: open surgery combined with fast track (n=103) Control: open surgery usual care (n=108) Follow-up: 30 days Compliance: 15 components monitored for compliance,	N=211 (data for 191) Colorectal conditions (%): colon cancer and benign disease 100 Procedures (%): right colectomy (45), left colectomy (55) Age (mean): 66	Sequence generation: NR Allocation concealment: adequate Blinding: patients and medical staff blinded for surgical approach (laparoscopic vs open) until day of discharge

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
and fast track vs usual care)		11.1 of 15 components successfully applied per patient in fast-track group;.5.8 components of fast track successfully applied per patient in usual care group	Gender (% male): 59 BMI: 26 Comorbidity status (%): ASA I or II (79), III (21)	Incomplete outcome data: 10% (n=20) were excluded from analyses (9 of 20 [45%] withdrew consent) Selective outcome reporting: no *Risk of bias:* medium
Wang 2011[36] China Social Development Fund	Inclusion: NR Exclusion: non-selective admission, preoperative distant metastases, stoma, emergency situation, scheduled total colectomy or abdominoperineal resection, contraindications for epidural anesthesia or early ambulation	Intervention: fast-track rehabilitation (n=106) Control: conventional care (n=104) Follow-up: 30 days Compliance: NR	N=230 (data for 210) Colorectal condition (s)(%): colon (65), rectum (35) Procedures (%): right hemicolectomy (26), left hemicolectomy (20), sigmoid colectomy (29), anterior resection (25) Age (median): 57 (fast track), 55 (conventional care) Gender (% male): 60 BMI: NR Comorbidity status (%): ASA I (28), ASA II (55), ASA III (17)	Sequence generation: NR Allocation concealment: NR Blinding: NR Incomplete outcome data: 0% Selective outcome reporting: no *Risk of bias:* unclear
Ionescu 2009[26] Romania No funding indicated	Inclusion: ASA score I-III, admitted to hospital for elective open colorectal surgery for neoplasm Exclusion: previous abdominal surgery, extensive neoplasm, severe malnutrition, surgery for complications (bowel obstruction), and palliative surgical procedures	Intervention: fast-track protocol (n=48) Control: conventional care program (n=48) Follow-up: NR (perioperative; patients asked to mention	N=96 (Data for N=96) Colorectal conditions (%): rectosigmoid (58); colon (42) Procedures: right hemicolectomy (29). left hemicolectomy (11), segmental	Sequence generation: adequate Allocation concealment: adequate Blinding: NR Incomplete outcome data: 0%

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
		inclusion in study in case of readmission) Compliance: NR	colonic resection (1), rectosigmoidian resection (58) Age (mean): 62 Gender (% male): 64 BMI: NR Comorbidity status (%): ASA I (52), ASA II (45), ASA III (3) Subgroups noted [a]: None	Selective outcome reporting: no *Risk of bias:* low
Muller 2009[29] Switzerland No funding indicated	Inclusion: age >18, elective open colonic resection with a primary anastomosis Exclusion: emergency situations, contraindication to epidural anesthesia, scheduled total colectomy or rectum resection, preoperatively immobile	Intervention: fast-track program (n=76) Control: standard care (n=75) Follow-up: 30 days Compliance: adherence reported for intraoperative intravenous intake, first 24-hour intravenous intake, effective epidural analgesia, mobilization time day 1, and oral nutrition day 1 and day 4 NOTE: study stopped prematurely after reaching significant difference for primary endpoint (total complications to 30 days after surgery)	N= 156 (data for 151) Procedures (%): sigmoid resection or left hemicolectomy (67), resection of transverse colon (1), right hemicolectomy (32) Age (median): 62 (fast track), 59 (standard care) (P=.04) Gender (% male): 51 BMI (median): 24 (fast track), 26 (standard care) Comorbidity status (%): ASA I (3), ASA II (69); ASA III (28)	Sequence generation: NR Allocation concealment: unclear Blinding: no Incomplete outcome data: 3% (n=5) not included in analysis Selective outcome reporting: did not report data from BADL (need for personal care) nor IADL (ability to perform physical activities) *Risk of bias:* high
Šerclová 2009[33] Czech Republic	Inclusion: age 18-70 years, ASA score between I or II, open intestinal resection	Intervention: fast-track group (n=53)	N= 105 (data for 103) Colorectal conditions (%): Crohn's disease (78), ulcerative	Sequence generation: adequate

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
Government	Exclusion: pelvic radiation, multi-organ resections, cancer, pregnant women	Control: conventional care (n=52) Follow-up: 30 days Compliance: NR	colitis (9), familial adenomatous polyposis (5), carcinoma (7), other (2) Procedures (%): simple bowel resection (54), multiple (25), resection and stomy (20) Age (mean): 36 Gender (% male): 50 BMI (median): NR Comorbidity status (%): NR	Allocation concealment: adequate Blinding: NR Incomplete outcome data: 2% (n=2) not included in analysis Selective outcome reporting: no *Risk of bias:* low
Khoo 2007[28] UK No funding indicated	Inclusion: elective surgery for colorectal cancer. Exclusion: unable to mobilize independently over 100 meters at preoperative assessment, contraindications to thoracic epidurals, preexisting clinical depression, palliation, a joint operation involving another surgical specialty	Intervention: multimodal package (n=35) Control: usual care (n=35) Follow-up: 10-14 days Compliance: Both arms were protocol-driven, with checklists	N=81 (data for 70) Colorectal conditions (%): colon cancer (67), rectal cancer (33) Age (median): 69 (multimodal), 73 (usual care) Gender (% male): 39 BMI: NR Comorbidity status (%): ASA I (11), ASA II (74), ASA III (14)	Sequence generation: adequate Allocation concealment: adequate (telephone) Blinding: NR Incomplete outcome data: 14% (n=11 withdrawn, 7 due to metastatic disease 3 withdrew consent) Selective outcome reporting: no *Risk of bias:* medium
Gatt 2005[24] UK No funding indicated	Inclusion: requiring elective colorectal surgery, living independently at home Exclusion: age<18 years, pregnancy, intolerance to probiotics and/or preantibiotics, contraindication to one or more optimization strategy,	Intervention: multimodal optimization (n=19) Control: usual care (n=20) Follow-up: 30 days	N=39 Colorectal conditions (%): malignant disease (69) Procedures (%): right hemicolectomy (28), left	Sequence generation: unclear Allocation concealment: unclear Blinding: no

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
	contraindications to early postoperative discharge, prescribed medications that may independently prolong hospital stay (*eg,* anticoagulants), advanced malignancy on preoperative assessment, palliative or emergency surgery, failure to perform colonic or rectal resection	Compliance: NR	hemicolectomy (5), anterior resection (38), sigmoid colectomy (5), subtotal colectomy (8), abdominoperineal resection (5), other (11) Age (median): 67 (both groups) Gender (% male): 59 BMI: medians 24 (multimodal), 27 (usual care) Comorbidity status: POSSUM score (medians) 28 (multimodal), 32 (usual care); ASA (median)=2 (both groups)	Incomplete outcome data: all included in the analyses Selective outcome reporting: no *Risk of bias:* unclear
Anderson 2003[22] UK No funding indicated	Inclusion: lived independently at home and required left or right hemicolectomy Exclusion: NR	Intervention: multimodal optimization (n=14) Control: usual care (n=11) Follow-up: 30 days Compliance: NR	N=25 Colorectal conditions (%): malignant disease 72% Age (medians): 64 (multimodal), 67 (usual care) Gender (% male): 44 BMI: medians 24 (multimodal), 26 (usual care) Comorbidity status: POSSUM score (median) 26 (both groups); ASA I/II 92%, III 8%	Sequence generation: NR Allocation concealment: unclear Blinding: no Incomplete outcome data: no Selective outcome reporting: no *Risk of bias:* unclear
Laparoscopic Studies				
Ota 2017[42] Japan	Inclusion: ASA grade I or II, elective surgery for colonic or rectosigmoid cancer in 1 of 6 hospitals, white blood cell count	Intervention: enhanced recovery after surgery (n=159)	N=320	Sequence generation: NA, not randomized

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
CCT No funding indicated	≥3000/μL, platelet count ≥100,000/μL, serum aspartate aminotransferase or alamine aminotransferase level ≤100IU/μL, total bilirubin ≤2mg/dl, serum creatinine ≤1.5 mg/dl Exclusion: emergency surgery, bowel obstruction preoperatively, routine use of steroids, history of cancer treatment using irradiation or chemotherapy, previous laparotomy other than for appendectomy, oophorectomy, or caesarean section	Control: conventional perioperative care (n=161) Follow-up: 30 days Compliance: average rate of compliance with each ERAS intervention in ERAS group was 85%; over 50% of ERAS components were implemented in conventional care group; improved adherence to ERAS protocol significantly associated with reduced length of stay (P=.01) but not overall complications (P=.29)	Colorectal locations (%): cecum (16), ascending (29), transverse (12), descending (7), sigmoid (29), rectosigmoid (14) Age (medians): 69 (ERAS), 68 (conventional care) Gender (% male): 50 BMI: NR Comorbidity status (%): ASA I (37), ASA II (63)	Allocation concealment: NA, grouped according to hospital where operation was performed Blinding: NR Incomplete outcome data: no Selective outcome reporting: no *Risk of bias:* high
Scioscia 2017[43] Italy No funding indicated	Inclusion: age >18 years, preoperative evidence of bowel endometriosis (imaging or other), primary laparoscopic approach Exclusion: surgery for reasons other than endometriosis, laparotomy or vaginal approach, endometriosis without bowel involvement, did not consent to intestinal surgery	Intervention: fast-track care (n=62) Control: conventional care (n=165) NOTE: 1:3 ratio for randomization Follow-up: 30 days Compliance: NR	N=227 Colorectal conditions (%): bowel endometriosis (100) Procedure (%): bowel segmental resection (86) Age (mean): 35 Gender (% male): 0 BMI: 22 Comorbidity status: Barthel index (median) 100 for both groups (complete independence)	Sequence generation: unclear; based on scheduled day of surgery Allocation concealment: unclear; day of surgery assigned by secretary blind to study Blinding: surgeons and anesthetists blinded to the group assigned to them Incomplete outcome data: adequate (no loss to follow-up) Selective outcome reporting: no *Risk of bias:* medium

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
Mari 2016[40] Italy No funding indicated	Inclusion: indication for major colorectal surgery, age 18-80 years, ASA I to III, autonomous for mobilization and walking, eligible for laparoscopic technique Exclusion: no additional criteria reported	Intervention: ERAS (n=70) Control: standard care (n=70) Follow-up: 5 days Compliance: 90% accordance with ERAS guidelines	N=140 Colorectal conditions (%): diverticulitis (25), adenocarcinoma (75) (left 43%, right 31%, rectal 26%) Age (mean): 66 Gender (% male): 53 BMI: 27 Comorbidity status (%): ASA I (23), ASA II (64), ASA III (14)	Sequence generation: adequate Allocation concealment: unclear Blinding: unclear Incomplete outcome data: adequate; ITT analysis, 4% (n=5) from ERAS group discharged before day 5 blood sample Selective outcome reporting: no *Risk of bias:* medium
Wang 2015[45] China CCT No funding indicated	Inclusion: underwent colonic surgery (radical resection of colonic cancer) by one surgical group (July 2012-Oct 2013) Exclusion: NR	Intervention: ERAS program (n=57) Control: usual care (n=60) Follow-up: 28 days Compliance: NR	N=117 Colorectal conditions (%): cancer 100 (right side 79%, left side 21%) Age (mean): 59 Gender (% male): 47 BMI: 24 Comorbidity status: ASA score=1 72%, ASA score=2 28%	Sequence generation: NA (CCT) Allocation concealment: NA (CCT) Blinding: self-administered questionnaire Incomplete outcome data: 96% response rate overall Selective outcome reporting: no *Risk of bias:* medium
Feng 2014[38] China	Inclusion: age 18-75 years; diagnosed with rectal cancer based on clinical symptoms, imaging, and pathological evidence, with no findings of tumor invasion to adjacent organs, local, or distal	Intervention: fast-track surgery (n=60) Control: usual care (n=60)	N=120 (data for n=116) Colorectal condition (s): rectal cancer	Sequence generation: adequate Allocation concealment: adequate

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
National Natural Scientific Foundation of China Laparoscopic (94%)	metastasis; no preoperative radiotherapy or chemotherapy; ASA physical status I or II Exclusion: pregnant or lactating women; primary diabetes; complete bowel obstruction; severe cardiopulmonary or immune related diseases; human immunodeficiency virus infection or acquired immunodeficiency syndrome related diseases; palliative or emergency operation; combined resection of spleen or pancreas; severe adverse events (*eg,* cerebrovascular accident or massive hemorrhage); history of radio-chemotherapy	Follow-up: 4 weeks Compliance: NR	Procedure: radial anterior resection with TME Age (mean): 55 Gender (% male): 66 BMI: 22 Comorbidity status (%): ASA I (4), ASA II (96)	Blinding: adequate (outcomes assessment) Incomplete outcome data: 3% (n=4, unresectable tumor and withdrawal of consent) not included in analyses Selective outcome reporting: no *Risk of bias:* low
Mari 2014[41] Italy No funding indicated	Inclusion: age 18-85 years, total laparoscopic high anterior resection, ASA score I-III, BMI <30, no intestinal diversion Exclusion: NR	Intervention: fast-track program (n=26) Control: usual care (n=26) Follow-up: 30 days Compliance: NR	N=52 (data for 50) Colorectal condition (s) (%): colon cancer (69), diverticular disease (31) Age (median): 66 (29-83) Gender (% male): 48 BMI: 25 Comorbidity status (%): ASA, I (67), ASA II (29), ASA III (2)	Sequence generation: NR Allocation concealment: unclear Blinding: NR Incomplete outcome data: 4% (n=2) not included in analyses Selective outcome reporting: BADL not reported *Risk of bias:* unclear
Gouvas 2012[25] CCT Greece No funding indicated 2 X 2 study (open vs laparoscopic	Inclusion: diagnosed with adenocarcinoma of lower 2/3 of rectum Exclusion: emergency cases, tumor other than adenocarcinoma, distant metastases, neuromuscular disability, unsuitable for epidural anesthesia; ASA IV, refusal to consent to fast-track care or laparoscopy,	Intervention: laparoscopy combined with fast track (n=42) Control: laparoscopy usual care (n=33) Follow-up: 30 days	N=75 Colorectal conditions (%): rectal cancer (100) Age (mean): 66	Sequence generation: NA, not randomized Allocation concealment: NA, grouped according to surgeon's preference Blinding: NR

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
and fast track vs usual care)	different operation performed than originally scheduled	Compliance: NR	Gender (% male): 44 (fast track 52% vs 33% usual care, P=.001 across groups) BMI: 28 Comorbidity status (%): ASA I (52), ASA II (36), ASA III (12)	Incomplete outcome data: no Selective outcome reporting: no *Risk of bias:* high
Wang 2012[35] China No funding indicated 2 X 2 study (open vs laparoscopic and fast track vs usual care)	Inclusion: no disease of immune system, no pre-operative radiotherapy or chemotherapy, no history of operation on abdominal and distant metastases; ASA score I–III, and self-care function prior to hospitalization Exclusion: association with other organ resection, conversion from laparoscopic operation to laparotomy, inability to place an epidural catheter, inability to infuse drugs, need for a stoma, and emergency operation	Intervention: laparoscopy combined with fast track (n=42) Control: laparoscopy usual care (n=42) Follow-up: 30 days Compliance: NR	N=84, data for 80 Colorectal conditions (%): colon cancer 100 Procedures (%): right hemicolectomy (39), left hemicolectomy (34), sigmoid colectomy (28) Age (median): 56 (both groups) Gender (% male): 66 BMI: 22 Comorbidity status (%): ASA I (39), ASA II (48), ASA3 (14)	Sequence generation: NR Allocation concealment: adequate Blinding: NR Incomplete outcome data: 5% (n=4) excluded from analyses Selective outcome reporting: no *Risk of bias:* unclear
Wang 2012[44] China Social Development Fund	Inclusion: no previous abdominal surgery, no preoperative chemotherapy or radiotherapy, absence of distant metastases, ASA physical status I=III Exclusion: age < 18 years, cannot take care of themselves at home, undergone conversion to laparotomy, epidural catheter could not be inserted or did not work, anastomosis performed below 12cm from the anus, or patients receiving a stoma	Intervention: fast-track rehabilitation (n=54) Control: usual care (n=54) Follow-up: 30 days Compliance: study team made rounds 3 times daily to direct care but no compliance data reported	N=107 (data for 99) Colorectal condition (s): adenocarcinoma of colon Procedures (%):right hemicolectomy (34), left hemicolectomy (26), sigmoid colectomy (39) Age (median): 54 (fast track), 53 (usual care)	Sequence generation: unclear Allocation concealment: unclear Blinding: no; groups separated into different wards; outcomes observed by all members of study team and consensus reached Incomplete outcome data: 7% (n=8, unavailable PCA pump,

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
			Gender (% male): 60 BMI: median 22 (both groups) Comorbidity status (%): ASA I (28), ASA II (52), ASA III (20)	conversion to laparotomy, stoma, metaptosis to pelvic floor); not included in analyses Selective outcome reporting: no *Risk of bias:* unclear
Wang 2012[46] China No funding indicated	Inclusion: age > 65 years, diagnoses of colorectal cancer, undergoing laparoscopic colorectal resection Exclusion: distant metastasis involving pelvic invasion, the urethra, or iliac vessels; or were unable to undergo surgery because of poor cardiopulmonary function	Intervention: fast-track rehabilitation (n=40) Control: usual care (n=38) Follow-up: 3-44 months Compliance: NR	N=78 Colorectal conditions (%): colon cancer (68), rectal cancer (32) Procedures (%): right hemicolectomy (17), left hemicolectomy (4), sigmoid colectomy (29), anterior resection (25) Age (median): 71 (fast track), 72 (usual care) Gender (% male): 54 BMI: NR Comorbidity status (%): ASA I (28), ASA II (55), ASA III (17)	Sequence generation: adequate Allocation concealment: unclear Blinding: NR Incomplete outcome data: no Selective outcome reporting: no *Risk of bias:* medium
Vlug 2011[34] *LAFA-study* The Netherlands (multisite) Industry 2 X 2 study (open vs laparoscopic	Inclusion: ages 40-80 years; ASA I, II, or III; elective segmental colectomy for histologically confirmed adenocarcinoma or adenoma; without evidence of metastatic disease Exclusion: prior midline laparotomy, unavailability of a laparoscopic surgeon, emergency surgery, or a planned stoma	Intervention: laparoscopy combined with fast track (n=106) Control: laparoscopy usual care (n=110) Follow-up: 30 days Compliance: 11.2 of the 15 components successfully	N=216 (data for 209) Colorectal conditions (%): colon cancer and benign disease 100 Procedures (%): right colectomy (47), left colectomy (53) Age (mean): 67	Sequence generation: NR Allocation concealment: adequate Blinding: patients and medical staff blinded for surgical approach until day of discharge)

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
and fast track vs usual care)		applied per patient; 6.0 components of fast track were successfully applied per patient in the usual care group	Gender (% male): 58 BMI: 26 Comorbidity status (%) ASA I/II (81), III (19)Comorbidity (%): 69	Incomplete outcome data: 3% (n=7) excluded from analyses (3 protocol violation, 2 withdrew consent) Selective outcome reporting: no *Risk of bias:* medium
Mixed Open and Laparoscopic Surgery Studies				
Forsmo 2016[50] Norway Funding: Internal (University Hospital)	Inclusion: age >18 years, scheduled for elective open or laparoscopic colorectal surgery for malignant or benign disease; also included rectal cancer patients who had pelvic radiation Exclusion: multivisceral resection planned, ASA IV, pregnancy, emergency operation, impaired mental capacity making consent difficult, inability to adapt to ERAS criteria NOTE: operating surgeon decided which surgical approach should be used	Intervention: enhanced recovery after surgery (n=162) Control: standard care (n=162) Follow-up: 30 days Compliance: significant differences between groups for a) preoperative counseling (ERAS 100%), b) carbohydrate drink (night before and 2 hr before surgery (ERAS 100%), c) laxative (ERAS 100%), d) intravenous anesthesia (ERAS 99%), e) earlier and increased oral intake and decreased intravenous fluid (ERAS group), f) earlier and increased mobilization (ERAS group), g) laxative POD1 (ERAS 80%, standard 3%), h) post-op oral opiates (ERAS 40%, standard 54%),	N=324 (data for 307) Colorectal conditions (%): colon (46), rectal (54) (overall 79% malignant) Procedures (%): right (25), left or sigmoid (21), low anterior resection (30), abdominoperineal (20), proctocolectomy (5) Age (median): 65 (ERAS), 66 (usual care) Gender (% male): 54 BMI: NR Comorbidity status (%): ASA I (21), ASA II (63), ASA III (15)	Sequence generation: adequate Allocation concealment: adequate Blinding: none Incomplete outcome data: 5% excluded after randomization (protocol violation, emergency procedure, different hospital) Selective outcome reporting: no *Risk of bias:* low

Author, year Country Funding Source	Inclusion/Exclusion Criteria	Intervention (n) Control (n) Follow-up	Demographics	Risk of Bias
		i) post-op nasogastric tube (ERAS 3%, standard 12%), j) urine catheter removal (medians: ERAS POD2, standard POD4), k) thoracic epidural removal (medians: ERAS POD2, standard POD4)		

ASA=American Society of Anesthesiologists score; BMI= body mass index; ERAS=enhanced recovery after surgery; NR=not reported; POSSUM=Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity; POD=post-operative day; TME=total mesorectal excision

Table 2. Final Health Outcomes, Part A

Author Year Population	Length of stay, days mean (SD)		Length of stay (total[a]), mean (SD)		Overall morbidity % (n/N)		Overall mortality (note timepoint) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Open Surgery Studies								
Feng 2016[23] Colorectal cancer	Post-operative 7.5 (2.2) (n=116) P=..001[b]	Post-operative 8.6 (2.8) (n=114)	NR	NR	Surgical complications 6 (7/116) P=.03	Surgical complications 15 (17/114)	NR	NR
Pappalardo 2016[31] Rectal cancer	Dischargeable[c] POD4 68% (17/25) POD5 20% (5/25) POD6 12% (3/25) P<.05 (overall)	Dischargeable[c] POD4 16% (4/25) POD5 20% (5/25) POD6 32% (8/25) POD7 or longer 28% (7/25)	NR	NR	NR	NR	0 (0/25)	0 (0/25)
Jia 2014[27] Colorectal cancer (elderly)	9.0 (1.8) (n=117) P<.001	13.2 (1.3) (n=116)	NR	NR	NR	NR	Perioperative 0 (0/117)	Perioperative 0 (0/116)
Nanavati 2014[30] Gastrointestinal surgery (3% cancer)	4.7 (1.3) (n=30) P=.000	7.3 (1.4) (n=30)	NR	NR	NR	NR	30 day 0 (0/30)	30 day 0 (0/30)
Gouvas 2012[25] *CCT* Rectal cancer	Median 7 (range 4-13) P=.001	Median 8 (range 7-23)	Median 7 (range 4-25) P=.104	Median 8 (range 7-25)	Overall morbidity (related to complications) 39 (14/36) P=.18[b]	Overall morbidity (related to complications) 56 (25/45)	30 day 3 (1/36) P=NS	30 day 0 (0/45)
Ren 2011[32] Colorectal cancer	5.7 (1.6) (n=299) P<.001	6.6 (2.4) (n=298)	NR	NR	Post-op complications 9.7 (29/299) P=.90	Post-op complications 9.4 (28/298)	30 day 0 (0/299)	30 day 0 (0/298)

Author Year Population	Length of stay, days mean (SD)		Length of stay (total[a]), mean (SD)		Overall morbidity % (n/N)		Overall mortality (note timepoint) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Wang 2012[35] Colon cancer	NR	NR	Post-operative 6.5 (4.1) (n=41) P<.05	Post-operative 7.4 (4.2) (n=42)	Overall complications 17 (7/41) P=NS	Overall complications 24 (10/42)	30 day 0 (0/41) P=NS	30 day 2 (1/42)
Yang 2012[37] Colorectal cancer	6.0 (1.0) (n=32) P<.05	11.7 (3.8) (n=30)	NR	NR	Total infectious complications 6 (2/32) Total non-infectious complications 13 (4/32) Overall P=.09[b]	Total infectious complications 27 (8/30) Total non-infectious complications 13 (4/30)	NR	NR
Vlug 2011[34] Colon cancer and benign disease	Postoperative Median 6 (IQR 4.5-10) P=.032	Postoperative Median 7 (IQR 6-10.5)	Postoperative Median 7 (IQR 5-11) P=NS	Postoperative Median 7 (IQR 6-13)	Overall morbidity (related to complications) 46 (43/93) P=NS	Overall morbidity (related to complications) 41 (41/98)	30 day 4 (4/93) P=NS	30 day 2 (2/98)
Wang 2011[36] Colorectal cancer	Postoperative 5.1 (3.1) (n=106) P=.001	Postoperative 7.6 (4.8) (n=104)	NR	NR	Patients with complications 19 (20/106) P=.02	Patients with complications 38 (39/104)	2 (2/106) P=.57	1 (1/104)
Ionescu 2009[26] Rectosigmoid (58%) or colon (42%) cancer	6.4 (3.4) (n=48) P=.001	9.2 (2.7) (n=48)	NR	NR	NR	NR	NR	NR
Muller 2009[29] Colon surgery (87% malignant) with primary anastomosis	Median LOS 5 (2-30) (n=76) P<.0001	Median LOS 9 (6-30) (n=75)	NR	NR	Total complications 21 (16/76) P=.001	Total complications 49 (37/75)	NR	NR

Author Year Population	Length of stay, days mean (SD)		Length of stay (total[a]), mean (SD)		Overall morbidity % (n/N)		Overall mortality (note timepoint) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Šerclová 2009[33] Intestinal resection (78% Crohn's disease, 7% cancer)	7.4 (1.3) (n=51) P<.001	10.4 (3.1) (n=52)	NR	NR	Total complications 22 (11/51) P=.003	Total complications 48 (25/52)	0 (0/51)	0 (0/52)
Khoo 2007[28] Colon (67%) or rectal (33%) cancer	Median 5 (range 3-37) P<.001 Rectal cancer 5.5 (4-37) Colon cancer 4 (3-13)	Median 7 (range 4-63) Rectal cancer 8.5 (4-63) Colon cancer 7 (5-35)	Median 5 (range 3-37) P<.001	Median 7 (range 4-63)	NR	NR	At day 14 0 (0/35)	At day 14 6 (2/35)
Gatt 2005[24] Colon surgery (69% malignant)	Median 5 (IQR 4-9) P=.03	Median 7.5 (IQR 6-10)	NR	NR	Total complications of surgery 47 (9/19) P=.08	Total complications of surgery 75 (15/20)	At day 30 5 (1/19) P=.49[b]	At day 30 0 (0/20)
Anderson 2003[22] Colon surgery (72% malignant)	4.0 (1.8) (n=14) Median 3 (IQR 2-7) P=.002 for both	7.0 (2.1) (n=11) Median 7 (IQR 4-10)	NR	NR	NR	NR	At day 30 0 (0/14) P=NS	At day 30 9 (1/11)
Laparoscopic Studies								
Ota 2017[42] CCT Colorectal cancer NOTE: 97% (ERAS) and 91% (control) had laparoscopic surgery	Postoperative Median 8.5 (5-41) P<.001 Met discharge criteria POD3 (1-39) P<.001	Postoperative Median 14 (7-46) Met discharge criteria POD10 (7-56) P<.001	NR	NR	NR	NR	0 (0/159)	0 (0/161)
Scioscia 2017[43] Bowel endometriosis	Median 3 (3-12) P<.001	Median 7 (4-33)	NR	NR	NR	NR	NR	NR

Author Year Population	Length of stay, days mean (SD)		Length of stay (total[a]), mean (SD)		Overall morbidity % (n/N)		Overall mortality (note timepoint) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Mari 2016[40] Colorectal cancer (75%) or diverticular disease (25%)	Day of discharge 5.0 (2.6) P<.05	Day of discharge 7.2 (3.0)	NR	NR	Patients with complications 17 (12/70) P=NS	Patients with complications 21 (15/70)	0 (0/70)	0 (0/70)
Wang 2015[45] CCT Colon cancer	Postoperative 6.1 (1.7) P<.001	Postoperative 8.7 (2.8)	NR	NR	Total morbidity 17.5% (10/57) P=.24	Total morbidity 26.7% (16/60)	0 (0/57)	0 (0/60)
Feng 2014[38] Rectal cancer	Postoperative 5.1 (1.4) (n=57) P<.001	Postoperative 7.0 (2.3) (n=59)	All patients admitted 2-3 days before operation		Total complications 3 (2/59) P=.03	Total complications 17 (10/57)	0 (0/57)	0 (0/59)
Mari 2014[41] Colon cancer (69%) or diverticular disease (31%)	Day of discharge 4.7 (2.4) (n=25) P<.005	Day of discharge 7.7 (2.4) (n=25)	NR	NR	No major complications in either group		0 (0/25)	0 (0/25)
Gouvas 2012[25] *CCT* Rectal cancer	Median 4 (range 3-12) P<.001	Median 8 (range 3-18)	Median 4 (range 3-31) P<.001	Median 9 (range 3-22)	Overall morbidity (related to complications) 21 (9/42) P=.008 [b]	Overall morbidity (related to complications) 52 (17/33)	At day 30 2 (1/42) P=NS	At day 30 0 (0/33)
Wang 2012[35] Colon cancer	NR	NR	Postoperative 5.2 (3.9) (n=40) P<.05	Postoperative 6.3 (4.7) (n=40)	Complications, overall 8 (3/40) P=.48[b]	Complications, overall 15 (6/40)	At day 30 3 (1/40) P=NS	At day 30 0 (0/40)
Wang 2012[44] Adenocarcinoma of the colon	NR	NR	Postoperative, median 4 (2-12) P<.01	Postoperative, median 5 (3-48)	Patients with 1 or more complications 12 (6/49) P=.30	Patients with 1 or more complications 20 (10/50)	2 (1/49) on POD3 P=.31	0 (0/50)

Author Year Population	Length of stay, days mean (SD)		Length of stay (total[a]), mean (SD)		Overall morbidity % (n/N)		Overall mortality (note timepoint) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Wang 2012[46] Colorectal cancer (elderly)	5.5 (5-6) P<.001 (n=40)	7.0 (6-8) (n=38)	NR	NR	Overall complications 5 (2/40) P=.045	Overall complications 21 (8/38)	1 death from hepatic metastasis after right hemicolectomy; 2 deaths from myocardial infarction Groups not reported; no significant difference between groups	
Vlug 2011[34] Colon cancer and benign disease	Postoperative Median 5 (IQR 4-7) P=.020	Postoperative Median 6 (IQR 4-8.5)	Postoperative Median 5 (IQR 4-8) P=.026*	Postoperative Median 6 (IQR 4.5-9.5)	Overall morbidity (related to complications) 34 (34/100) P=NS	Overall morbidity (related to complications) 34 (37/109)	At day 30 2 (2/100) P=NS	At day 30 2 (2/109)
Mixed Open and Laparoscopic Surgery Studies								
Forsmo 2016[50] Colorectal cancer and benign disease	Postoperative Median 5 (IQR 2-50) P<.001	Postoperative Median 7 (IQR 2-48)	Postoperative Median 5 (IQR 2-50) P=.001	Postoperative Median 8 (IQR 2-48)	Overall morbidity 42 (65/154) P=.69 Patients with 1 or more major complications 11 (17/154) P=.33	Overall morbidity 44 (68/153) Patients with 1 or more major complications 8 (12/153)	< 30 days 2 (3/154) P=.08	< 30 days 0 (0/153)

ASA= American Society of Anesthesiologists Index; IQR= interquartile range; NR=not reported; NS=not statistically significant; POD=Postoperative day

[a] Initial and readmission

[b] Calculated (t-test or Fisher's exact test)

[c] Defined as meeting discharge criteria: normal oral feeding, complete canalization, abdominal drain and vesical catheter removed, no fever, no need for intravenous therapy; NOTE: one patient in traditional care group not accounted for by study authors

Table 3. Final Health Outcomes, Part B

Author Year Population	Readmission rate % (n/N)		Ileus % (n/N)		Pain score, Clinically meaningful change (note score and define)		Quality of life, Clinically meaningful change (note score and define)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Open Surgery Studies								
Feng 2016[23] Colorectal cancer	NR	NR	1 (1/116) P=.62	2 (2/114)	NR	NR	NR	NR
Pappalardo 2016[31] Rectal cancer	NR	NR	NR	NR	NR	NR	NR	NR
Jia 2014[27] Colorectal cancer (elderly)	NR	NR	NR	NR	NR	NR	NR	NR
Nanavati 2014[30] Gastrointestinal surgery (3% cancer)	3 (1/30) for leak P=NS	3 (1/30) for leak	3 (1/30) P=NS	10 (3/30)	NR	NR	NR	NR
Gouvas 2012[25] *CCT* Rectal cancer	Not reported by group, rates ranged from 9.5 to 15% P=NS between all groups		8 (3/36) P=.045[a]	27 (12/45)	NR	NR	NR	NR
Ren 2011[32] Colorectal cancer	NR	NR	NR	NR	NR	NR	NR	NR
Wang 2012[35] Colon cancer	7 (3/41) P=NS	5 (2/42)	NR	NR	NR	NR	NR	NR
Yang 2012[37] Colorectal cancer	0 (0/32)	0 (0/30)	NR	NR	NR	NR	NR	NR
Vlug 2011[34] Colon cancer and benign disease	8 (7/93) P=NS	7 (7/98)	Mechanical ileus requiring reoperation n=2 Prolonged postoperative	Mechanical ileus requiring reoperation n=5 Prolonged postoperative	NR	NR	NR	NR

Author Year Population	Readmission rate % (n/N)		Ileus % (n/N)		Pain score, Clinically meaningful change (note score and define)		Quality of life, Clinically meaningful change (note score and define)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
			(5 days) ileus n=5	(5 days) ileus n=5				
Wang 2011[36] Colorectal cancer	4 (4/106) P=NS	9 (9/110)	NR	NR	NR	NR	NR	NR
Ionescu 2009[26] Rectosigmoid (58%) or colon (42%) cancer	0 (0/48)	0 (0/48)	NR	NR	NR	NR	NR	NR
Muller 2009[29] Colon surgery (87% malignant) with primary anastomosis	4 (3/76) P=NS[a]	3 (2/75)	Postoperative Ileus 4 (3/76) P=.72[a]	Postoperative Ileus 5 (4/75)	NR	NR	NR	NR
Šerclová 2009[33] Intestinal resection (78% Crohn's disease, 7% cancer)	0 (0/51)	0 (0/52)	NR	NR	VAS pain score (0-10) Clinically important difference in pain defined as 1 (standard deviation 0.5 to 1.5) Clinically significant lower pain for FT group vs non-FT group for postoperative days 0-5		NR	NR
Khoo 2007[28] Colon (67%) or rectal (33%) cancer	9 (3/35) P=.61[a]	3 (1/35)	NR	NR	NR	NR	NR	NR
Gatt 2005[24] Colon surgery (69% malignant)	5 (1/19) P=.17	20 (4/20)	16 (3/19) P=NS[a]	15 (3/20)	NR	NR	NR	NR
Anderson 2003[22] Colon surgery (72% malignant)	0 (0/19)	0 (0/20)	7 (1/14) P=NS	9 (1/11)	NR	NR	NR	NR

Author Year Population	Readmission rate % (n/N)		Ileus % (n/N)		Pain score, Clinically meaningful change (note score and define)		Quality of life, Clinically meaningful change (note score and define)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Laparoscopic Studies								
Ota 2017[42] CCT Colorectal cancer NOTE: 97% (ERAS) and 91% (control) had laparoscopic surgery	1 (2/159) P=.16	0 (0/161)	6 (10/159) P=.79	6 (9/161)	NR	NR	NR	NR
Scioscia 2017[43] Bowel endometriosis	18 (11/62) P=.69	16 (26/162)	NR	NR	NR	NR	NR	NR
Mari 2016[40] Colorectal cancer (75%) or diverticular disease (25%)	NR	NR	3 (2/70) P=NS	6 (4/70)	NR	NR	NR	NR
Wang 2015[45] CCT Colon cancer	NR	NR	5.2 (3/57) P=NS	8.3 (5/60)	Pain Scale QLQ-C30[b,c] Change from pre-op to POD3: 24.6 P=.82 POD28: 7.9 P=.05	Pain Scale QLQ-C30[b,c] Change from pre-op to POD3: 22.2 POD28: 11.1	Global Quality of Life (QLQ-C30)[b,c] Change from pre-op to POD3: -10.9 P=.000 POD28: 0.5 P=.11	Global Quality of Life (QLQ-C30)[b,c] Change[s] from pre-op to POD3: -18.7 POD28: -1.8
Feng 2014[38] Rectal cancer	0 (0/57) P=NS	1.7 (1/59) for rectovaginal fistula	0 (0/57) P=NS	1.7 (1/59)	NR	NR	NR	NR
Mari 2014[41] Colon cancer (69%) or diverticular disease (31%)	0 (0/25)	0 (0/25)	NR	NR	NR	NR	NR	NR
Gouvas 2012[25] *CCT*	Not reported by group, rates ranged from 9.5 to 15%		7 (3/42) P=.17[a]	18 (6/33)	NR	NR	NR	NR

Author Year Population	Readmission rate % (n/N)		Ileus % (n/N)		Pain score, Clinically meaningful change (note score and define)		Quality of life, Clinically meaningful change (note score and define)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Rectal cancer	P=NS between all groups							
Wang 2012[35] Colon cancer	3 (1/40) P=NS	8 (3/40)	NR	NR	NR	NR	NR	NR
Wang 2012[44] Adenocarcinoma of the colon	4 (2/49) P=.66	6 (3/50)	NR	NR	NR	NR	NR	NR
Wang 2012[46] Colorectal cancer (elderly)	NR	NR	NR	NR	NR	NR	NR	NR
Vlug 2011[34] Colon cancer and benign disease	6 (6/100) P=NS[a]	6 (7/109)	Mechanical ileus requiring reoperation n=3 Prolonged postoperative ileus n=7	Mechanical ileus requiring reoperation n=0 Prolonged postoperative ileus n=8	NR	NR	NR	NR
Mixed Open and Laparoscopic Surgery Studies								
Forsmo 2016[50] Colorectal cancer and benign disease	19 (29/154) P=.23	13 (21/153)	Mechanical, requiring reoperation 0 (0/154) P=.32 Prolonged postoperative 3 (4/154) P=.35	Mechanical, requiring reoperation 1 (1/153) Prolonged postoperative 5 (7/153)	NR	NR	NR	NR

NR=not reported; NS=not statistically significant; POD=post-operative day

[a] Calculated (Fisher's exact test)

[b] QLQ-C30=European Organization for Research and Treatment of Cancer Quality of Life tool (cancer-specific); QLQ-CR29=colonic cancer specific module; higher scores for function and quality of life indicate higher function and higher quality of life

[c] Change of 5-10 points (on 0-100 scale) denotes clinically significant change of "little better (or worse)"; change of 10-20 points denotes "moderate better (or worse)"; change of >20 points denotes "very much better (or worse)"

Table 4. Intermediate Outcomes

Author Year Population	Gastrointestinal function (define), days Mean (SD)		IV fluid administration		Mobilization, days Mean (SD)		Pain scale score (define) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Open Surgery Studies								
Feng 2016[23] Colorectal cancer	Flatus 3.7 (1.1) P=.049 Stool passage 4.8 (1.6) P=.04 Oral intake 3.3 (1.3) P=.03	Flatus 4.3 (1.5) Stool passage 5.8 (2.1) Oral intake 5.3 (1.6)	NR	NR	First ambulation 3.7 (1.7) P=.02	First ambulation 5.4 (2.1)	NR	NR
Pappalardo 2016[31] Rectal cancer	Bowel movement 52 hours P<.05	Bowel movement 19 to 33 hours later than ERAS group	NR	NR	Mobilization POD1 100 (25/25) Ambulate POD2 100 (25/25)	Mobilization POD2 68% (17/25) POD3 32% (8/25) Ambulate subsequent day for 100%	NR	NR
Jia 2014[27] Colorectal cancer (elderly)	Flatus, hours 48.5 (9.6) (n=117) P<.001	Flatus, hours 77.7 (7.2) (n=116)	NR	NR	NR	NR	NR	NR
Nanavati 2014[30] Gastrointestinal surgery (3% cancer)	Flatus 2.8 (n=30) Stool passage 4.0 P<.05 for both	Flatus 4.0 (n=30) Stool passage 6.2	NR	NR	NR	NR	NR	NR
Gouvas 2012[25] *CCT* Rectal cancer	First bowel movement Median 4 (range 1-7) P<.001	First bowel movement Median 6 (range 1-12)	NR	NR	NR	NR	NR	NR
Ren 2011[32]	Flatus, hours 53.7 (17.1)	Flatus, hours 63.1 (20.0)	NR	NR	NR	NR	NR	NR

Author Year Population	Gastrointestinal function (define), days Mean (SD)		IV fluid administration		Mobilization, days Mean (SD)		Pain scale score (define) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Colorectal cancer	(n=299) Bowel movement, hours 73.7 (23.7) P<.001 for both	(n=298) Bowel movement, hours 88.8 (29.5)						
Wang 2012[35] Colon cancer	NR	NR	NR	NR	NR	NR	NR	NR
Yang 2012[37] Colorectal cancer	Flatus 2 (1) (n=32) Defecation 3.8 (1.6) Soft Diet 4.0 (2.0) P<.05 for all	Flatus 4 (2) (n=30) Defecation 6.4 (2.5) Soft Diet 8.2 (2.2)	NR	NR	NR	NR	NR	NR
Vlug 2011[34] Colon cancer and benign disease	Medians Tolerate solid food 1 (IQR 1–3) Flatus 1 (IQR 1–3) Stool passage 3 (IQR 2–4) *Overall dis-charge criteria (including components above and mobilization) achieved significantly earlier in ERAS group versus usual care*	Medians Tolerate solid food 3 (IQR 2–5) Flatus 2 (IQR 1–3) Stool passage 4 (IQR 3–6)	NR	NR	Mobilization, median minutes POD1 120 (60-215) Mobilization as pre-operative, median days 4 (IQR 3–7)	Mobilization, median minutes POD1 20 (0-60) Mobilization as pre-operative, median days 6 (IQR 5–8)	SF-36 Bodily Pain score returned to baseline at 4 weeks with no significant differences across groups	
Wang 2011[36]	Flatus 2.1 (2.0)	Flatus 3.2 (2.5)	NR	NR	Walk on surgery day	Walk on surgery day	NR	NR

Author Year Population	Gastrointestinal function (define), days Mean (SD)		IV fluid administration		Mobilization, days Mean (SD)		Pain scale score (define) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Colorectal cancer	(n=106) P=.001	(n=104)			35% (11/106) P=.001 Walk on day 1 53% (56/106) P=.000 Walk on day 2 85% (90/106) P=.001	0% (0/104) Walk on day 1 23% (24/104) Walk on day 2 59% (61/104)		
Ionescu 2009[26] Rectosigmoid (58%) or colon (42%) cancer	Bowel function, hours 43.7 (14.9) (n=48) P=.042 Solid Food intake, hours 42.2 (12.7) P=.01 Fluid intake, hours 10.9 (8.1) P=.001	Bowel function, hours 52.02 (23.7) (n=48) Solid Food intake, hours 64.3 (23.3) Fluid intake, hours 23.5 (16.9)	NR	NR	Complete Mobilization, hours 19.6 (8.6) P=.001	Complete Mobilization, hours 37.1 (23.9)	NR	NR
Muller 2009[29] Colon surgery (87% malignant) with primary anastomosis	NR	NR	NR	NR	NR	NR	NR	NR
Šerclová 2009[33] Intestinal resection (78% Crohn's disease, 7% cancer)	Bowel Movement 1.3 (0.8) (n=51) Stool 2.1 (1.1) P<.001 for both Semi-solid and solid diet on Day 5 100 (51/51)	Bowel Movement 3.1 (1.0) (n=52) Stool 3.9 (1.1) Semi-solid and solid diet on Day 5 20 (10/52)	NR	NR	Day 0 64% could walk Day 1 54% walked 44% used treadmill 2% rehabilitated in sitting position only	Day 0 0% could walk Day 1 14% walked 2% used treadmill 68% rehabilitated in sitting position only	Mean daily VAS values (post-op day 0 to 5) 1.6, 1.0, 0.6, 0.3, 0, 0	Mean daily VAS values (post-op day 0 to 5) 3.2, 2.4, 1.8, 1.6, 1.2, 0.8

Author Year Population	Gastrointestinal function (define), days Mean (SD)		IV fluid administration		Mobilization, days Mean (SD)		Pain scale score (define) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
	P<.001					16% rehabilitated in bed		
Khoo 2007[28] Colon (67%) or rectal (33%) cancer	Tolerate solid diet Median 1 (range 0-6) Stool passage/ stoma functioning 3 (range 1-5) P<.001 for both	Tolerate solid diet Median 4 (range 2-9) Stool passage/ stoma functioning 5 (range 0-23)	Median over 47 hours peri-operatively 3000 mL	Median over 47 hours peri-operatively 6263 mL	Median 2 (range 1–10) P<.001	Median 4 (range 2–32)	NR	NR
Gatt 2005[24] Colon surgery (69% malignant)	Ability to tolerate diet of 3 light meals a day Median, hours approx. 50 P=.04	Ability to tolerate diet of 3 light meals a day Median, hours approx. 90	Duration of intravenous fluids from the time of surgery Median, hours approx. 35 P=.007	Duration of intravenous fluids from the time of surgery Median, hours approx. 68	No differences between the groups in time to be able to walk to toilet unaided (P=.79)		No differences between the groups in pain scores	
Anderson 2003[22] Colon surgery (72% malignant)	Ability to tolerate diet of 3 light meals a day Median, hours 48 (IQR 33-55) P<.001	Ability to tolerate diet of 3 light meals a day Median, hours 76 (IQR 70-110)	Discontinuation of supplemental intravenous fluids Median, hours 26 (IQR 24-37) P<.001	Discontinuation of supplemental intravenous fluids Median, hours 57 (IQR 42-105)	Walk to toilet unaided Median, hours 46 (IQR 37-54) P=.04	Walk to toilet unaided Median, hours 69 (IQR 44-121)	Post-op day 1 median pain scores at rest, on movement, and on coughing all significantly higher in usual care group versus intervention group Post-op day 7 pain on coughing remained significantly higher in usual care group	
Laparoscopic Studies								
Ota 2017[42] CCT Colorectal cancer NOTE: 97% (ERAS) and 91% (control) had laparoscopic surgery	Flatus Median 1 (1-5) P<.001 Bowel movement 2 (1-6) P<.001	Flatus Median 2 (1-5) Bowel movement 3 (1-7)	IV fluid until POD Median 1 (1-11) P<.001	IV fluid until POD Median 5 (3-35)	NR	NR	NR	NR

Author Year Population	Gastrointestinal function (define), days Mean (SD)		IV fluid administration		Mobilization, days Mean (SD)		Pain scale score (define) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
	Oral food 1 (1-31) P<.001	Oral food 3 (1-9)						
Scioscia 2017[43] Bowel endometriosis	NR	NR	NR	NR	NR	NR	NR	NR
Mari 2016[40] Colorectal cancer (75%) or diverticular disease (25%)	Flatus 1.6 (0.7) P<.05 Bowel movement P=NS (data NR) Solid diet 1.5 (0.9) P<.05	Flatus 2.1 (0.8) Bowel movement (data NR) Solid diet 3.0 (0.5)	NR	NR	Walk ≥100 m 1.5 (0.7) P<.05	Walk ≥100 m 2.6 (0.9)	NR	NR
Wang 2015[45] CCT Colon cancer	Flatus, hours 60.9 (11.1) P=.000 Bowel movement, hours 75.1 (14.9) P=.002	Flatus, hours 74.2 (16.3) Bowel movement, hours 85.5 (19.4)	NR	NR	First time out of bed, hours 15.3 (3.6) P=.000	First time out of bed, hours 42.5 (14.7)	NR	NR
Feng 2014[38] Rectal cancer	Flatus, hours 53.4 (23.6) P=.001 First defecation, hours 65.2 (22.2) P=.000 All (n=57)	Flatus, hours 67.9 (20.1) First defecation, hours 87.0 (24.9) All (n=59)	NR	NR	NR	NR	Pain (VAS) POD1 4.3 (1.0) P=.02 POD3 2.7 (1.2) P=.03 POD5 2.3 (1.5) P=.11	Pain (VAS) POD1 3.4 (1.0) POD3 1.8 (0.9) POD5 1.6 (1.2)
Mari 2014[41]	First bowel movement 0.3 (0.65)	First bowel movement 1.7 (0.5)	NR	NR	Walk at least 60-meters 1.3 (0.8)	Walk at least 60-meters 3.6 (0.5)	Pain, based on VAS pain scale Higher pain perception in immediate postoperative time in	

Author Year Population	Gastrointestinal function (define), days Mean (SD)		IV fluid administration		Mobilization, days Mean (SD)		Pain scale score (define) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Colon cancer (69%) or diverticular disease (31%)	(n=25) Stool passage 1.6 (1.0) Flatus 0.9 (0.8) Solid diet 1.2 (0.4) All P<.005	(n=25) Stool passage 5 (1.8) Flatus 2.1 (0.9) Solid diet 3.8 (1.0)			(n=25) P<.005	(n=25)	ERAS group (P<.05) but non-significant after 5 hours; From day 1, ERAS patients referred less pain as compared with control patients P=NS	
Gouvas 2012[25] *CCT* Rectal cancer	First bowel movement Median 2 (range 0-6) P<.001	First bowel movement Median 5 (range 2-12)	NR	NR	NR	NR	NR	NR
Wang 2012[35] Colon cancer	NR	NR	NR	NR	NR	NR	NR	NR
Wang 2012[44] Adenocarcinoma of the colon	Flatus, median 2 (1-6) P=.017 Semi-liquid diet 1 (1-3) P<.001 Normal diet 3 (2-5) P<.001 All (n=49)	Flatus, median 3 (1-7) Semi-liquid diet 2 (1-5) Normal diet 4 (3-7) All (n=50)	NR	NR	Autonomic mobilization 1 (1-3) P<.001	Autonomic mobilization 2 (1-3)	NR	NR
Wang 2012[46] Colorectal cancer (elderly)	Flatus, median hours 31 (26-40) P=.001 Bowel movement, median hours 55 (48-63) P=.009 Fluid diet, median hours 12 (11-16)	Flatus, median hours 38 (32-51) Bowel movement, median hours 64 (51-71) Fluid diet, median hours 47 (35-50)	NR	NR	Ambulation, median hours 12 (10-14) P<.001 (n=40)	Ambulation, median hours 19 (16-24) (n=38)	NR	NR

Author Year Population	Gastrointestinal function (define), days Mean (SD)		IV fluid administration		Mobilization, days Mean (SD)		Pain scale score (define) % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
	P<.001 All (n=40)	All (n=38)						
Vlug 2011[34] Colon cancer and benign disease	Medians Tolerate solid food 1 (IQR 1-2) Flatus 1 (IQR 1-2) Stool passage 2 (IQR 1-4) *Overall dis-charge criteria (including components above and mobilization) achieved significantly earlier in ERAS group versus usual care*	Medians Tolerate solid food 2 (IQR 1-3) Flatus 2 (IQR 1–3) Stool passage 3 (IQR 2-4)	NR	NR	Mobilization, median minutes POD1 120 (50-240) Mobilization as pre-operative, median days 3 (IQR 2-5)	Mobilization, median minutes POD1 30 (15-60) Mobilization as pre-operative, Median days 5 (IQR 4-7)	NR	NR
Mixed Open and Laparoscopic Surgery Studies								
Forsmo 2016[50] Colorectal cancer and benign disease	Flatus, median 1 (0-4) Bowel movement, median 1 (1-6) Both P<.001 Tolerate solid food, median 2 (0-9) P=.61	Flatus, median 1 (1-14) Bowel movement, median 2 (1-14) Both P<.001 Tolerate solid food, median 1 (0-12)	IV fluid, first 24 hrs (including intraoperative), L (median) 3.9 (1.9-9.0) P=.001 First 7 days 5.6 (1.9-19.2) P<.001	IV fluid, first 24 hrs (including intraoperative), L (median) 4.4 (1.8-9.5) First 7 days 7.8 (2.8-30.1)	NR	NR	NR	NR

IQR=interquartile range; NR=not reported; NS=not statistically significant; POD=post-operative day; VAS= Visual Analogue Scale

Table 5. Harms Associated with Enhanced Recovery, Part A

Author Year Population	Surgical complications (define) % (n/N)		Need for reoperation % (n/N)		Bleeding % (n/N)		General or gastrointestinal complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Open Surgery Studies								
Feng 2016[23] Colorectal cancer	Anastomotic leakage 1 (1/116) P=.37 Wound infection 1 (1/116) P=.37	Anastomotic leakage 3 (3/114) Wound infection 3 (3/114)	NR	NR	Anastomotic bleeding 1 (1/116) P=.62	Anastomotic bleeding 2 (2/114)	NR	NR
Pappalardo 2016[31] Rectal cancer	Anastomotic leakage 12 (3/25) (1 major) P=NS	Anastomotic leakage 8 (2/25) (1 major)	NR	NR	NR	NR	NR	NR
Jia 2014[27] Colorectal cancer (elderly)	Infection of incision 5 (6/117) P=.57 Anastomotic leakage 3 (3/117) P=1.0	Infection of incision 7 (8/116) Anastomotic leakage 2 (2/116)	NR	NR	NR	NR	Intestinal obstruction 3 (4/117) P=.74	Intestinal obstruction 5 (6/116)
Nanavati 2014[30] Gastrointestinal surgery (3% cancer)	Anastomotic leakage 0 (0/30) P=NS Wound infection 3 (1/30) Wound dehiscence 3 (1/30) Total 13 (4/30) P=NS	Anastomotic leakage 3 (1/30) Wound infection 0 (0/30) Wound dehiscence 0 (0/30) Total 17 (5/30)	0 (0/130)	3 (1/30) for anastomotic leak	NR	NR	NR	NR

Author Year Population	Surgical complications (define) % (n/N)		Need for reoperation % (n/N)		Bleeding % (n/N)		General or gastrointestinal complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Gouvas 2012[25] *CCT* Rectal cancer	Leak 11 (4/36) Wound complications 31 (11/36) P=NS for both	Leak 7 (3/45) Wound complications 38 (17/45)	Not reported by group, rates ranged from 4 to 15% P=NS between all groups		8 (3/36) P=.21[a]	20 (9/45)	Obstruction 3 (1/36) P=NS	Obstruction 2 (1/45)
Ren 2011[32] Colorectal cancer	Wound infection 2 (5/299) Anastomotic Leaks 2 (5/299) Intestinal Perforation 0 (1/299) P=NS for all	Wound infection 2 (5/298) Anastomotic Leaks 2 (5/298) Pancreatic Leakage 0 (1/298)	NR	NR	NR	NR	Intestinal obstruction 2 (6/299) P=NS Gastric retention 3 (10/299) P=.30[a] Diarrhea 0 (1/299)	Intestinal Obstruction 2 (7/298) Gastric retention 2 (5/298)
Wang 2012[35] Colon cancer	"Surgical"[b] 7 (3/41) P=NS	"Surgical"[b] 7 (3/42)	NR	NR	NR	NR	"General"[b] 10 (4/41) P=NS	"General"[b] 17 (7/42)
Yang 2012[37] Colorectal cancer	Surgical site infection 3 (1/32) P=.61 Anastomotic leaks 0 (0/32)	Surgical site infection 7 (2/30) Anastomotic leaks 0 (0/30)	NR	NR	NR	NR	Dysbiosis 3 (1/32) P=.10[a]	Dysbiosis 17 (5/30)

Author Year Population	Surgical complications (define) % (n/N)		Need for reoperation % (n/N)		Bleeding % (n/N)		General or gastrointestinal complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Vlug 2011[34] Colon cancer and benign disease	Major complications (including non-surgical) 20 (18/93) P=NS Including: Anastomotic leakage n=8 (2 fatal) Iatrogenic bowel perforation n=2 Dehiscence n=6 Wound infection 16 total	Major complications (including non-surgical) 21 (21/98) Including: Anastomotic leakage n=7 Iatrogenic bowel perforation n=1 Dehiscence n=3 Wound infection 10 total	14 (13/93) P=NS	18 (18/98)	NR	NR	Minor complications (including surgical) 26 (25/93) P=NS	Minor complications (including surgical) 19 (20/98)
Wang 2011[36] Colorectal cancer	Anastomotic leakage 4 (4/106) Wound infection 4 (4/106) P=NS for both	Anastomotic leakage 2 (2/104) Wound infection 7 (7/104)	2 (2/106) for bowel obstruction	5 (5/104) for bowel obstruction	NR	NR	Bowel obstruction 2 (2/106) P=.28 Re-insertion of nasogastric tube 4 (4/106) P<.05	Bowel obstruction 5 (5/104) Re-insertion of nasogastric tube 11 (12/104)
Ionescu 2009[26] Rectosigmoid (58%) or colon (42%) cancer	Anastomotic leak 2 (1/48) Wound infection 8 (4/48) P=NS for both	Anastomotic leak 2 (1/48) Wound infection 10 (5/48)	0 (0/48) for anastomotic leak P=NS[a]	2 (1/48) for anastomotic leak	NR	NR	Post-operative nausea and vomiting 35 (17/48) P=.54	Post-operative nausea and vomiting 43 (21/48)

Author Year Population	Surgical complications (define) % (n/N)		Need for reoperation % (n/N)		Bleeding % (n/N)		General or gastrointestinal complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Muller 2009[29] Colon surgery (87% malignant) with primary anastomosis	Wound infection 5 (4/76) P=.37[a] Anastomotic leaks 1 (1/76) P=.62[a]	Wound infection 9 (7/75) Anastomotic leaks 3 (2/75)	NR	NR	Postoperative bleeding 1 (1/76) P=.62[a]	Postoperative bleeding 3 (2/75)	"Other events" 0 (0/76) P=.12[a]	"Other events" 4 (3/75)
Šerclová 2009[33] Intestinal resection (78% Crohn's disease, 7% cancer)	>1 complication 0 (0/51) P=.50[a] Wound complications 8 (4/51) P=.003	>1 complication 4 (2/52) Wound complications 33 (17/52)	NR	NR	NR	NR	Vomiting Day of surgery 8% POD1 16% POD2 2%* POD3 2% POD4 2% *P<.05 (P=NS all other days)	Vomiting Day of surgery 14% POD1 12% POD2 16% POD3 10% POD4 8%
Khoo 2007[28] Colon (67%) or rectal (33%) cancer	Anastomotic leakage 3 (1/35) P=.61[a]	Anastomotic leakage 9 (3/35)	NR	NR	NR	NR	Nasogastric tube reinsertion 9 (3/35) P=NS[a]	Nasogastric tube reinsertion 11 (4/35)
Gatt 2005[24] Colon surgery (69% malignant)	Wound infection 0 (0/19) P=.11[a]	Wound infection 20 (4/20)	NR	NR	NR	NR	Diarrhea/ nausea 5 (1/19) P=NS[a]	Diarrhea/ nausea 10 (2/20)
Anderson 2003[22] Colon surgery (72% malignant)	Wound infection 7 (1/14) P=NS[a]	Wound infection 0 (0/11)	NR	NR	NR	NR	NR	NR

Author Year Population	Surgical complications (define) % (n/N)		Need for reoperation % (n/N)		Bleeding % (n/N)		General or gastrointestinal complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Laparoscopic Studies								
Ota 2017[42] CCT Colorectal cancer NOTE: 97% (ERAS) and 91% (control) had laparoscopic surgery	Surgical complications (total) 17 (27/159) P=NS Surgical site infection 3 (5/159) P=1.0 Intraperitoneal infection 0 (0/159) P=.25 Anastomotic leakage 3 (4/159) P=.99	Surgical complications (total) 16 (26/161) Surgical site infection 4 (6/161) Intraperitoneal infection 2 (3/161) Anastomotic leakage 3 (4/161)	1 (2/159) P=.16	4 (6/161)	Anastomotic bleeding 5 (8/159) P=.02 Intraperitoneal bleeding 0 (0/159) P=.08	Anastomotic bleeding 1 (1/161) Intraperitoneal bleeding 2 (3/161)	NR	NR
Scioscia 2017[43] Bowel endometriosis	NR	NR	For severe complications 6.5 (4/62) P=.20	For severe complications 8.5 (14/162)	Need for transfusion 3.2 (2/62) P=.73	Need for transfusion 5.5 (9/162)	NR	NR
Mari 2016[40] Colorectal cancer (75%) or diverticular disease (25%)	Wound infection 3 (2/70) Anastomotic fistula 3 (2/70) P=NS for both	Wound infection 1 (1/70) Anastomotic fistula 4 (3/70)	NR	NR	Proctorrhagia 1 (1/70) P=NS	Proctorrhagia 4 (3/70)	Vomiting 7 (5/70) P=NS	Vomiting 3 (2/70)
Wang 2015[45] CCT Colon cancer	Wound infection 3.5 (2/57) Anastomotic leakage 1.8 (1/57) P=NS[a] for b oth	Wound infection 3.3 (2/60) Anastomotic leakage 3.3 (2/60)	NR	NR	NR	NR	Gastric retention 1.8 (1/57) P=NS[a]	Gastric retention 3.3 (2/60)

Author Year Population	Surgical complications (define) % (n/N)		Need for reoperation % (n/N)		Bleeding % (n/N)		General or gastrointestinal complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Feng 2014[38] Rectal cancer	Change to open surgery due to difficulty in tumor resection (4/57) Incision Infection 0 (0/57) Anastomotic leakage 0 (0/57) Abdominal infection 0 (0/57) All P=NS	Change to open surgery due to difficulty in tumor resection (3/59) Incision Infection 1.7 (1/59) Anastomotic leakage 6.8 (4/59) Abdominal infection 0 (0/59)	0 (0/57) P=NS	1.7 (1/59) for anastomotic leak	NR	NR	Rectovaginal fistula 0 (0/57) P=NS	Rectovaginal fistula 1.7 (1/59)
Mari 2014[41] Colon cancer (69%) or diverticular disease (31%)	No anastomotic leaks	No anastomotic leaks	NR	NR	NR	NR	NR	NR
Gouvas 2012[25] *CCT* Rectal cancer	Leak 10 (4/42) Wound complications 7 (3/42) P=NS for both	Leak 15 (5/33) Wound complications 12 (4/33)	Not reported by group, rates ranged from 4 to 15% P=NS between all groups		0 (0/42)	0 (0/33)	Obstruction 0 (0/42)	Obstruction 3 (1/33)
Wang 2012[35] Colon cancer	"Surgical"[b] 3 (1/40) P=NS	"Surgical"[b] 5 (2/40)	NR	NR	NR	NR	"General"[b] 5 (2/40) P=NS	"General"[b] 10 (4/40)
Wang 2012[44] Adenocarcinoma of the colon	Anastomotic leakage 0 (0/49) Wound infection 6 (3/49) P=NS for both	Anastomotic leakage 2 (1/50) Wound infection 4 (2/50)	None	None	NR	NR	Obstruction 0 (0/49)	Obstruction 2 (1/50)

Author Year Population	Surgical complications (define) % (n/N)		Need for reoperation % (n/N)		Bleeding % (n/N)		General or gastrointestinal complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Wang 2012[46] Colorectal cancer (elderly)	Incision infection 3 (1/40) P=.35 (n=40) Leakage 0 (0/40)	Incision infection 8 (3/38) (n=38) Leakage 0 (0/38)	NR	NR	NR	NR	Obstruction 0 (0/40)	Obstruction 5 (2/38)
Vlug 2011[34] Colon cancer and benign disease	Anastomotic leakage n=7 Wound infection 6 total	Anastomotic leakage n=6 (1 fatal) Iatrogenic bowel perforation n=2 (1 patient died) Dehiscence n=3 Wound infection 8 total	10 (10/100) P=NS	10 (11/109)	NR	NR	NR	NR
Mixed Open and Laparoscopic Surgery Studies								
Forsmo 2016[50] Colorectal cancer and benign disease	Anastomotic leakage[c] Colon: 5 (3/59) P=.45 Rectum: 12 (7/58) P=.17 Wound infection Abdominal: 7 (10/154) P=.51 Perineal: 25 (8/154) P=.81 Abdominal wall dehiscence 3 (5/154) P=.99	Anastomotic leakage[c] Colon: 3 (2/77) Rectum: 4 (2/45) Wound infection Abdominal: 9 (13/153) Perineal: 32 (9/153) Abdominal wall dehiscence 3 (5/153)	11 (17/154) P=.24	7 (11/153)	NR	NR	NR	NR

NR=not reported; NS=not statistically significant

[a] Calculated (Fisher's exact test)

[b] Surgical complications includes wound complications, anastomotic leak, and bowel obstruction requiring re-operation; General complications includes cardiovascular, pulmonary, thromboembolic, urinary and other complications
[c] In patients with an anastomosis

Table 6. Harms Associated with Enhanced Recovery, Part B

Author Year	Foley catheter re-insertion/other renal or urologic complications % (n/N)		Aspiration pneumonia or pulmonary infection % (n/N)		Vascular or cardiovascular complications % (n/N)		Miscellaneous complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Open Surgery Studies								
Feng 2016[23] Colorectal cancer	Urinary retention 2 (2/116) P=.68	Urinary retention 3 (3/114)	Pulmonary infection 1 (1/116) P=.21	Pulmonary infection 4 (4/114)	NR	NR	NR	NR
Pappalardo 2016[31] Rectal cancer	Urinary complications 0 (0/25)	Urinary complications 0 (0/25)	NR	NR	Vascular complications 0 (0/25)	Vascular complications 0 (0/25)	Pulmonary complications (not specified) 0 (0/25)	Pulmonary complications 0 (0/25)
Jia 2014[27] Colorectal cancer (elderly)	UTI 4 (5/117) P=.05	UTI 11 (13/116)	Pulmonary infection 5 (6/117) P=.006	Pulmonary infection 16 (19/116)	Heart failure 3 (4/117) P=.02 DVT 3 (4/117) P=.34	Heart failure 11 (13/116) DVT 6 (7/116)	Post-op delirium[a] 3 (4/117) P=.008	Post-op delirium[a] 13 (15/116)
Nanavati 2014[30] Gastrointestinal surgery (3% cancer)	NR	NR	NR	NR	NR	NR	NR	NR
Gouvas 2012[25] *CCT* Rectal cancer	Urinary retention 11 (4/36) P=NS	Urinary retention 20 (9/45)	Chest infection 17 (6/36) P=.004 [b]	Chest infection 49 (22/45)	DVT 3 (1/36) Pulmonary embolism 3 (1/36)	DVT 16 (7/45) Pulmonary embolism 4 (2/45)	NR	NR
Ren 2011[32] Colorectal cancer	NR	NR	NR	NR	Cardiovascular and cerebro-vascular complication 0 (1/299)	Cardiovascular and cerebro-vascular complication 2 (5/298)	NR	NR
Wang 2012[35] Colon cancer	NR	NR	NR	NR	NR	NR	NR	NR

Author Year	Foley catheter re-insertion/other renal or urologic complications % (n/N)		Aspiration pneumonia or pulmonary infection % (n/N)		Vascular or cardiovascular complications % (n/N)		Miscellaneous complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Yang 2012[37] Colorectal cancer	Urine distension 3 (1/32) P=NS	Urine distension 3 (1/30)	Pneumonia 0 (0/32) P=.48	Pneumonia 3 (1/30)	Arrhythmia 0 (0/32) P=NS	Arrhythmia 3 (1/30)	Stress ulcer 0 (0/32) P=NS	Stress ulcer 3 (1/30)
Vlug 2011[34] Colon cancer and benign disease	Urine retention n=6 complications	Urine retention n=1 complication	NR	NR	None reported	CVA n=2 complications (1 fatal)	Other infectious complications n=11 Respiratory n=2 complications (1 fatal)	Other infectious complications n=14 Respiratory n=4 complications
Wang 2011[36] Colorectal cancer	Catheter re-insertion 4 (4/106) P=.06[b] Urinary retention 5 (5/106) P=.01[b] Urinary tract complication 2 (2/106) P=NS	Catheter re-insertion 11 (12/104) Urinary retention 15 (16/104) Urinary tract complication 5 (5/104)	NR	NR	Cardiac complication 2 (2/106) Thrombo-embolic complication 1 (1/106) P=NS[b] for both	Cardiac complication 5 (5/104) Thrombo-embolic complication 3 (3/104)	Pulmonary complication (not specified) 3 (3/106) P=.13[b]	Pulmonary complication 8 (8/104)
Ionescu 2009[26] Rectosigmoid (58%) or colon (42%) cancer	UTI 0 (0/48) Hematuria 2 (1/48) P=NS for both	UTI 6 (3/48) Hematuria 0 (0/48)	NR	NR	Pulmonary embolism 0 (0/48) P=NS	Pulmonary embolism 2 (1/48)	Postoperative hernia 0 (0/48) P=NS	Postoperative hernia 2 (1/48)
Muller 2009[29] Colon surgery (87% malignant) with primary anastomosis	Urinary infection/ retention 4 (3/76) P=.49[b]	Urinary infection/ retention 7 (5/75)	Pneumonia or respiratory events 1 (1/76)	Pneumonia or respiratory events 5 (4/75)	Cardiovascular events 4 (3/76) P=.08[b]	Cardiovascular events 12 (9/75)	NR	NR

Author Year	Foley catheter re-insertion/other renal or urologic complications % (n/N)		Aspiration pneumonia or pulmonary infection % (n/N)		Vascular or cardiovascular complications % (n/N)		Miscellaneous complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Šerclová 2009[33] Intestinal resection (78% Crohn's disease, 7% cancer)	NR	NR	NR	NR	NR	NR	NR	NR
Khoo 2007[28] Colon (67%) or rectal (33%) cancer	Re-insertion due to urinary retention 11 (4/35) P=.11[b] UTI 3 (1/35) P=NS	Re-insertion due to urinary retention 0 (0/35) UTI 6 (2/35)	NR	NR	Cardio-respiratory compromise 0 (0/35) P=.11[b]	Cardio-respiratory compromise 11 (4/35)	Pressure sores 0 (0/35)	Pressure sores 9 (3/35)
Gatt 2005[24] Colon surgery (69% malignant)	UTI 0 (0/19) P=.49[b]	UTI 10 (2/20)	Chest infection 5 (1/19) P=NS	Chest infection 0 (0/20)	DVT 10 (2/19) P=.23[b]	DVT 0 (0/20)	NR	NR
Anderson 2003[22] Colon surgery (72% malignant)	UTI 7 (1/14) P=.56[b]	UTI 18 (2/11)	NR	NR	Atrial fibrillation 0 (0/14)	Atrial fibrillation 9 (1/11)	Respiratory depression related to patient-controlled analgesia 0 (0/14)	Respiratory depression related to patient-controlled analgesia 9 (1/11)
Laparoscopic Studies								
Ota 2017[42] CCT Colorectal cancer NOTE: 97% (ERAS) and 91% (control) had laparoscopic surgery	Hepatorenal complication 0 (0/159) P=.32 UTI 0 (0/159)	Hepatorenal complication 1 (1/161) UTI 0 (0/161	NR	NR	Cardiovascular complication 0 (0/159) P=.32 DVT 0 (0/159)	Cardiovascular complication 1 (1/161) DVT 0 (0/161)	Respiratory complication (not specified) 0 (0/159) P=.32 Delirium 0 (0/159) P=.25	Respiratory complication 1 (1/161) Delirium 2 (3/161)
Scioscia 2017[43] Bowel endometriosis	NR	NR	NR	NR	NR	NR	Pyrexia 14.5 (9/62) P=.83	Pyrexia 12.7 (21/162)

Author Year	Foley catheter re-insertion/other renal or urologic complications % (n/N)		Aspiration pneumonia or pulmonary infection % (n/N)		Vascular or cardiovascular complications % (n/N)		Miscellaneous complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Mari 2016[40] Colorectal cancer (75%) or diverticular disease (25%)	Urinary retention 1 (1/70) P=NS	Urinary retention 4 (3/70)	Pneumonia 4 (3/70) P=NS	Pneumonia 7 (5/70)	Atrial fibrillation 0 (0/70) P=NS	Atrial fibrillation 1 (1/70)		
Wang 2015[45] CCT Colon cancer	NR	NR	Pulmonary infection 1.8 (1/57) P=.62[b]	Pulmonary infection 5.0 (3/60)	Cardiovascular events 3.5 (2/57) P=NS[b]	Cardiovascular events 3.3 (2/60)	NR	NR
Feng 2014[38] Rectal cancer	Urinary retention 1.8 (1/57) Urinary infection 0 (0/57) P=NS for both	Urinary retention 3.4 (2/59) Urinary infection 0 (0/59)	Pneumonia 1.8 (1/57) P=NS	Pneumonia 1.7 (1/59)	DVT 0 (0/57)	DVT 0 (0/59)	NR	NR
Mari 2014[41] Colon cancer (69%) or diverticular disease (31%)	NR	NR	NR	NR	NR	NR	Respiratory distress 4 (1/25) P=NS[b]	Respiratory distress 0 (0/25)
Gouvas 2012[25] *CCT* Rectal cancer	Urinary retention 5 (2/42) P=.01[b]	Urinary retention 24 (8/33)	Chest infection 10 (4/42) P=.20[b]	Chest infection 21 (7/33)	DVT 2 (1/42) P=NS	DVT 9 (3/33)	NR	NR
Wang 2012[35] Colon cancer	NR	NR	NR	NR	NR	NR	NR	NR
Wang 2012[44] Adenocarcinoma of the colon	Catheter reinsertion 8 (4/49) UTI 2 (1/49) P=NS for both	Catheter reinsertion 14 (7/50) UTI 2 (1/50)	NR	NR	Cardiac complication 0 (0/49) P=.49[b] Thrombo-embolic complication 0 (0/49) P=NS[b]	Cardiac complication 4 (2/50) Thrombo-embolic complication 2 (1/50)	Pulmonary complication (not specified) 2 (1/49) P=NS[b]	Pulmonary complication 4 (2/50)

Author Year	Foley catheter re-insertion/other renal or urologic complications % (n/N)		Aspiration pneumonia or pulmonary infection % (n/N)		Vascular or cardiovascular complications % (n/N)		Miscellaneous complications % (n/N)	
	ERAS	Control	ERAS	Control	ERAS	Control	ERAS	Control
Wang 2012[46] Colorectal cancer (elderly)	NR	NR	Intrapulmonary infection 3 (1/40) P=.35	Intrapulmonary infection 8 (3/38)	NR	NR	NR	NR
Vlug 2011[34] Colon cancer and benign disease	Urine retention n=4 complications	Urine retention n=6 complications	NR	NR	CVA n=1 complication (fatal)	CVA n=0	Other infectious complications n=8 Respiratory n=2 complications (1 fatal)	Other infectious complications n=9 Respiratory n=2 complications
Mixed Open and Laparoscopic Surgery Studies								
Forsmo 2016[50] Colorectal cancer and benign disease	Renal failure 5 (8/154) P=.79 Urinary retention 6 (9/154) P=.20 UTI 7 (11/154) P=.31	Renal failure 5 (7/153) Urinary retention 10 (15/153) UTI 10 (16/153)	Pneumonia 5 (7/154) P=.79 Pleural effusion requiring drainage 3 (5/154) P=.47	Pneumonia 5 (8/153) Pleural effusion requiring drainage 2 (3/153)	Cardiac arrhythmia 1 (2/154) P=.65 Pulmonary embolism 1 (2/154) P=.16	Cardiac arrhythmia 2 (3/153) Pulmonary embolism 0 (0/153)	Respiratory complications requiring ICU (not specified) 1 (2/154) P=.16 Post-operative confusion 2 (3/154) P=.99 Intra-abdominal infection 7 (11/154) P=.22	Respiratory complications requiring ICU 0 (0/153) Post-operative confusion 2 (3/153) Intra-abdominal infection 4 (6/153)

CVA=cerebral vascular accident; DVT=deep vein thrombosis; ICU=intensive care unit; UTI=urinary tract infection; NR=not reported; NS=not statistically significant

[a] Based on Delirium Rating Scale-Revised-98, Delirium was defined as the total score ≧18

[b] Calculated (Fisher's exact test)

APPENDIX E. ERAS AND USUAL CARE COMPONENTS

Table 1. ERAS and Standard Care Protocol Components - Open Surgery Studies (SEE Appendix E Table 2 for Gouvas 2012, Wang 2012 J Gast Surg, and Vlug 2011)

Author, Year: Feng 2016[23]	Reason for Surgery: Colorectal Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)		
	Control of body temperature	ü	
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Pappalardo 2016[31] (Standard Protocol Not Specified)	Reason for Surgery: Rectal Cancer

Phases	ERAS Components	ERAS Protocol	Standard Care Protocol
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)		
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		
	Carbohydrate treatment		
	Thrombosis prophylaxis	**ü**	
	Infection prophylaxis including skin preparation with chlorhexidine-alcohol	**ü**	
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques		
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	**ü (epidural)**	
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia		
	Control of body temperature		
POSTOPERATIVE	Early mobilization		
	Early intake of oral fluids and solids		
	Early removal of urinary catheters and intravenous fluids		
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	**ü**	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Jia 2014[27]	Reason for Surgery: Colon (49%) or Rectal (51%) Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		ü
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	
INTRAOPERATIVE	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Nanavati 2014[30]	**Reason for Surgery: Colorectal Procedures (42% Ileostomal Closure, 17% Colostoma Closure); 7% Laparoscopic**

Phases	ERAS Components	ERAS Protocol	Standard Care Protocol
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	
	Nausea and vomiting prophylaxis	ü	
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques	ü	
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery		
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	ü
	Control of body temperature		
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol		
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Ren 2012[32]	Reason for Surgery: Colorectal Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	
	Nausea and vomiting prophylaxis	ü	ü
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery		
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature	ü	
	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	**ü (early removal)**	**ü (early removal)**
POSTOPERATIVE	Chewing gum, laxatives, peripheral opioid-blocking agents	ü	
	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Yang 2012[37]	Reason for Surgery: Colorectal Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)		
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	ü
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	**ü (avoid long-acting opiods)**	**ü (avoid long-acting opiods)**
INTRAOPERATIVE	Maintain fluid balance; vasopressors for blood pressure control	**ü (fluid restriction)**	**ü (fluid restriction)**
	Restrictive use of surgical site drains	ü	ü
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature	ü	ü
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements	ü	
	Glucose control	ü	
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	ü
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Wang 2011[36]	Reason for Surgery: Colon (65%) or Rectal (35%) Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)	ü	
	Minimal invasive surgical techniques	ü	
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery		
INTRAOPERATIVE	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Ionescu 2009[26]	Reason for Surgery: Rectosigmoid (58%) or Colon (42%) Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques		
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	ü
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
POSTOPERATIVE	Early mobilization	ü	ü
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	ü
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge	ü	ü

Author, Year: Muller 2009[29]	**Reason for Surgery: 87% Colon Cancer**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	ü
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	**ü (4 hrs)**	**ü (4 hrs)**
	Carbohydrate treatment		
	Thrombosis prophylaxis	ü	ü
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	ü
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	ü
	Maintain fluid balance; vasopressors for blood pressure control	ü	ü
	Restrictive use of surgical site drains	ü	ü
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	ü
	Control of body temperature		
	Early mobilization	ü	ü
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
POSTOPERATIVE	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	ü
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Šerclová 2009[33]	**Reason for Surgery: 78% Crohn's, 9% Ulcerative Colitis, 7% Cancer, 6% Other, only ASA I-II, average age 35**

Phases	ERAS Components	ERAS Protocol	Standard Care Protocol
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques		
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery		
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Khoo 2007[28]	Reason for Surgery: Colon (67%) and Rectal (33%) Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)		
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	**ü (3 hrs)**	**ü (3 hrs)**
	Carbohydrate treatment		
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis	**ü**	
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	**ü**	**ü**
	Maintain fluid balance; vasopressors for blood pressure control	**ü**	
	Restrictive use of surgical site drains		
POSTOPERATIVE	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	**ü**	
	Control of body temperature		
	Early mobilization	**ü**	
	Early intake of oral fluids and solids	**ü**	
	Early removal of urinary catheters and intravenous fluids	**ü**	
	Chewing gum, laxatives, peripheral opioid-blocking agents	**ü**	
	Protein and energy-rich nutritional supplements	**ü**	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	**ü**	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Gatt 2005[24]	**Reason for Surgery: 69% Colon Cancer, 31% Other (Colon)**

Phases	ERAS Components	ERAS Protocol	Standard Care Protocol
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü **(3 hrs)**	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	ü
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids		
	Chewing gum, laxatives, peripheral opioid-blocking agents		
POSTOPERATIVE	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	ü
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Anderson 2003[22]	Reason for Surgery: 72% Colon Cancer; 28% Other (Colon)

Phases	ERAS Components	ERAS Protocol	Standard Care Protocol
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	ü
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
	Early mobilization		
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids		
	Chewing gum, laxatives, peripheral opioid-blocking agents		
POSTOPERATIVE	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Table 2. ERAS and Standard Care Protocol Components – Laparoscopic Surgery Studies

Author, Year: Ota 2017[42] (Standard Care at surgeon's discretion; many components [*] implemented)	**Reason for Surgery: Colon or Rectosigmoid Cancer (90% Laparoscopic Surgery)**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü[a]	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		
	Carbohydrate treatment	ü	
INTRAOPERATIVE	Thrombosis prophylaxis	ü	
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	*
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques	**ü (>90%) laparoscopic)**	**ü (>90% laparoscopic)**
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	**ü (epidural anesthesia)**	*** (epidural anesthesia)**
	Maintain fluid balance; vasopressors for blood pressure control	ü	*
	Restrictive use of surgical site drains	ü	*
POSTOPERATIVE	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	*
	Control of body temperature		
	Early mobilization	ü	*
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents	**ü (gum, laxative)**	*** (laxative)**
	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or	ü	

	spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol		
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

[a] not used for right hemicolectomy or transverse colectomy

Author, Year: Scioscia 2017[43]	**Reason for Surgery: Bowel Endometriosis**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	**ü (low residue diet)**	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		
	Carbohydrate treatment		
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques	**ü (laparoscopic)**	**ü (laparoscopic)**
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery		
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	**ü**	
	Control of body temperature		
	Early mobilization	**ü**	
	Early intake of oral fluids and solids	**ü**	
	Early removal of urinary catheters and intravenous fluids		
	Chewing gum, laxatives, peripheral opioid-blocking agents		
POSTOPERATIVE	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol		
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Mari 2016[40]	**Reason for Surgery: Major Colorectal Surgery (75% Cancer, 25% Diverticular Disease)**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment		
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques	ü (laparoscopic)	ü (laparoscopic)
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery		
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids		
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Wang 2015[45] (same protocol as Ren 2012[32] except minimally invasive)	**Reason for Surgery: Colon Cancer**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	
	Nausea and vomiting prophylaxis	ü	ü
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques	ü	ü
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery		
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature	ü	
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	**ü (early removal)**	**ü (early removal)**
	Chewing gum, laxatives, peripheral opioid-blocking agents	ü	
	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Feng 2014[38]	**Reason for Surgery: Rectal Cancer**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques	ü	ü
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	ü
	Maintain fluid balance; vasopressors for blood pressure control		
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)		
	Control of body temperature	ü	
	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
POSTOPERATIVE	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Mari 2014[41]	**Reason for Surgery: 69% Colon Cancer, 31% Diverticular Disease**

Phases	ERAS Components	ERAS Protocol	Standard Care Protocol
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)		
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	ü	ü
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques	ü	ü
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature	ü	ü
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	ü
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Gouvas 2012[25]	**Reason for Surgery (Open and Laparoscopic): Rectal Cancer**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)		
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques **(laparoscopic arms only)**	ü	ü
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	ü
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü **(removal)**	
	Control of body temperature	ü	
	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids		
	Chewing gum, laxatives, peripheral opioid-blocking agents		
POSTOPERATIVE	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge	ü	

Author, Year: Wang 2012[35] and Wang 2012[44]	Reason for Surgery: Colon Cancer NOTE: Wang 2012[35] – Open and Laparoscopic

Phases	ERAS Components	ERAS Protocol	Standard Care Protocol
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
	Minimal invasive surgical techniques (laparoscopic arms only)	ü	ü
INTRAOPERATIVE	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains	ü	
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	
	Control of body temperature		
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents		
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Wang 2012[46]	Reason for Surgery: Colorectal Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement		
	Bowel preparation (no routine use of mechanical bowel prep)	ü	
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)		
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		ü
	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)		
INTRAOPERATIVE	Minimal invasive surgical techniques	ü	ü
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	ü	
	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains		
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü (removal)	
	Control of body temperature		
	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents	ü	
POSTOPERATIVE	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol		
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

Author, Year: Vlug 2011[34]	Reason for Surgery (Open and Laparoscopic): Colon Cancer		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
PREOPERATIVE	Structured information/patient and caretaker engagement	ü	
	Bowel preparation (no routine use of mechanical bowel prep)	ü	ü
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	ü	
	Carbohydrate treatment	ü	
	Thrombosis prophylaxis		
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol		
	Nausea and vomiting prophylaxis	ü	
	Pre-anesthetic sedative medication (no routine use)	ü	
	Minimal invasive surgical techniques (laparoscopic arms only)	ü	ü
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	**ü (and general anesthesia)**	**ü (and general anesthesia)**
INTRAOPERATIVE	Maintain fluid balance; vasopressors for blood pressure control	ü	
	Restrictive use of surgical site drains	ü	ü
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	ü	ü
	Control of body temperature	ü	ü
POSTOPERATIVE	Early mobilization	ü	
	Early intake of oral fluids and solids	ü	
	Early removal of urinary catheters and intravenous fluids	ü	
	Chewing gum, laxatives, peripheral opioid-blocking agents	ü	
	Protein and energy-rich nutritional supplements	ü	
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	ü	ü
	Multimodal approach to control of nausea and vomiting		

Table 3. ERAS and Standard Care Protocol Components - Open and Laparoscopic Surgery Studies

Author, Year: Forsmo 2016[50]	**Reason for Surgery: Colorectal Surgery (Malignant [79%] or Benign [21%]) (Open [60%] or Laparoscopic [40%] Surgery)**		
Phases	**ERAS Components**	**ERAS Protocol**	**Standard Care Protocol**
PREADMISSION	Smoking/alcohol cessation		
	Nutritional screening/support		
	Medical optimization of chronic disease		
	Structured information/patient and caretaker engagement	**ü**	
PREOPERATIVE	Bowel preparation (no routine use of mechanical bowel prep)		
	Pre-operative fasting (clear fluids to 2 hours and solids to 6 hours before surgery)	**ü**	**ü (fluids to 2 hrs)**
	Carbohydrate treatment	**ü**	
	Thrombosis prophylaxis	**ü**	**ü**
	Infection prophylaxis and/or skin preparation with chlorhexidine-alcohol	**ü**	**ü**
INTRAOPERATIVE	Nausea and vomiting prophylaxis		
	Pre-anesthetic sedative medication (no routine use)	**ü**	
	Minimal invasive surgical techniques		
	Standardized anesthesia protocol – may use thoracic epidural blocks with local anesthetics and low-dose opioids for open surgery and spinal analgesia or patient-controlled morphine as alternative to thoracic epidural for laparoscopic surgery	**unclear**	**unclear**
	Maintain fluid balance; vasopressors for blood pressure control	**ü**	
	Restrictive use of surgical site drains	**ü (no drain for colon resection)**	**ü (no drain for colon resection)**
	Remove nasogastric tubes before reversal of anesthesia (and no routine use)	**ü**	**ü**
	Control of body temperature	**ü**	**ü**
POSTOPERATIVE	Early mobilization	**ü (enforced)**	**ü**
	Early intake of oral fluids and solids	**ü (enforced)**	**ü**
	Early removal of urinary catheters and intravenous fluids	**ü**	
	Chewing gum, laxatives, peripheral opioid-blocking agents	**ü**	
	Protein and energy-rich nutritional supplements		
	Glucose control		
	Multimodal approach to opioid-sparing pain control – consider thoracic epidural analgesia (open surgery) or spinal analgesia (laparoscopic surgery); also NSAIDS and paracetamol	**ü**	
	Multimodal approach to control of nausea and vomiting		
	Prepare for early discharge		

APPENDIX F. EVIDENCE PROFILE FOR ERAS COMPARED TO CONTROL FOR COLORECTAL SURGERIES

Quality assessment							№ of patients		Effect		Quality
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**ERAS**	**Control**	**Relative (95% CI)**	**Absolute (95% CI)**	
Length of stay											
21	randomized trials	serious [a]	serious [b]	not serious	not serious	strong association	1463	1470	-	MD **2.4 days lower** (3.1 lower to 1.8 lower)	⊕⊕⊕◯ MODERATE
Mortality											
22	randomized trials	serious [a]	not serious	not serious	serious [c]	none	16/1619 (1.0%)	9/1636 (0.6%)	**OR 1.79** (0.81 to 3.95)	**4 more per 1,000** (from 1 fewer to 16 more)	⊕⊕◯◯ LOW
Perioperative morbidity											
19	randomized trials	serious [a]	not serious	not serious	not serious	none	299/1456 (20.5%)	426/1463 (29.1%)	**RR 0.66** (0.54 to 0.80)	**99 fewer per 1,000** (from 58 fewer to 134 fewer)	⊕⊕⊕◯ MODERATE
Readmissions											
19	randomized trials	serious [a]	not serious	not serious	serious [d]	none	73/1196 (6.1%)	84/1319 (6.4%)	**RR 1.11** (0.82 to 1.50)	**7 more per 1,000** (from 11 fewer to 32 more)	⊕⊕◯◯ LOW
Surgical site infection											
17	randomized trials	serious [a]	not serious	not serious	serious [d]	none	50/1443 (3.5%)	69/1437 (4.8%)	**RR 0.75** (0.52 to 1.07)	**12 fewer per 1,000** (from 3 more to 23 fewer)	⊕⊕◯◯ LOW

CI: Confidence interval; **MD:** Mean difference; **RR:** Risk ratio; **OR:** Odds ratio

Explanations

a. Mostly moderate, high, or unclear RoB

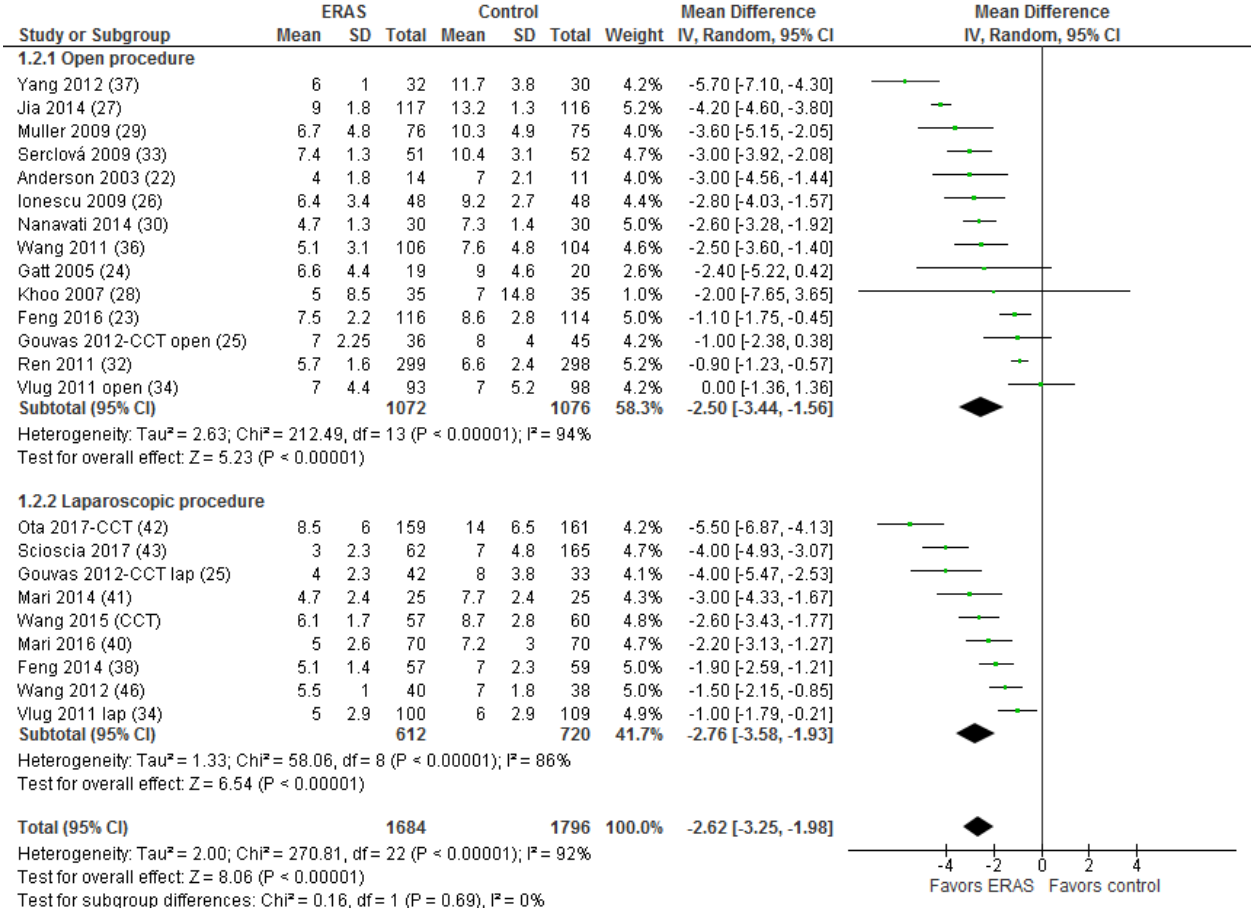
b. I-square indicated substantial statistical heterogeneity

c. Wide confidence intervals and very few events

d. Wide confidence intervals

APPENDIX G. POOLED ANALYSES BY PROCEDURE AND COLORECTAL CONDITION

Figure 1. Length of Stay by Procedure[a]



[a]Excludes Forsmo 2016[50] (mixed open and laparoscopic surgery)

Figure 2. Length of Stay by Condition

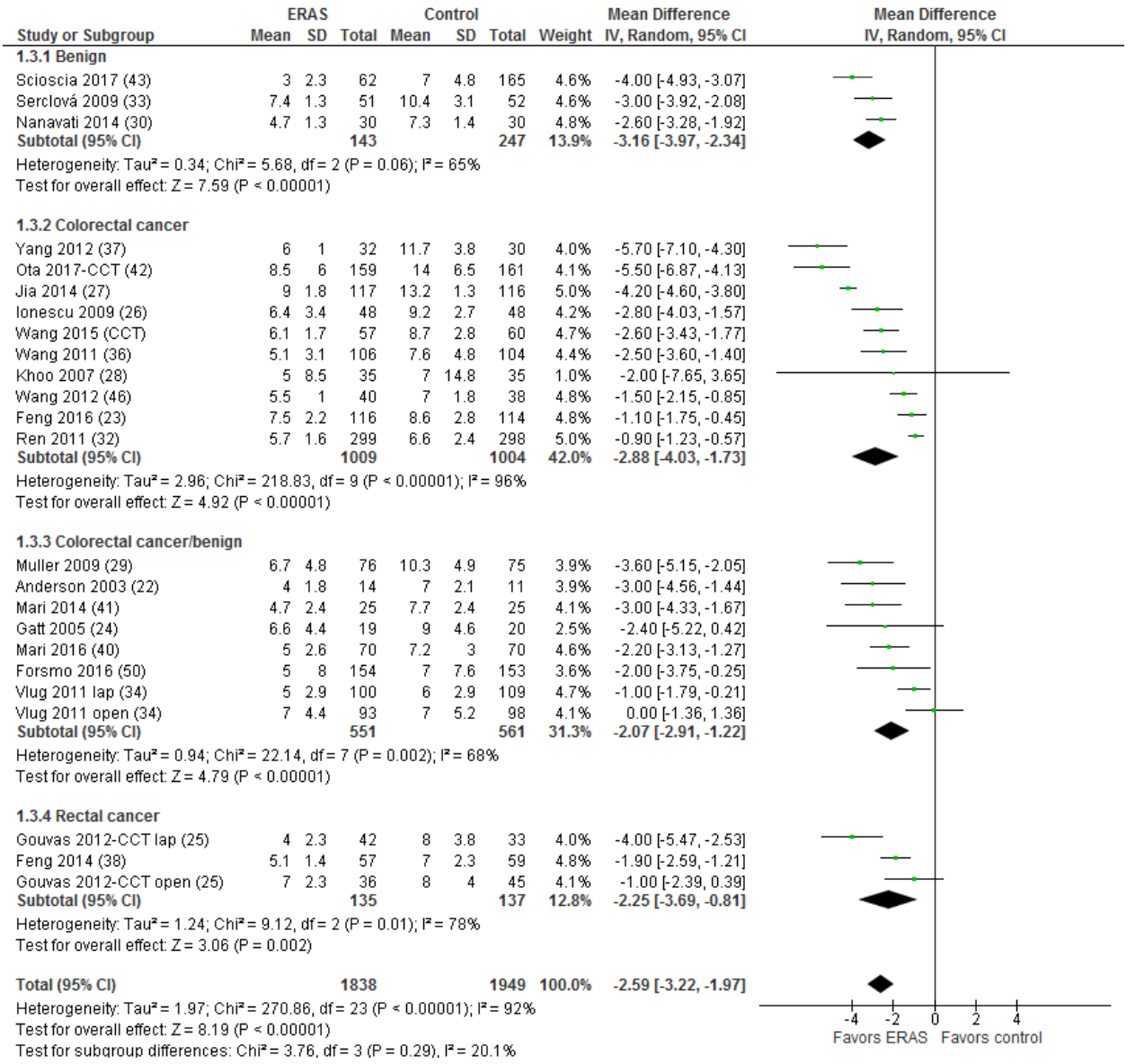
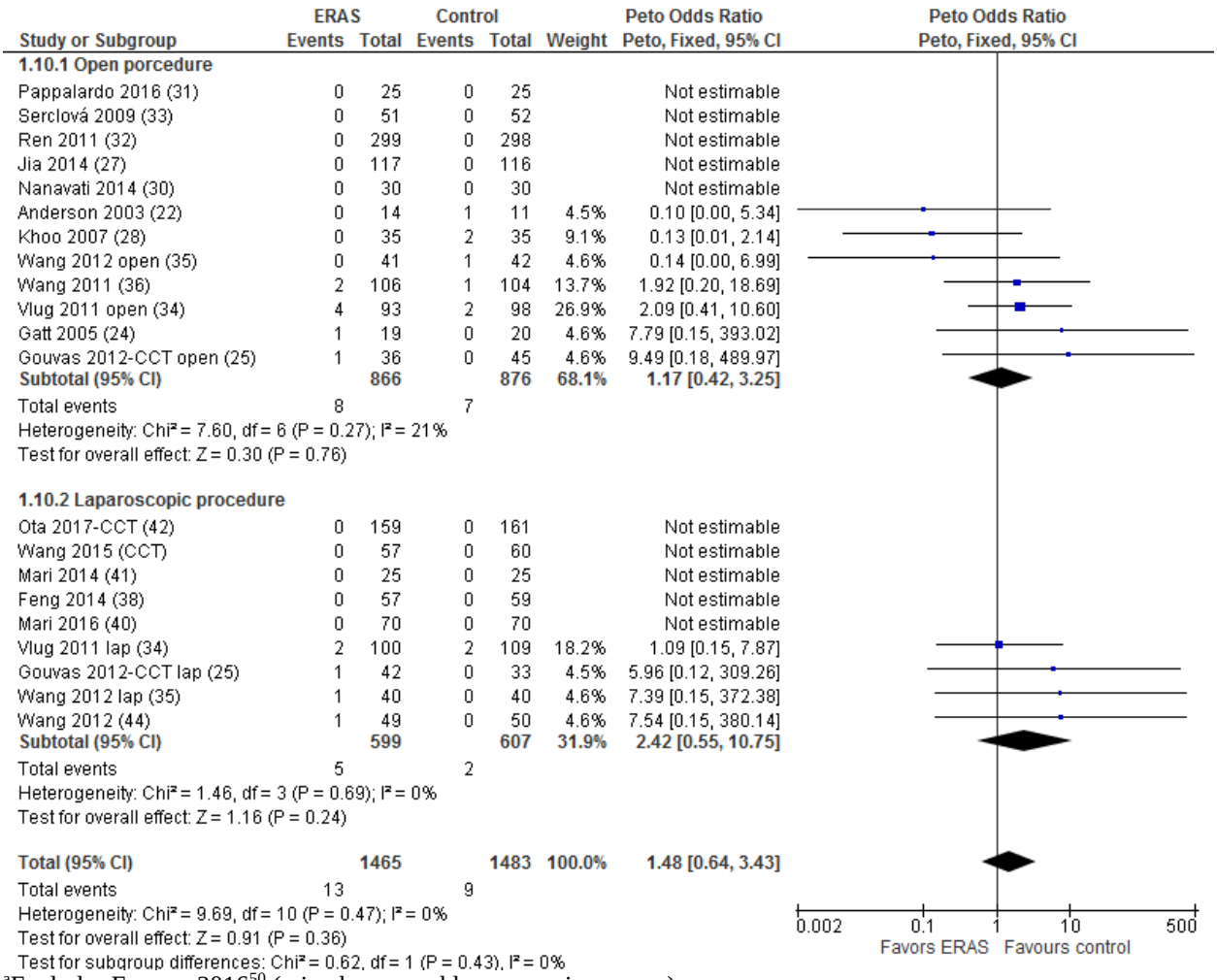


Figure 3. Mortality by Procedure[a]



[a]Excludes Forsmo 2016[50] (mixed open and laparoscopic surgery)

Figure 4. Mortality by Condition

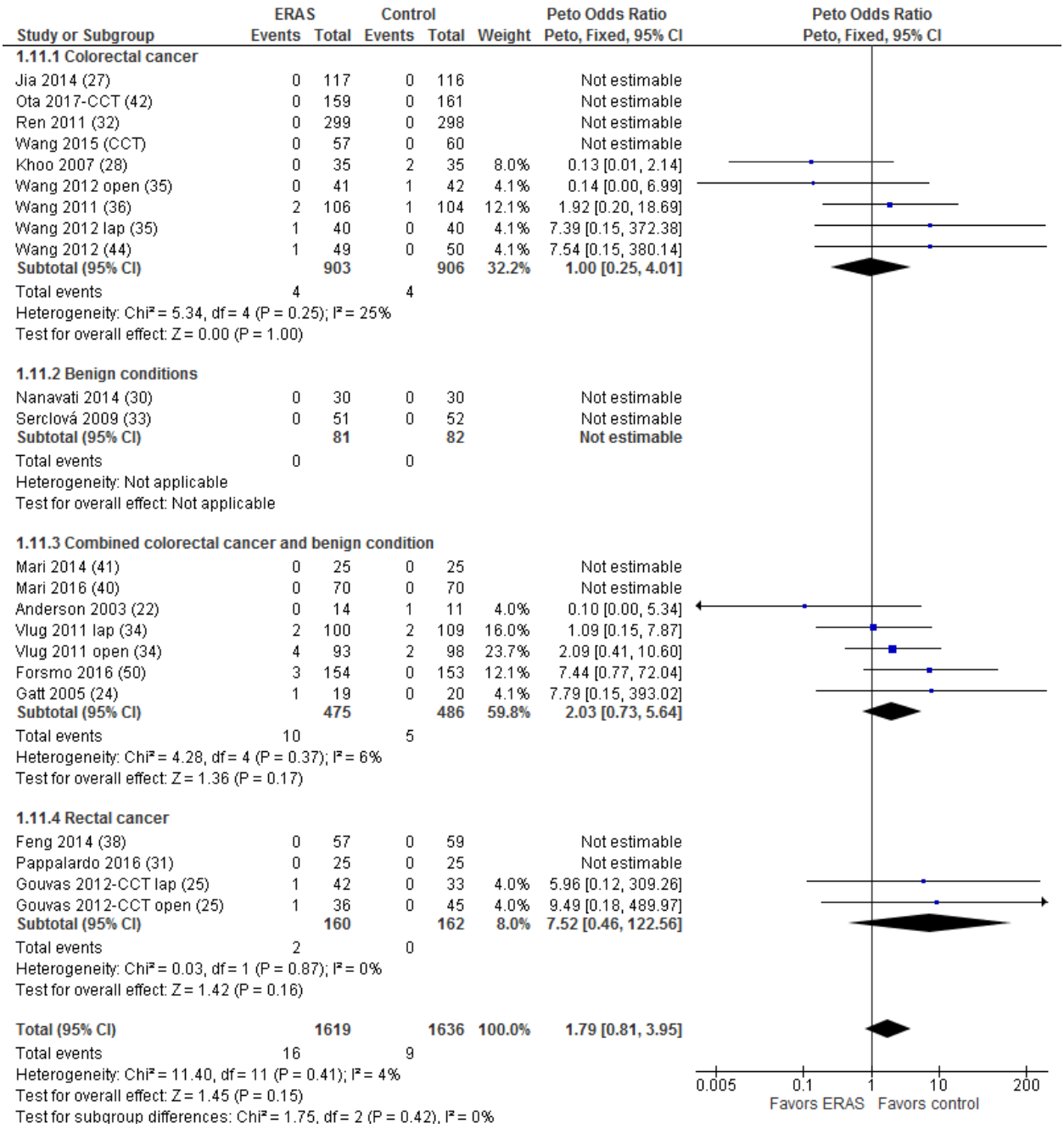
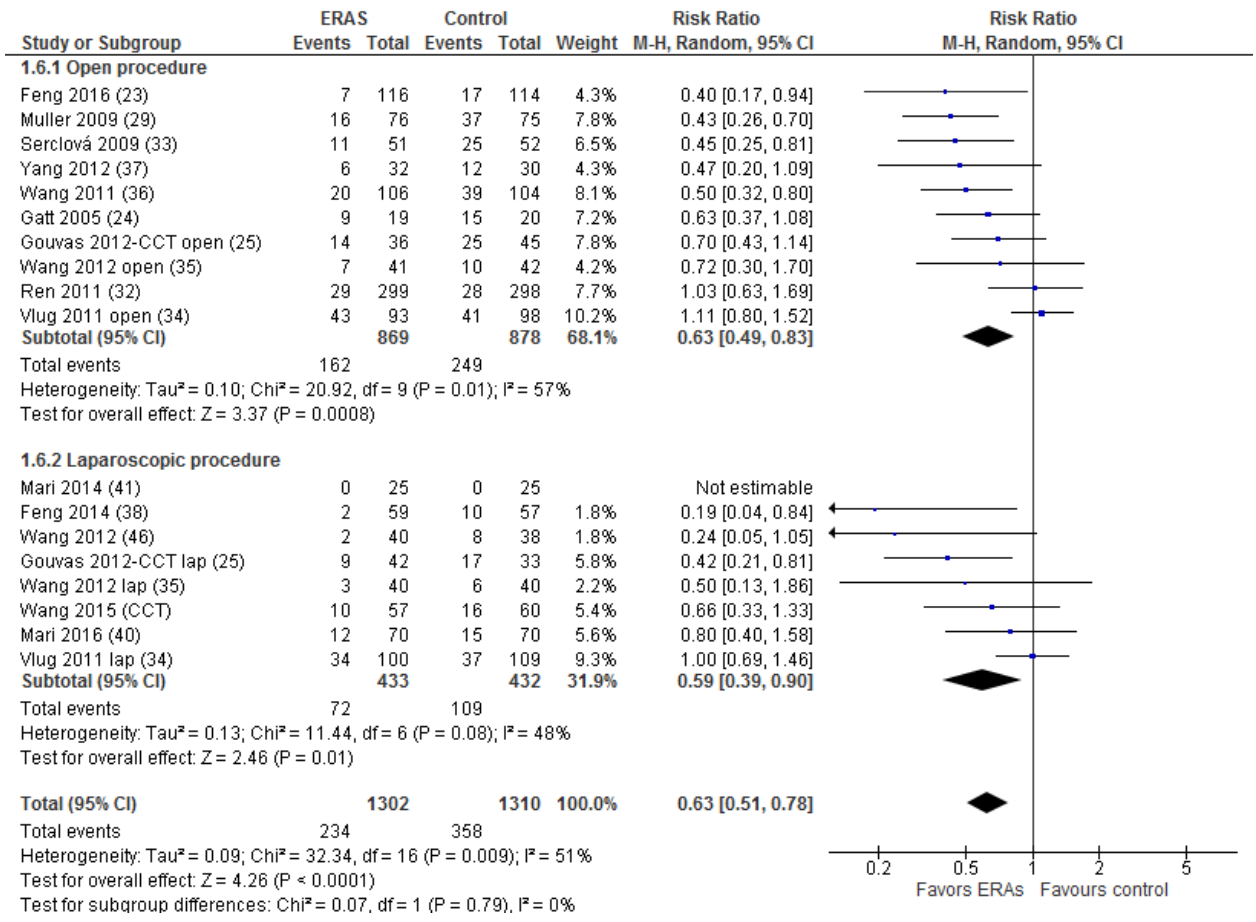


Figure 5. Morbidity by Procedure[a]



[a]Excludes Forsmo 2016[50] (mixed open and laparoscopic surgery)

Figure 6. Morbidity by Condition

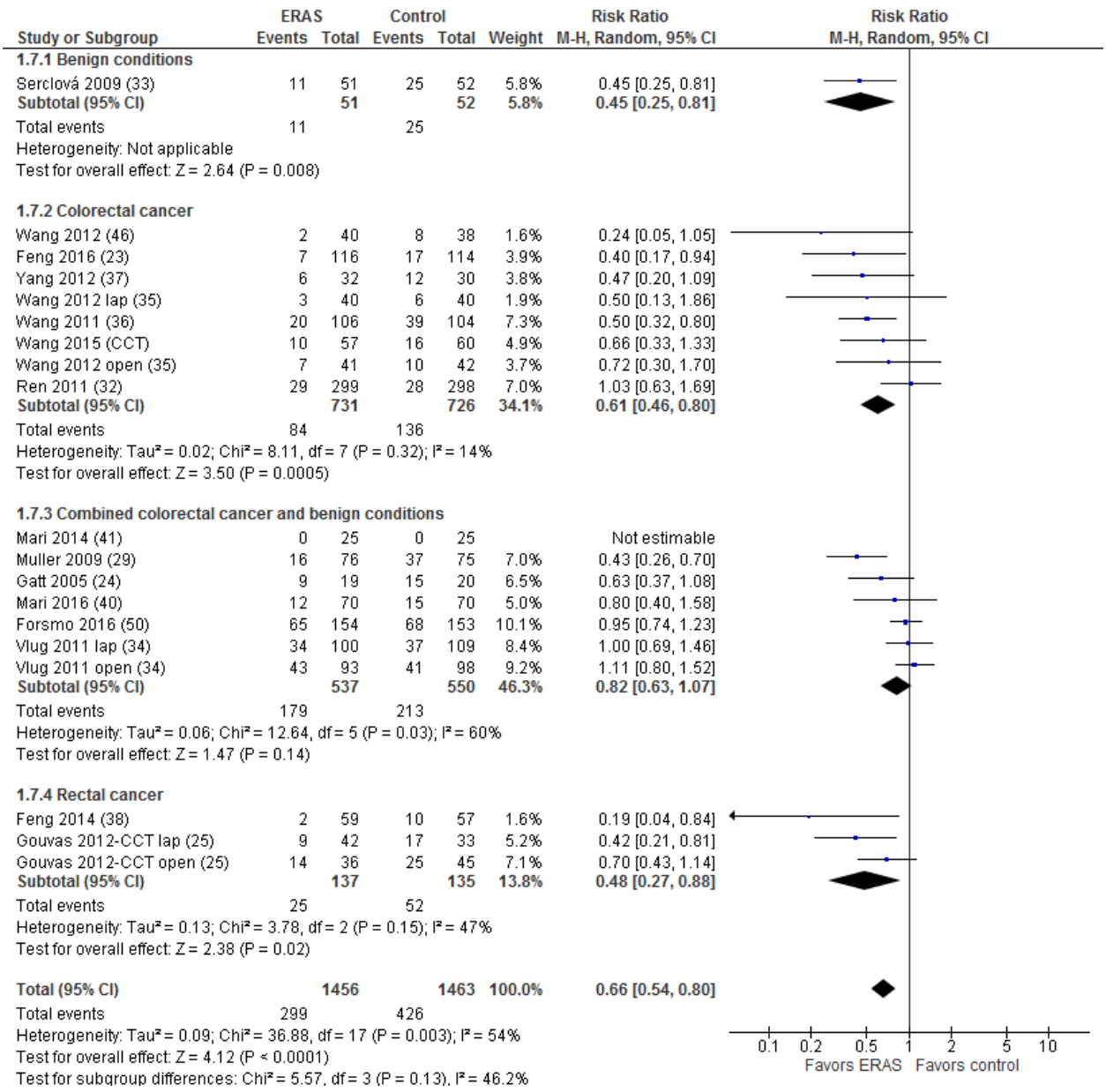
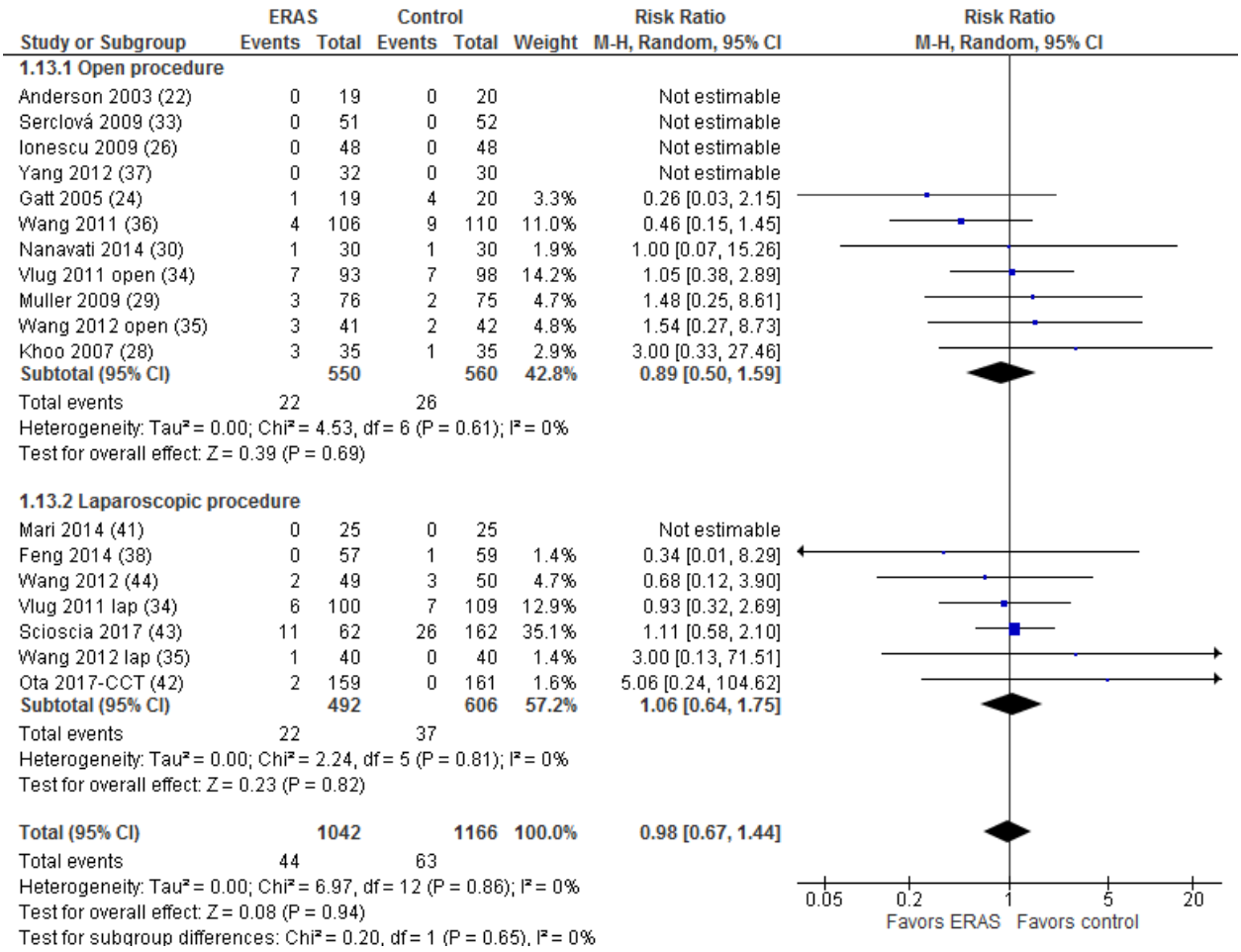


Figure 7. Readmissions by Procedure[a]



[a]Excludes Forsmo 2016[50] (mixed open and laparoscopic surgery)

Figure 8. Readmissions by Condition

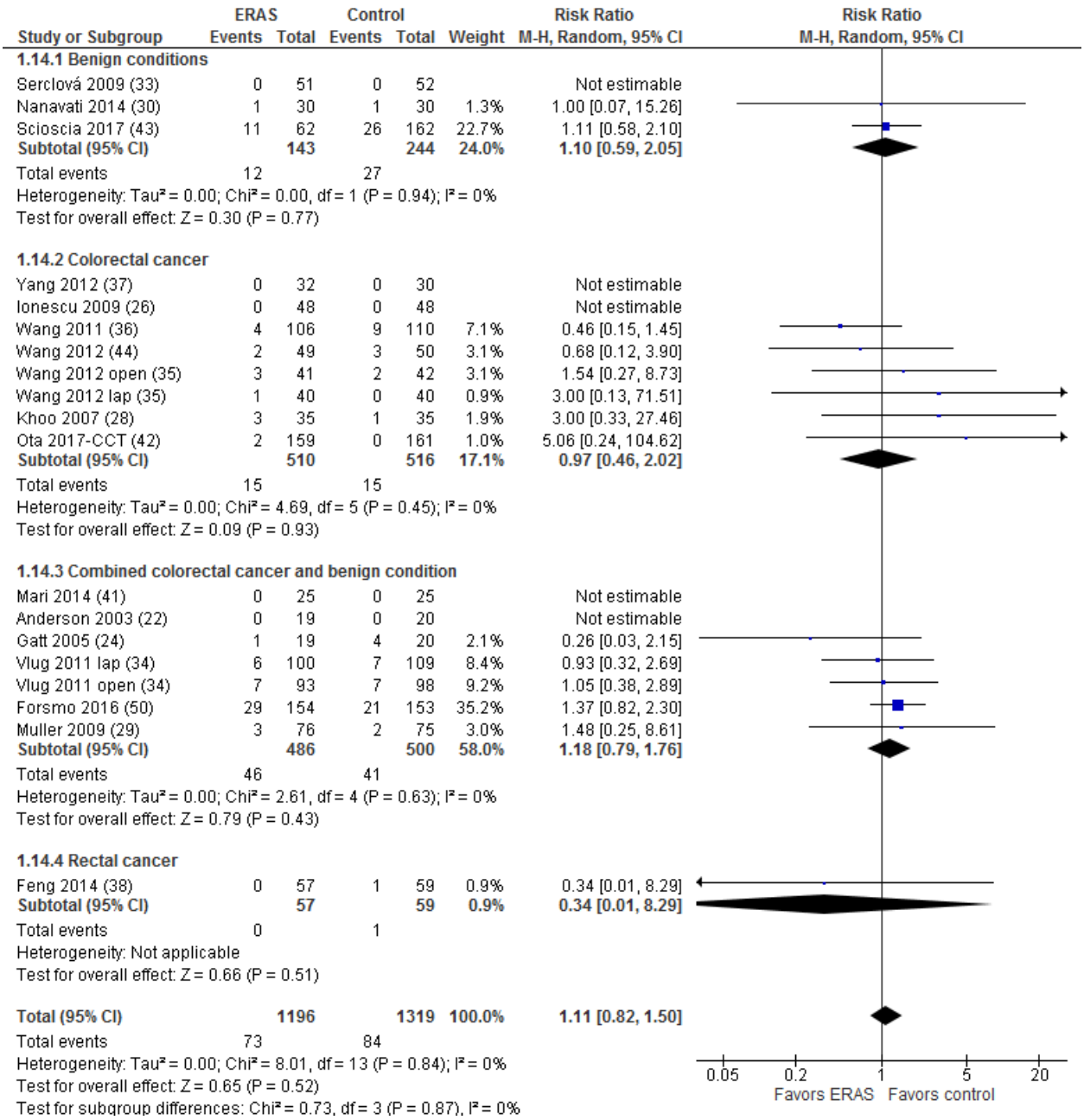
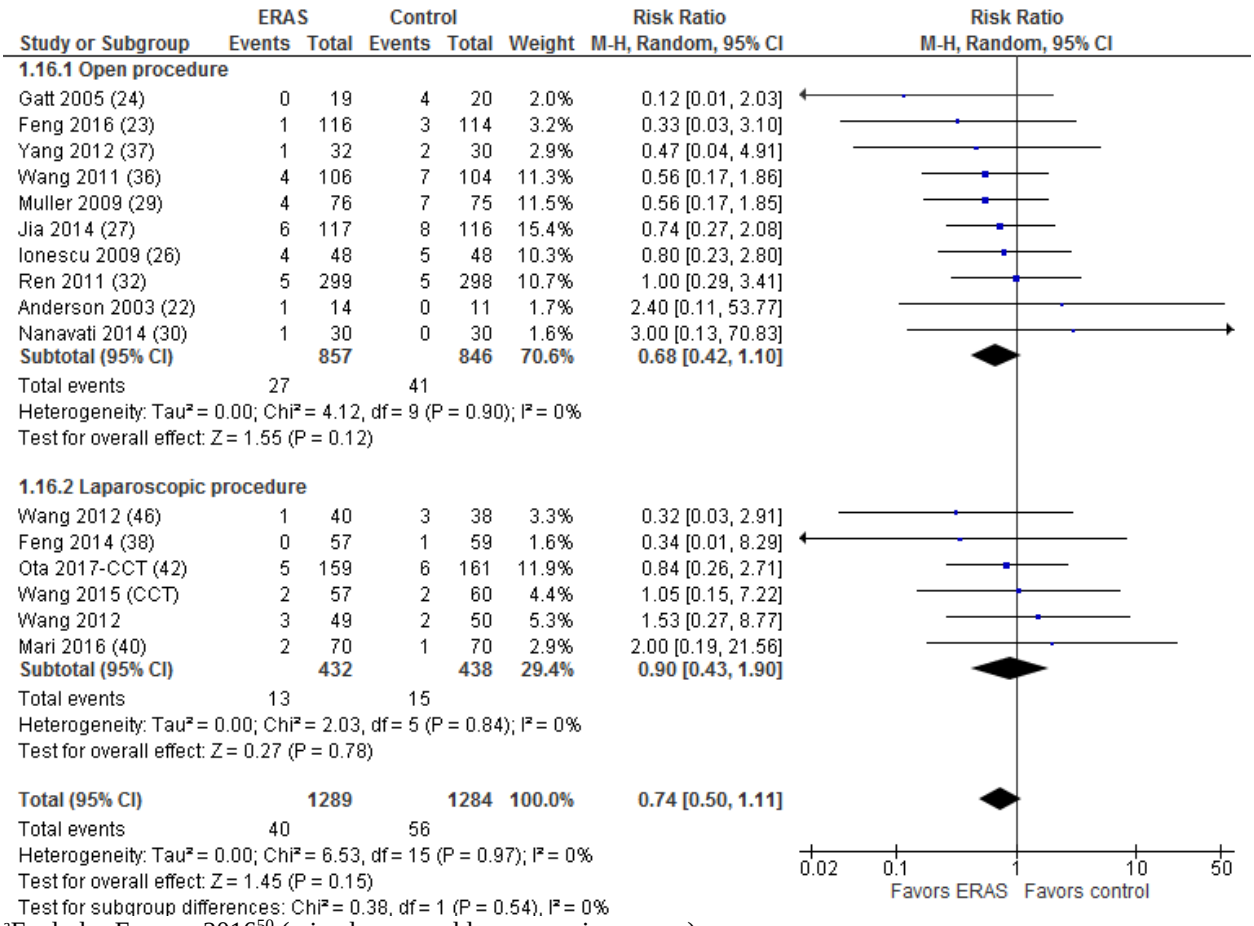


Figure 9. Surgical Site Infections by Procedure[a]



[a]Excludes Forsmo 2016[50] (mixed open and laparoscopic surgery)

Figure 10. Surgical Site Infections by Condition