Supplementary materials 3: Tables providing full descriptions of interventions used within each study within each procedural group

Table 1. Description of ERP and ERAS interventions for patients undergoing colorectal and abdominal surgery

Stage of Care	Care Component	Chen 2017[1]
Pre-Treatment	**Bowel Preparation**	In both E+C groups: Mechanical bowel preparation (1-day for gastric and pancreatic surgery; 3-day for colon surgery). IV hydration to compensate for bowel preparation
	Fasting	Overnight starvation
During Treatment	**Anaesthetic and surgical technique**	In both E+C groups: Mostly general or spinal anaesthesia. No regular use of opioid sparing techniques. Laparoscopy used for approximately 47% of abdominal surgeries
	NG tubes, drains and catheters	Routine use of nasogastric tubes, abdominal drain, and urinary catheter
Post-Treatment	**Drain and catheter removal**	Removal of nasogastric tube and abdominal drain till markers of bowel motility seen
	Nutrition	Oral and nutritional assistance protocol: 1. Daily oral care, ROM exercises for lips, tongue, and jaw, 2. Diet education for postsurgical intake; Dumping syndrome diet, Diet after pancreatic surgery. Tips for digestive distress 3. Encourage oral intake and companionship during meals; feeding assistance if needed vs Oral intake given in graded manner once bowel motility restarted
	Mobilisation	Early mobilisation protocol: Physically assist patient to carry out activities 3 x day . All participants: encouraged to ambulate as tolerated (Mobilisation encouraged but not enforced)
	Communication protocol	Orienting Communication Protocol: Active orientation: During conversations, HELP nurse asks about specific time-, place-, and person-related information; Talk about current/past events
	Other	In both E+C groups: Use of prokinetic agents if bowel motility delayed
Black text=Experimental group; Blue text=Comparator group; Red text=both groups. C=Comparator; E=Experimental; IV=Intravenous; ROM=Range of Motion		

Table 2. Description of ERP and ERAS interventions for patients undergoing colorectal surgery: Studies A-L

Stage of care	Intervention component	Anderson 2003[2]	Dhruva Rao 2015[3]	Forsmo 2016[4]	Garcia-Botello 2011[5]	Gatt 2005[6]	Khan 2013[7]	Khoo 2007[8]	King 2006[9]	Lee 2011[10]
Pre-admission Pre-operation	**Assessment & Education**	Pre-assessment by surgical registrar or anaesthetist. Verbal and written information about the operative procedure and rehabilitation programme vs Pre-assessment clinic (pre-registration house officer)	Multi-disciplinary counselling and DVD. Pre-operative optimisation. Multi-disciplinary counselling	One to two consultations with the ERAS nurse. Informed about principles of ERAS care and the goal of the project. Informed about details of the care pathway, the expected LOS and the discharge criteria	Visit with a nurse. The patient and his/her family were given both verbal and written information of the recommendations and actions to be taken by themselves and the hospital staff during the postoperative period vs No nurse visit	Pre-assessment by surgical registrar or anaesthetist. Verbal and written information about the operation and the postoperative rehabilitation programme	Preoperative counselling		Pre-operative assessment with written information vs Standard pre-operative assessment	Operative risk assessment, counselling with patient and family
	Nutrition	Prebiotic: oligofructose, 15 g daily. Probiotic (capsules containing 4 × 109 Colonyforming units of Lactobacillus acidophilus La5, Lactobacillus Bulgaricus, Bifidobacterium lactis Bb-12 and Streptococcus thermophiles) 7–14 days				Probiotics and prebiotics			3 x high protein /high calorie drinks (Enlive /Ensure)	

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		before surgery: one capsule three times per day Prebiotic as above								
	Day of admission	Day before surgery	NR	Day before	Day before surgery	Day before surgery	NR	Day of surgery	NR vs Day before	NR
	Nutrition+ Carb loading	Normal diet day before surgery. Drink of 100 g carbohydrate in 400 ml water administered at 22.00 hours evening before surgery. 50 g 400 ml water given 3–4 h before the operation vs Fast from midnight	Pre-operative carbohydrate load. Minimum fasting vs Fasting >6h, no carbohydrate loading	Carbohydrate-loaded drink (ProvideXtra , 200 ml) the evening before surgery and 2 h before surgery + preoperative feeding. Clear liquids allowed up to 2 h before surgery in both groups	Normal diet until night before surgery vs Liquid diet 2 days prior to the operation	Normal diet until midnight before surgery. Drink of 100 g carbohydrate in 400 ml water administered at 22·00 hours and a further 50 g carbohydrate in 400 ml water was given 3–4 hours before operation vs Fasting from midnight	Carbohydrate loading. Fasting: 6h for solids, 3h for clear fluids	No supplementary intravenous fluids until 3 hours before surgery but were encouraged to make up the loss through oral rehydration. Both groups were allowed oral fluids up to 3 hours before surgery vs 125 mL/h of intravenous fluid starting from 2200 hours on the night of admission		Preoperative fasting at least 8h
	Bowel prep	No bowel prep vs Bowel prep (PicolaxTM)	Selective bowel preparation	Both groups: Standard for rectal surgery; the main surgeon preoperatively determined the appropriate bowel	No colon preparation. Patients undergoing an intraoperative colonoscopy or might require a loop ileostomy received an	No bowel prep vs Bowel prep		Sodium dihydrogen phosphate dihydrate given on admission and 12 hours later	Bowel preparation (Fleetx2) left colonic, sigmoid and rectal tumours only	All patients received standard bowel preparation with polyethylene glycol 3350 electrolyte solution on the

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				preparation on an individual basis for patients undergoing colon surgery; bowel preparation did not include enema	antegrade mechanical bowel preparation with Fosfosodat vs ante grade mechanical bowel preparation with Fosfosoda					evening 2 days before surgery
	Pain relief	Epidural catheter inserted immediately before surgery. Infusion of Bupivacaine 0·15 per cent and Fentanyl 2 µg/ml commenced and continued into postoperative period		No premedication		Analgesia was standardised throughout the perioperative period. Patients received epidural analgesia through a catheter placed between levels T7 and L1 immediately before surgery		Thoracic epidural in all patients, Bupivacaine 0.167% and diamorphine infusion. Patient controlled analgesia with morphine and Cyclizine was used if a thoracic epidural was not possible. In multimodal arm, infusion rate was not adjusted unless there were features of narcotization. Epidurals discontinued 48 h PO		
	Other		Early discharge planning	All patients received thrombo-	Both groups: administered low molecular					

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				embolic prophylaxis, preoperative antibiotics	weight heparin subcutaneously based on patient's weight; antibiotic prophylaxis					
Perioperative	**Surgical technique**	Transverse laparotomy incision vs Midline or paramedian incisions	Standardised surgery	Five surgeons performed both laparoscopic and open surgery, two performed open surgery only. Open resections were performed through a midline incision. Minimal invasive incisions	NR	Colorectal resection. Transverse incision vs Vertical (midline or paramedian) incisions	Transverse incision when possible	NR	Transverse/ curved incision for open surgery. Vs Midline incision for open surgery	Midline incision for specimen extraction of right colon lesions and a transverse incision for left colon lesions (both groups)
	Anaesthesia	During maintenance of anaesthesia, 80% oxygen administered, intravenous morphine avoided. Induction: Fentanyl, Propofol, Atracurium. Maintenance: IPPV, 80% oxygen, Sevoflurane (1·0–1·2	Protocol driven, reduced use of inhalational anaesthetic, minimised opioid use vs Consultant/lead clinician dependent. Epidural/opioid based analgesia	Thoracic epidural (T9-11) with a continuous dose of Bupivacaine 1 mg/ml Fentanyl 0.002 mg/ml and adrenalin 0.002 mg/ml. Epidural anaesthesia was used only in open surgery, in both groups.	Same anaesthesiologist treated all patients. Induction using 5mg/kg sodium thiopental, 0.5mg/kg Atracurium besylate, and 0.1 µg/kg Fentanyl, and was then maintained using 1.4%-2.5%	Following an initial bolus of 15–20 ml 0·25% Bupivacaine, a combination infusion of 0·15% Bupivacaine and 2 µg/ml Fentanyl was used to cover the intraoperative period. Induction: combination of		Continuation of epidural infusion vs The epidural infusion rate was titrated against pain and narcotization, and removed when the rate was 1 mL/h	Gentamycin 1.5 mg/kg Metronidazole 500 mg (both groups), Epidural T8-9, Bupivicaine 0.5% <= 10mls Diamorphine 2.5 mg in Bupivicaine 0.25% at wound closure. No epidural as standard. Pre-medication with	Epidural anesthesia and local anesthesia infilitaration of the wound were not used in either group

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		MAC) and nitrogen. Incremental Atracurium. Epidural sited between T7 and L1, initial bolus of 15–20 ml 0·25% Bupivacaine, then continuous infusion vs As above except 40% oxygen, no epidural, intravenous morphine titrated according to response		General anaesthesia was total intravenous anaesthesia with Propofol and remifentanil	Sevoflurane, with dosage varying based on patient age. Additional Fentanyl was administered on demand. vs The general anaesthesia was gas with Propofol or Thiopental, Fentanyl, and Isofluran or Sevofluran	Fentanyl, Propofol and Atracurium. Patients maintained on Sevoflorane (1·0–1·2 minimum alveolar concentration) and medical air, supplemented with oxygen. Reversal was achieved using 2·5 mg neostigmine and 0·5 mg Glycopyrroniu m vs As above			Temazepam (both groups). Remifentanil 0.4 lg/kg/min at induction Remifentanil 0.1 lg/kg/min maintenance. Propofol and Atracurium (both groups). Air O2 Sevoflurane. Air NO2 Sevoflurane. Ondansetron 4 mg and Ketorolac 20 mg (both groups). Bupivicaine 0.25% to largest wound	
	Fluid manage–ment	None	Goal-directed fluids vs Ad hoc—consultant dependent for both fluid and diet	Fluid restrictions.	Fluids administered at 15 ml/kg/h to maintain systolic pressure above 90 mm Hg and diuresis of at least 80 ml/h. Initial blood losses were compensated for using colloids or crystalloids	Intravenous fluids during surgery	Restrictive fluid administration with fluid cessation by POD2. Balanced solutions used	Intraoperative fluids were restricted to 1500 mL unless bleeding in excess of 500 mL occurred vs The anaesthetist was free to follow the normal intraoperative fluid practice	Ephedrine ± Metaraminol for low blood pressure. IV fluid = 2000 mls crystalloid intra-operatively vs Unrestricted IV fluids. IV fluids & Ephidrine for low blood pressure.	
	Other	Intravenous cefuroxime	PONV prophylaxis	In both groups, patients	High doses of oxygen (80%)	No drains or nasogastric	No nasogastric tube. No	Nasogastric tubes were	No nasogastric tubes/surgical	A nasogastric tube was not

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		and metronidazole. Nasogastric tubes were used only for gastric decompression during surgery and removed at the end of the procedure. No abdominal drains were sited vs Nasogastric tubes and drains according to surgeon's preference		operated with colon resection had no drain, while all patients with rectal resections received a pelvic drain. Prevention of hypothermia	intra-operatively and during the first 2 hours after the operation. Body temperature maintained using a heating blanket vs Nasogastric tube maintained and oxygen administered through nasal cannula at 2 l/min. No anti-emetics were prescribed as they had the nasogastric tube	tubes. Urinary catheter inserted vs Nasogastric tubes and abdominal drains were placed according to the surgeon's preference	drains. High (80%) inspired oxygen	inserted in all patients	drains. Nasogastric tube peri-operatively	inserted, but an intraperitoneal drain was used (both groups)
Post-operation	**Drain/ catheter/ tube removal**	NA		Early removal of urine catheter. Nasogastric tubes were removed immediately after extubation	Nasogastric tube removed before extubation. POD1: urinary catheter was removed. POD2: Drains were removed as appropriate vs POD2: Urinary catheter and drains removed	Removal of any drains or tubes at end of surgery	Urinary catheter removed by POD2	Nasogastric tubes removed in the recovery room. Urinary catheters removed 24h PO following colonic resection and 72h after TME vs Nasogastric tubes were removed the following morning unless there was 200	Bladder catheter removed day 1 for colonic resections and day 3 for rectal resections vs Bladder catheter removed at the discretion of the surgeon	Removal of the urinary catheter on the first POD

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								mL of free drainage overnight. Urinary catheters were removed following epidural catheter removal		
	Pain management	Epidural infusion for the first 24–36 hours (Neostigmine 2·5 mg + glycopyrronium 0·5 mg Supplemental 80% oxygen) Patient controlled epidural anaesthesia whenever possible. Oral paracetamol (1 g, four times daily) and ibuprofen (400 mg every 8 h as required). Parenteral morphine (5–10 mg) as 'rescue' analgesia. No oral opiates vs Patient-controlled	Minimised opioid use, multi-modal analgesia vs Epidural/opioid based analgesia	No systemic morphine use.	Anaesthesiologist decided on postoperative analgesia. In both groups, either an intravenous infusion pump controlled by the patient with morphine at 0.5 mg/ml, continuous perfusion at 1 ml/h, and bolus administration at 2 ml/h and a 15 min lockout time, or an epidural catheter with Bupivacaine at 0.125% with continuous perfusion at 10ml/h. On the second day following the operation, the intravenous/epi	Oral paracetamol (1 g four times daily) and ibuprofen (400 mg, as required); opiate analgesics avoided except for rescue analgesia vs As above	Thoracic epidural for 48 h. NSAIDs unless contra-indicated. Routine opiates avoided	Oral paracetamol (1 g every 6 hours) and ibuprofen (400 mg every 6 hours) were given from the immediate postoperative period in the multimodal arm but were given as required in the control arm	Continuous epidural analgesia (2 days) 5 mg diamorphine in 60 mls Bupivicaine 0.125% at 0–10 ml/h. Paracetamol 1 g 4 hourly from POD1. Ibuprofen 400 mg 8 hourly +200 mg PRN (max 1.2 g/24 h) once epidural stopped (Cox II Inhibitor if gastric contra-indication to Ibuprofen) Morphine for breakthrough pain (last choice) vs IV Morphine Patient	All patients: ~~received~~ morphine/~~ or~~ Fentanyl based IV PCA. ~~The dosage of Fentanyl was converted to morphine equivalents by a ratio of 1:100. The PCA reservoir bag contained 100 mL of solution: 199mg of morphine plus 150mg of keorolac with normal saline. The~~ PCA: ~~was set as a~~ bolus of 1mL with a 15 minute lockout interval without continuous infusion for all

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		analgesia (intravenous bolus of 1 mg morphine, 5-min 'lockout')			dural PCA was removed in both groups, and intravenous paracetamol at 1 g/8 h, alternating every 4 h with intravenous magnesium metamizol at 2 g/8 h				Controlled Analgesia. Postoperative analgesia at the discretion of surgeon and pain team	patients' vs PCA: ~~was~~ kept in the conventional care group until relief of pain. PCA continued for 2 days after surgery. After ~~removal of~~ PCA, ~~additional~~ nonsteroidal analgesics provided if necessary (I.V. ketorolac 30mg ~~mixed~~ with 5% dextrose water 50ml, ~~IV injection~~) or oral ~~Ultracet orally~~ (~~(~~acetaminophen 325mg, tramadol HCl 37.5mg~~),~~ ~~Janssen Korea, Inc., Seoul, Korea)~~ (both groups)
	Early mobilisation	Structured programme that entailed sitting out of bed for 20 min on the day of	Goal directed mobilisation starting 4hr post op. Early physiotherapy	Enforced patient mobilisation postoperatively All patients in both groups	6 hours after the procedure encouraged to get out of bed if possible. POD1:	Structured mobilization plan with active intervention by PT. Involved	Sitting out POD1. Pre-planned regime under supervision of PT	Encouraged from the night of the operation. Patients were encouraged to	Patient sat out in chair for 2 h on day 0. Patient dressed and sat out for	Patients sat in a chair for more than 1 hour on the operation day, with assisted or

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		surgery, walking the length of the ward on the first postoperative day, and further daily mobilisation according to patient tolerance vs Ward mobilisation by nurses	team input vs As able	encouraged to mobilise early starting immediately after surgery.	recommended walking and respiratory physical therapy vs POD3: commenced mobility	sitting patients out of bed on the day of surgery, and walking the length of the ward on POD1. Further mobilisation encouraged depending on tolerance. Kept patient diary of daily activities. vs Mobilised by nursing staff		meet predefined mobility targets over the postoperative days vs Patients were sat out and assisted to mobilize on the first postoperative day, but not normally aggressively mobilized until discontinuation of the thoracic epidural	at least 8 h per day thereafter 4x60 metre walks from POD1 vs No formal mobilization plan	unassisted ambulation over 400m
	Diet	Patients were allowed free fluids on the day of surgery, and diet as tolerated following this vs Fluids and diet introduced in stepwise manner	Oral fluids: 6h post op, normal diet POD1 vs Ad hoc—consultant dependent for both fluid and diet	Enforced oral feeding postoperatively. Patients were allowed to start drinking and eating immediately after surgery if they wanted	Encouraged to drink water ad libitum 6 hours after procedure. POD1: patients commenced soft diet tolerance if liquid tolerance was established, without waiting for signs of intestinal motility. POD 2: patient commenced normal diet if	Fluids allowed immediately after surgery. Diet was then introduced as tolerated vs Reintroduced in a traditional stepwise manner	Fluids to light diet on POD1 as tolerated	Diet was allowed immediately after the operation vs Diet was commenced only on signs of returning bowel motility. 30 mL/h of oral fluids. This was increased stepwise (30 mL/h to 60 mL/h to free oral fluids) every 12 hours unless there	Dextrose Saline IV 83 ml/h stopped 8am day 1. 1 high protein/high calorie drink on day 0. 3xhigh protein/high calorie drinks per day thereafter. Free fluids from day 0. Normal diet offered and encouraged from day 1 vs Nsaline 1000 mls and 5%	Water (less than 1L) immediately after the operation and commenced a regular diet in 2 days after surgery

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					adequate tolerance to soft diet had been established vs POD2: water tolerance commenced if signs of recovered intestinal transit were present. POD3: liquid diets when appropriate; intake progressed according to tolerance and in the presence of signs of recovered intestinal transit			was nausea. Sufficient supplementary intravenous fluids were given to maintain a urine output of at least 0.5 mL/kg per hour and a systolic blood pressure of 90 mm Hg	dextrose 2000 mls over 24 h until oral fluids established. No standard reintroduction of fluid and food. Normal diet offered once fluids tolerated	
	Other	Chest physiotherapy		Routine pre-operative glucocorticoid was not used. Standard laxative	6 hours after procedure, commenced IV ondansetron at 4 mg/8 h. POD 2: perfusions removed	None vs Chest physiotherapy		Regular domperidone, magnesium hydroxide 8%, and liquid protein/calorie supplements from admission	Lactulose 15 mls 12 hourly postoperatively. Oxygen 4l 24h postoperatively in both groups. Aim for discharge day 3 for colonic and day 5 for rectal resections. vs No	Regular laxative (magnesium oxide) vs Laxative only if necessary

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									predetermined discharge plan	
Black text= Experimental group; Blue text-Comparator groups; Red text=Both Experimental and Comparator groups; h=Hours; IV=Intravenous; LOS=Length of Stay; POD=Post-Operative Day; PT=Physiotherapist										

Table 3. Description of ERP and ERAS interventions for patients undergoing colorectal surgery: Studies L-Z

Stage of care	Intervention component	Lidder 2013[11]	Maggiori 2017[12]	Mari 2014[13]	Mari 2016[14]	Muller 2009[15]	Pappalardo 2016[16]	Van Bree 2011[17]; Vlug 2011[18]
Pre-admission	**Assessment & Education**		Pre-assessment of risk adjustment at outpatient department of anaesthesiology. information about FT programme at outpatient department of surgery and anaesthesiology	Attended daily interview about bowel function, first passage of flatus and stool, walking capability, first solid meal intake, and pain perception during recovery				Pre-assessment for risk adjustment. Discussion about placement of epidural and about essence of FT protocol. Pre-admission counselling and guided tour of surgical ward. vs Open discussion about PO pain management options
	Nutrition			Fibre-free diet for 4-5 days before surgery				
	Day of admission	NR	Day before	Day before	NR	NR	NR	Day before
	Nutrition	400 ml of carbohydrate supplement given 2 h before surgery. Nutricia PreOp solution (Numico, Zoetermeer, Netherlands; carbohydrate, 50 kcal per 100 ml, 290 mOsm/kg, pH 5.0) vs 400 ml placebo drink was given 2 h before surgery. Water with artificial sweetener	200ml evening before. Preoperative carbohydrate loaded liquid intake 3 hours before surgery. Last meal 6h before vs Complete preoperative fasting with last meal until midnight the day before surgery	Day before: Free diet for lunch, maltodestrine drinks for dinner vs fasting (1000g lucosalina)		Clear fluids allowed until 4h before surgery		Last meal 6 h before operation, two units carbohydrate 2 h before surgery vs Fasting from midnight, no carbohydrate

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		(acesulfame-K, 0.64 g per100 ml citrate, 0 kcal per 100 ml, 107 mOsm/kg, pH 5.0), identical in taste and appearance to the carbohydrate supplement drink						
	Bowel prep		Routine	Clisma fleet 100mL x2 the evening before surgery		No bowel preparation	Mechanical bowel preparation (polyethylene glycol)	Enema
	Pain relief		Routine pre-anaesthetic medication before surgery					Pre-anaesthetic evening medication: Lorazepam, 1 mg evening before operation, if necessary. None on day of surgery vs Lorazepam, 1 mg or Temazepam 10 or 20 mg on day of admission. Lorazepam 1mg, or Midazolam 7.5mg on day of surgery
	Other		Pre-anaesthetic Hydrokyzine 1mg/kg if necessary	Osmotic laxative		All patients received thrombo-prophylaxis and perioperative antibiotics		Additional fast track information on intake
Perioperative	**Surgical technique**	NR	Laparoscopic resection of colon	High anterior resection with a transanal anastomosis. Ligation of the inferior mesenteric artery at the origin, and mobilization of the splenic fixture	NR	Median laparotomy	NR	Minimally invasive incisions/ laparoscopy vs Open surgery performed through a midline laparotomy

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	Anaesthesia	Both groups: general anaesthesia was induced with Propofol and maintenance was achieved with Sevofluorane or isofluorane. Atracurium, Rocuronium or Vecuronium was given as a muscle relaxant according to anaesthetist preference. No patient received exogenous insulin during surgery. Before induction of anaesthesia, patients received a thoracic epidural catheter, unless contra-indicated or the patient refused	No epidural. Lodicaine intravenous infusion 1mg/kg/h.	NR vs Morfyn 3fL + NSAID. 2fL + Metoclopramyd 1fL in continuous infusion		Both groups: Mid-thoracic epidural catheter with Ropivacaine 0.33% or Bupivacaine 0.25%. All anaesthetic procedures and agents were standardised	General anaesthesia (transdermal Scoplamine, Fentanyl and Properidol). Epidural anaesthesia (Ropivacaine + Morfine). Epidural anaesthesia (Ropivacaine 225mg 4ml/h) for 48 hours	Placement of thoracic epidural catheter (T6–T10, depending on the surgical resection); test-dose (Bupivacaine 0.25% with adrenaline 1:200,000), top-up dose (Bupivacaine 0.25% [± 10 ml] with Sufentanil 25 µg, followed by continuous infusion (Bupivacaine 0.125% with Fentanyl 2.5 µg.ml-1) until POD2. Combined with balanced general anaesthesia vs Thoracic epidural as per fast track group, or lower level or PCA pump. Combined with balanced general anaesthesia. No infiltration of surgical wounds with local anaesthetic
	Fluid management		Goal-directed perioperative fluid infusion regime (6ml/kg/h). Optimized hemodynamic monitoring vs Free perioperative	10 mL/kg/h administered. Restriction of fluids vs 15ml/kg/h administered		Restricted fluid regimen with a preoperative loading of Ringer's lactate solution at 1 mL/kg/h, nothing by mouth and an	Electrolyte solutions IV for 48 hours	Restricted per-operative fluid infusion regime (Ringers lactate 20 $ml.kg^{-1}$ in the first hour, followed by 6 $ml.kg\text{-}1.h^{-1}$). Vasopressor as first

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			intravenous fluid infusion, standard intraoperative hemodynamic optimisation			intraoperative substitution of 5 mL/kg/h vs Ringer's lactate at 2 mL and 10 mL/kg/h for preoperative loading and intraoperative substitution, respectively. 2000 mL of Ringer's lactate per 24 hours until POD3. Additional fluid or vasopressors given when mean arterial pressure <60 mm Hg or urine output <0.5 mL/kg/h. The transfusion limit was a haematocrit level less than 25%		choice for management of mean blood pressure drop > 20% of baseline Vs Ringer's lactate 20 $mL.kg^{-1}$ in the first hour followed by 10– 12 $mL.kg^{-1}$. Extra fluid challenge as first choice for management of mean blood pressure drop > 20% of baseline
	Other	Both arms: Perioperative care was undertaken by the attending surgical and anaesthetic staff as clinically indicated; Nasogastric tubes were only placed if clinically indicated (vomiting > 100 ml on two occasions within 24 h). Active warming using forced air blankets	Forced body heating. Prophylactic Odansetron	No nasogastric tube. Air warming and IV fluid warming, prophylactic antibiotics at induction, bladder catheter, no central line vs Nasogastric tube, central line		No nasogastric tubes or intra-abdominal drains were used postoperatively	Antibiotic prophylaxis (Ceftriaxone 2g + metronidazolo 500 mg). Venous thromboembolism prophylaxis (low molecular weight heparin)	Forced body heating (Bair hugger system and warmed IV fluids). Prophylactic use of Odansetron (4 mg) to prevent PONV. Supra-pubic urine catheter. Infiltration of surgical wounds with Bupivacaine. No standard use of abdominal drains vs Use of Ondansetron, Dexamethasone, or Droperidol for PONV according to attending

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								anaesthesiologist. Urine catheter according to surgeon
Post-operation	**Drain/ catheter/tube removal**		Removal of nasogastric tube before extubation. Remove IV cannula in the absence of stoma, by POD2	Remove nasogastric tube after surgery (vs POD1). Remove bladder catheter POD1 (vs POD2)	Nasogastric tube removed before POD1 vs Nasogastric tube removed on POD1		Nasogastric tube removed after 12 hours	Removal of nasogastric tube before extubation. Supra-pubic catheter removed POD1 when residue <50mol.
	Pain management	Both groups: After surgery, an epidural infusion of Bupivacaine and Fentanyl was maintained for at least 48 h. In addition, patient-controlled epidural analgesia could be used according to a protocol. Patient-controlled analgesia with morphine and/or tramadol was prescribed for patients who did not have epidural anaesthesia	Infiltration of surgical wounds with Ropivacaine. Opiate sparing analgesia Nefopam, 120mg/day for 48h, paracetamol 6g/24h	Paracetamol 1g 4 x wound infiltration with naropine 7.5% 2fL. Paracetamol 1g x 4 on POD2 and POD3. Opioid-free postop analgesia. vs POD1 stop opioid, NSAID if necessary	No opioid based analgesia given on POD0 and POD1 vs Opioid based analgesia given on POD0 and POD1	Both groups: Epidural catheter removed POD2. Only additional paracetamol was given intravenously. A failure of epidural analgesia was defined as the need for supplemental intravenous opioids	Epidural anaesthesia (ropivacaine 225mg 4ml/h) for 48 hours. Pain killers (Acetaminophen 1000 mg if pain ≥ 5 VAS)	Paracetamol 4 × 1 $g.d^{-1}$ added to thoracic epidural catheter. POD2: Remove epidural, add Diclofenac 3 × 50 $mg.d^{-1}$, Remove IV cannula vs Early post op: Epidural or PCA morphine to which paracetamol 4x1 $g.d^{-1}$ and/or diclofenac 3x50 $mg.d^{-1}$ are added. POD2: Epidural removed according to attending anaesthesiologist. Continue as on POD1 until discharge criteria fulfilled
	Early mobilisation		Out of bed 6h POD1, 8h POD2; walking >50m POD1, 100m POD2, free movement POD3 vs Progressive	5h after surgery patient sits down, free walking from day 1. At least 100m POD1, increased on POD2 until fulfilment of	Mobilised before POD1 vs Not mobilised until POD1	Early mobilization starting immediately after surgery	Mobilisation After 24 Hours	POD0: Mobilization in the evening (>2 h out of bed). POD1: >6h out of bed. POD2: >8 hours. POD3 continue

Stage of care	Intervention component	Lidder 2013[11]	Maggiori 2017[12]	Mari 2014[13]	Mari 2016[14]	Muller 2009[15]	Pappalardo 2016[16]	Van Bree 2011[17]; Vlug 2011[18]
			mobilisation starting on POD1	discharge criteria vs Mobilisation from POD1 until fulfilment of discharge criteria				until discharge criteria met vs Early post op: No mobilization scheme. POD1: Mobilization according to attending surgeon
	Diet	Free fluids permitted immediately after surgery and a light diet as tolerated. Polymeric nutritional supplement drink (600 ml/day) from the period immediately after their operation until discharge. Fortifresh (Numico, Zoetermeer, the Netherlands; 150 kcal per 100 ml, 965 mOsm/kg, pH 4.2) vs Placebo (600 ml/day)	Carbohydrate loaded liquid (200mL) evening of surgery. POD1 semi-solid foot intake, CHL 400m/day, normal diet by POD2 vs Progressive oral intake starting on POD1	5h after surgery, oral semi-solid diet. 100ml/h for 20h in continuous parenteral infusion. Protein-loaded drink 1L (Protifar). POD1: semi-solid diet. POD2: fiber-free diet vs 100ml/h for 48h in continuous parenteral infusion. Until POD3, then semi-solid diet. POD4, 5 fiber-free diet	Oral feeding before POD1 vs Oral feeding delayed until POD1	Start drinking immediately after surgery. Two additional protein drinks were given (Fresenius Power Drink; Fresenius Kabi, Stans, Switzerland) for the first 3 days, and patients were invited to resume oral nutrition on POD1	Clear liquid diet after 24 hours	First oral drinks at 2 h post-surgery, supplemented with CHL liquids, 2 units (Nutridrink). First semi-solid food intake in the evening. POD1: Oral intake > 2l (including 4 units CHL liquids). Normal diet. POD2: Normal diet vs Early post op: Small amount of water orally. POD1: Diet increased on daily basis
	Other	Both arms: Intravenous fluids after POD1 were not encouraged and only given if patients would not drink enough to maintain a urine output or blood pressure	Limited intravenous intake (<1500ml/day) POD1, normal diet POD3	Short term antibiotic therapy with Cephazoline 2 g IV + Metronidazole		Fluids were discontinued at POD1 unless contraindicated	Protonic pump inhibitors (omeprazole 40mg/die)	POD0: IV infusion of Ringers lactate 1.5 Ld^{-1} POD1: Stop IV fluid administration (leave canulla). Start laxative (MgO, $2 \times 1\ g.d^{-1}$), Continue on POD2.

Stage of care	Intervention component	Lidder 2013[11]	Maggiori 2017[12]	Mari 2014[13]	Mari 2016[14]	Muller 2009[15]	Pappalardo 2016[16]	Van Bree 2011[17]; Vlug 2011[18]
								POD2: Plan discharge vs Early post op: IV infusion of Ringer's lactate 2.5 L POD1, then continued until adequate oral fluid intake. POD3: continue as on POD2 until discharge criteria are fulfilled

Black text=Experimental Group; Blue text=Comparator Group; Red text=Both Experimental and Comparator Groups; CHL=Carbohydrate Loading; fL=Fluid litres; FT=Fast-track; h=hours; IV=Intravenous; NSAID=Non-Steroidal Anti-Inflammatories; PCA=Patient Controlled Analgesia; POD=Post-operative Day; PONV=Prevention of Nausea and Vomiting

Table 4. Description of Prehabilitation programmes for patients undergoing colorectal surgery

		Study (First Author, Date)		
Stage of Care	**Component of Care**	**Carli 2010[19]**	**Dronkers 2010[20]**	**Gillis 2014[21]**
Pre-Admission	**Assessment and Education**		Informed about importance of physical condition to the PO course and encouraged to adhere to training programme	Approx. 4 weeks before operation: medical examination, consultation with kinesiologist, dietitian, and psychologist and instructed to begin the tri-modal prehabilitation program at home immediately. Instruction booklet provided, describing all elements of programme; patient diary to document all activities related to the programme. Written in easily comprehensible language with pictures and figures
	Physiotherapy	Exercise initially at 50% of maximal heart rate; increase by 10% each week, if tolerable Weight training 3xweek, 10–15 min per day. Weight based on what individual could lift to reach volitional fatigue with eight repetitions Push-ups, sit-ups and standing strides (lunges) until volitional fatigue, increasing to reach 12 repetitions Cycling began at 20 min per day, increasing to 30 min/day. Full adherence: 20–45 min per day for approximately 3·5 h per week, or 14 h over a 4-week period Stationary cycle and weights provided to each patient vs Daily 30 min walk and breathing exercises (practising deep breathing at full vital capacity as well diaphragmatic breathing, huffing and coughing for 5 min/day) 5–10 min of exercises to	2-4 weeks before surgery: 2x60 min supervised exercise session/wk in the outpatient department ~~of physical therapy while waiting for surgery (2–4 weeks).~~ Included: warm-up; resistance training of the lower limb extensors (~~with a maximum~~ max. ~~of one set of~~1x ~~8~~–15, ~~consistent with 60–80% of the one-repetition maximum~~; inspiratory muscle training: patients breathed against a variable resistance ~~(10–60% of the maximal inspiratory pressure)~~ for about 15 min ~~(240 breathing cycles)~~; aerobic training: ~~the subject trained~~ training at ~~a~~ moderate intensity ~~of exercise (to 55–75% of maximal heart rate)~~ or perceived exertion for ~~(between 11 and 13 on the Borg Scale; aerobic training lasted~~ 20–30 min ~~to obtain optimal benefit~~; ~~training~~ functional activities ~~according to~~based on capabilities and interests; cooling down. ~~When not training in the outpatient department, followed a~~ ~~h~~Home-based training programme~~:~~, ~~including:~~ Walking (~~patients received a~~monitored via pedometer ~~to monitor this activity~~) or 30 min cycling ~~daily. for a minimum of 30 min per day~~. Intensity ~~determined on the basis of~~based upon ~~the~~ perceived exertion. Equipment provided: ~~Subjects supplied with~~ inspiratory muscle training device+~~a~~ threshold	~~Certified kinesiologist assessed and trained each~~ Patients~~participant~~ assessed/trained by kinesioloigst according to ~~following the guidelines of the~~ American College of Sports Medicine guidelines Exercise regimen: ~~Total-body exercise prescription consisted of:~~ up to 50 min of ~~home-based,~~ unsupervised exercise ~~-~~ for at least 3 days per week~~,~~ ~~alternating between aerobic and resistance training.~~ ~~Aerobic exercise intensity prescribed based on the rate of perceived exertion (Borg scale) from the 6-min walk test (6MWT). The Karvonen formula [(220 − age) − (resting heart rate × % intensity) + resting heart rate] was used to determine the heart rate to be maintained to achieve the desired, prescribed intensity~~ Aerobic exercise ~~could~~ included a patient choice of walking, jogging, swimming, or cycling ~~at patient discretion~~. Session structure: ~~Each session included a~~ 5-min warm-up, 20 min ~~of~~ aerobic exercise ~~(starting at 40% of heart rate reserve)~~, 20 min ~~of~~ resistance training (eight exercises targeting major muscle groups, ~~performed at an intensity of~~ 8 to 12 repetitions max), ~~and a~~ 5-min cool-down Supervised by kinesiologist who provided corrective feedback as necessary. Progression occurred when participant could complete the aerobic exercise with mild exertion (Borg 12) and/or when the participant could complete 15 repetitions of a given resistance exercise

		Study (First Author, Date)		
Stage of Care	**Component of Care**	**Carli 2010[19]**	**Dronkers 2010[20]**	**Gillis 2014[21]**
		activate the circulation were prescribed: ankle rotations and pumping, static quadriceps contractions and bridging	loading device~~. The threshold loading device was~~ adjusted to a resistance equal to 20% of the maximal inspiratory pressure~~. , measured at baseline, and~~ Patients ~~subjects~~ trained with ~~the~~ threshold loading device for 15 min per day. Resistance was increased incrementally based on ~~the~~ perceived exertion~~: if perceived exertion was 5, the resistance of the inspiratory threshold trainer was increased incrementally by 10% of the maximal inspiratory pressure~~ vs Home-based exercise advice~~:~~. Informed of importance of ~~their~~ physical ~~condition~~ health to ~~the PO course~~recovery. Patients ~~and~~ encouraged ~~to be active for minimally~~to take part in 30 minutes activity per ~~/day~~ prior to hospital admission. Equipment provided: ~~Received a~~ pedometer, readings were read out in outpatient department 1xweek~~ to monitor their activities. 1x week the pedometers were read out in the outpatient department by therapist~~ ~~Received instruction~~Education on different breathing techniques (diaghragmatic, deep inspiration and 'forced expiration)~~. in (a) diaphragmatic breathing, (b) deep inspirations with the aid of incentive spirometry and (c) coughing and 'forced expiration techniques~~	Each patient provided with three resistance bands (light, moderate, and/or heavy resistance), a Borg scale and heart rate monitor
Pre-Admission	**Nutrition**			Assessment by registered dietitian assessed and individualised care plan provided, based on 3-day food diary. Macronutrient intake evaluated based on Dietary Reference Intake values and food choices were compared to Eating Well with Canada's Food Guide recommendations. Protein intake prioritised*. Whey protein supplement provided to all patients to guarantee adequate daily protein intake according to estimated dietary deficit. Patients instructed to consume protein supplement within 60 min of exercise regimen.

		Study (First Author, Date)		
Stage of Care	**Component of Care**	**Carli 2010[19]**	**Dronkers 2010[20]**	**Gillis 2014[21]**
				Product recipes also provided. Nutritional care plans focused on management of cancer-related symptoms (e.g., diarrhoea, constipation), blood glucose control if necessary, optimization of body composition (i.e., weight loss/gain if necessary), and appropriate balance of food choices
	Psychological input			60-min visit with a trained psychologist. Provided: techniques to reduce anxiety (e.g. exercises based on imagery and visualization, together with breathing exercises). Exercises practiced with psychologist. Compact disc provided to enable home practise 2/3 time/wk Suggestions given on how to enhance and reinforce patients' motivation to comply with the exercise and nutritional aspects of the intervention
	Support	1xhome visit to demonstrate the programme and at least once to verify exercise programme; telephoned weekly until surgery		Weekly telephone contact: assessed for compliance to the frequency, intensity, or duration of exercise, amount of whey protein ingested, and use of the relaxation methods
During Treatment	**Protocol of care**			Perioperative care guided by a standardised multi-element evidence-based comprehensive ERAS pathway following the consensus review on best care for patients undergoing colorectal surgery
After Treatment				All participants visited after the operation, before hospital discharge, by the kinesiologist, nutritionist, and psychologist to reinforce PrO instructions
Post-Discharge				The same programme carried out by experimental group PrO was carried out by all participants, at home following surgery for 8 weeks
Black text=Experimental group; Blue text=Comparator group; Red text=Both Experimental and Comparator groups; ERAS=Enhanced Recovery After Surgery; Min=Minute; PO=Post-Operative; PrO=Pre-Operative; WK=Week; *Individual protein requirements calculated as 1.2 g of protein per kilogram of body weight (adjusted body weight was used for obese patients), as per European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines for surgical patients				

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Table 5. Description of Enhanced Recovery Programmes/Enhanced Recovery After Surgery interventions for patients undergoing lower-limb arthroplasty: Studies A-M

		First Author, Date							
		Borgwardt 2009[22]	**Dwyer 2012[23]**	**Gordon 2011[24]**	**Harari 2007[25]**	**Hunt 2009[26]; Salmon 2013[27]**	**Khan 2014[28]**	**Larsen 2008[29, 30]**	**Maempel 2015[31]**
Pre-admission to hospital	**Assessment and Education**	1 x information meeting. An ON, an anaesthesiologist, and a PT informed patient about planned procedure	Pre-assessment clinic: Key aspects of ER provided +supplement drinks. Assessment of physical and social needs + planning for PO convalescence/ rehabilitation phase with focus on discharge arrangement. Patient information leaflet: supplied at the initial clinic visit and patients who needed to see an anaesthetist prior to surgery identified. Education and empowerment of patients, families and carers from the time of listing for surgery, through pre-admission, physiotherapy-led classes and literature.	Nurse assessed fitness for surgery, following decision to operate in clinic. Pre-operative investigations. Anaesthetic concerns referred to CA. Education: 2-4 weeks before admission, all patients attend (with their coach) compulsory 1x 0.5 day class by an anaesthetist, acute pain nurse, OT, PT, pharmacist + ward nurse. Information: anaesthetic and pain relief choices in education booklets/JRS. Regional anaesthesia promoted. Opportunity to ask questions. Emphasis that patients are not ill. Pharmacist, OT and PT assessments	POPS team: consultant geriatrician, nurse specialist in older people, OT, PT and SW. Pre-operative broad-domain assessment: AMTS, GDS, BI, Timed Up and Go, 180 degree turn, BMI, continence screen, orthostatic blood pressure, numeric pain score, and PEFR. Results used to predict and plan PO discharge needs. All patients received education in optimising PO recovery, including preoperative home exercises (respiratory, muscle strengthening), good nutrition, relaxation techniques and pain management	Assessment clinic: patient education about surgery, perioperative care and PO rehabilitation individually by dedicated nurses and PT	Outpatient consultation: Patient education, mobilisation and length-of-stay expectations discussed and information DVD provided vs "Generic" education	Information day: Friday before week of surgery. Groups to inform patients of the accelerated path, and have individual consultations with surgeon, anaesthetist, and nurse. Work with healthcare staff worked to gain information and identify pre-set daily goals regarding: (1) information, (2) pain relief, (3) nausea control, (4) nutrition, (5) mobilisation, (6) elimination. (7) discharge planned for day 4 Patients advised how to get help	Assessment clinic: Patients individually reviewed by an orthopaedic PT. Normal course of postoperative events and expectations for mobilisation on POD0 and early discharge explained Advice leaflet regarding exercises, wound care and answers to frequently asked questions

	Physio-therapy and Occupational Therapy	1x OT meeting. Duration unknown	Attend a 1hr joint replacement class run by the PT/OT + encouraged to bring a family member/ friend for support	During JRS: expected PO daily progress + rehabilitation goals explained. Exercises demonstrated, which patients encouraged to start pre-operatively. Individual sessions at JRS: mobility aid demonstrations and stair climbing. Given elbow crutches to take home + practise with. OT identifies potential barriers to resuming normal PO daily activities. At JRS, information given on preparing the home for the PO period. Individual assessments identify PO needs and support needs from Coach. Care packages implemented. Equipment delivered before admission	Most patients received home visits from OT and PT providing aid and equipment	Seen by an OT at the preoperative clinic and then at home before admission Vs Routinely visited by a community PT at home before admission; OT not routinely provided		Information day: OT & PT delivered helping aids, taught and practice exercises and techniques: how to rise from lying and sitting, how to walk with crutches and on stairs. Patients encouraged to perform exercises and practice walking with crutches until admission	
Pre-	**Day of admission**	NR	Evening before surgery	Day of surgery	NR	Day before surgery Vs Day of surgery 1 Vs Day of surgery	Day before?	Hospitalized in new accelerated unit on day of	Day of surgery vs NR

								surgery vs Day before on general orthopaedic ward	
	Nutrition and Carbohydrate loading		Day of admission: high carbohydrate drink 2x sachets of preload (by Vitaflo) dissolved in 400 ml of water at 8 p.m. in the evening. A further high carbohydrate drink with one sachet dissolved in 400 ml of water was given 3 h before surgery. Patients were given the high energy drink irrespective of any comorbidities, e.g. diabetes or high BMI*						
	Analgesia		No premedication				Analgesia started the night before surgery: Gabapentin (300 mg)		
During treatment	**Anaesthesia**	Spinal anaesthesia with 3ml bupivacaine (5 mg/mL) with 5 µg sufentanil added vs Combined spinal/epidural technique, continuous infusion with 5	Short-acting anaesthetic agents: All patients were given spinal or epidural anaesthesia. Propofol used for sedation and maintenance of	All patients receive peri-articular local anaesthetic injection unless contraindicated. Short acting sedation. Acceptance of a regional technique is High (Hip 75% ,		Spinal analgesia with sedation used both intraoperatively and PO vs Standardised general anaesthesia vs	Low-does spinal anaesthesia without any intrathecal opioids with Propofol (+/- Ketamine) and Paracetamol (+/- Parecoxib). Local anaesthetic: intra opertive infiltration		Intraoperative periarticular injection was undertaken with 4mg of morphine, 20ml of 0.5% bupivacaine with adrenaline (1:200,000) and 30mg of ketorolac

		mL/h of bupivacaine (1.25 mg/mL) and morphine (50 µg/mL) for 2 days postoperatively	light general anaesthesia	Knee 97%) vs (Hip 36% , Knee 45%) of knee arthroplasties performed under spinal or combined spinal and epidural anaesthesia. Typical regime of spinal anaesthesia with 2.75 mls 0.5% bupivacaine and 0.1-mg preservative free morphine with a target controlled propofol infusion for light sedation is used. A room separate from operating room used for anaesthetic administration. A periarticular infiltration of up to 60 mls of 0.25% Levobupivacaine administered prior to implant placement.		Epidural or spinal analgesia with sedation was used for anaesthesia.	and postoperative infusion Tranexamic acid...Low-dose spinal anaesthesia was administered for each procedure, with sedation or light general anaesthesia, and 1 g intravenous Paracetamol with or without 40 mg intravenous Parecoxib. Levobupivacaine (0.125%, 80ml) was infiltrated intraoperatively in a wide and layered field including joint. capsule, muscle, fat, and skin. Vs General anaesthesia, spinal or epidural according to anaesthetist's preference and patient consent.		made up to 50ml volume using normal saline. Patients in both groups received spinal anaesthesia unless failed or contraindicated
	Surgical technique	Minimally invasive surgery performed by consultant surgeon used				Lateral position using a posterior approach. Cementless Corail Total Hip System and Pinnacle acetabular cup prosthesis was inserted			Each patient received a PFC® Sigma® primary cemented TKR (DePuy Leeds, UK). One surgeon performed or directly supervised all procedures

						Vs under the care of one of two consultant surgeons. Patients operated on in the supine position, using a lateral approach, and a cemented Charnley Total Hip System prosthesis (DePuy Orthopaedics) was inserted in nearly all patients vs Under the care of one of three surgeons, operated on in the lateral position using a posterior approach. Variety of mainly cement less prostheses were used (predominantly Stryker variants)			
	Fluid management and catheter placement	All patients operated on without a catheter	No urinary catheter				Judicious intraoperative fluid and vasopressor administration. Catheterization only if indicated vs Perioperative urinary catheterization		

After treatment	Intravenous fluid		Wound drains removed on POD1				No drains		
	Analgesia	Postoperative pain treated with NSAIDs. Opioids used for breakthrough pain	Non-opiate and non-steroidal analgesia.	Seen by Acute Pain Nurse. Use of RRP Pain Standard protocol to standardise prescribing*[1] Patient controlled analgesia and opiates are avoided	Geriatrician + nurse reviewed patients in the surgical wards providing direct intervention and staff education including: pain management	Spinal analgesia with sedation was used intraoperatively and also provided postoperative analgesia vs patient controlled analgesia with morphine vs Patient controlled analgesia was not routinely provided after surgery	Postoperative regular analgesia included Gabapentin (300 mg twice daily for 5 days) and Oxycontin (5–20 mg twice daily for 2 days) followed by Tramadol (50–100 mg every 4–6 h). All patients received intravenous Tranexamic acid (15 mg/kg) as a slow bolus at induction	Pain relief consisted of Oxycontin/ Oxynorm and Paracetamol vs Immediately after surgery, patient's pain was evaluated and analgesics given accordingly	Analgesia was provided with regular paracetamol and OxyContin® (controlled release oxycodone; Napp, Cambridge, UK) and OxyNorm® (oxycodone; Napp), as required. Patient controlled analgaesia was not used in patients in the Experimental group vs Routine patient controlled analgesia
	Mobilisation and Resuming Normal Diet/Fluid intake	Patients encouraged to walk. Assisted by a trained physiotherapist every day starting on POD0 vs Same	Sat up in bed in the recovery room and oral fluids commenced. PO: Dedicated joint replacement physiotherapy started on the evening of the operation: patients encouraged to sit out of bed in the chair. Goal orientated mobilisation e.g. encouraged to	Exercises commenced by recovery nurse in recovery room to demonstrate to patient that it is safe to move new joint. A few hours post operatively, exercises commenced, including walking, then daily. Patient encouraged to exercise regularly with support from	Geriatrician + nurse reviewed patients in the surgical wards providing direct intervention and staff education including: early detection/treatment of medical complications, early mobilisation and nutrition	POD1: PT taught prophylactic chest/circulatory exercises/ in-bed hip exercises. Patients mobilised using walking aids (frame or elbow crutches), POD2: Weight-bearing exercise, attended hip class. Physiotherapy throughout PO stay.	POD0 mobilisation: Physiotherapy started within 3–5 h of surgery. Staff nurses trained to mobilise patients when PT not available. Physiotherapy moved from 5 to 7 days a week as the program started, with each patient	POD0: Mobilisation. POD1: Goal of4 h out of bed, including training with a PT and OT. Aimed for >8 h of mobilisation/day for rest of hospital stay. Mobilisation included: all activities out of bed, PT led gait training, and exercises. Same exercises for experimental and control groups, focusing on strengthening hip/knee muscles avoiding restricted	PO same for both Experimental and Control groups: active toe, ankle and quadriceps exercises, straight leg raise, static quadriceps exercises and active knee flexion on a sliding heel board

			reach a white board at the end of the ward. Mobilisation pathways with pre-agreed objectives and supported by PT. Oral nutrition commenced afternoon of surgery: protein and carbohydrate-rich drinks instead of reliance on IV fluids. 2 x sachets of build-up drink on the evening after surgery, 3 x sachets for 3 days thereafter	their Coach. Laminated instructions demonstrating exercises are provided by the bedside and duplicated in the patient information booklet. If the physiotherapist is unavailable, patients mobilised by ward nursing staff		Median PT contacts: 4. Vs POD2: patients mobilised using walking aids, transfer bed-chair, POD3: weight-bearing exercise, functional transfers and stair assessment. Median PT contacts: 5 vs POD1:, Patients were also mobilised using walking aids (frame or elbow crutches, POD2: Weight bearing exercises. Physiotherapy continued throughout the PO stay, progressing to functional transfers (e.g. bed to chair and using a toilet) and stair assessment. Median PT contacts: 7	being reviewed once immediately after surgery and twice on each subsequent day until discharge. Vs Mobilisation POD1	movements Experimental group; greater intensity/ repetitions. Patients taught to increase exercise and gait training after discharge. Healthcare staff aware of using available situations for functional training, need for rest. Followed goals for nutrition, fluid consumption, mobilisation vs POD1: training in bed before lunch, mobilised out of bed after lunch by PT. Mobilisation time and exercise volume increased over following days so patients achieved discharge criteria. Care given in response to patient's needs and rehabilitation adjusted according to the patient's immediate state	Mobilised on POD0 providing no excess wound soakage occurred*[2] Zimmer Frame used initially but progressed to two walking sticks
Post discharge	**Telephone /Fae to face follow up**	24-hour contact-line. Patients told they could call for hospital help after discharge. Personal nurse checked well-being of the patients by telephoning each	Reviewed by a PT between 1 and 3 weeks following discharge, but they could contact the hospital ward should they have any concerns	Call by ward sister 48 h after discharge. Designated questions (documented in patient notes) to detect post-operative morbidity	POPS: follow-up therapy home visit to those with functional difficulties	Access to a telephone help-line. Vs None Vs Access to a telephone help line			

		patient the day after discharge							
	Out-patient follow up		Wound care undertaken by a district/practise nurse in the community		POPS: outpatient clinic review in those with ongoing medical problems	Patients in Intervention and Control centres routinely assessed six weeks after surgery			
	Exercise regimen					No PT or OT			
Additional Components	**Other**	Indwelling epidural catheter used At end of surgery, tissues around the knee joint infiltrated with 50 mL bupivacaine (2.5 mg/mL) with adrenaline (5 µg/mL)	Pre-admission: Supplement drinks (Build-up® by Nestle Nutrition) to be taken 2 days before hospital admission in the morning provided. 3x sachets of Build-up dissolved in 150 ml of water 2 days before surgery and 2x sachets 1 day before surgery Emphasis on PONV and pain. Urinary catheterization was avoided, if at all possible. Pneumatic intermittent calf compression to minimize risk of DVT.	Pre-admission: Pharmacist assesses drug history. Drug cessation advice is given. Inpatient drugs recorded on inpatient chart. Patients asked to ensure sufficient medication for use in hospital and at home for PO period. PrO: admitted to dedicated short stay ward. Checks ensure required OT equipment in place. Patient reviewed by surgeon + anaesthetist. During treatment: Patients could use audio devices in theatre. Post treatment: Once fully recovered,	PrO: Investigation and treatment targeted identified issues, and medical co-morbidites were optimised according to evidence-based practice. Management plans and goals agreed with the patient, and disseminated within 48 h to all relevant providers and patient. Used to predict and plan PO discharge needs. Where needed, the social worker provides inputs, including organising post-discharge care packages or intermediate care.	PrO: Admitted to a high-dependency unit (HDU) for one night vs admitted directly to a general orthopaedic ward vs admitted to a post-anaesthesia care unit (PACU) or HDU for one night.	Pre-treatment: No drains. During treatment: During wound closure, epidural catheter with microbiological filter placed within joint and tunnelled to exit away from wound. Post treatment: 20 mL Levobupivacaine infusion after skin closure, and 3 boluses delivered at 6, 14, and 24 hrs. THA patients: 20-mL boluses, TKA patients: 40-mL boluses . Standardised wound dressings TKAs: single-layered crepe bandage and compressive cuff. All patients invited to	PrO: Nutrition screening on information day. Patient ate according to this result in combination with daily intake of two protein beverages, with a total fluid consumption of at least 2 litres. Pre-treatment: Final blood tests, heart EKG, and radiographs were taken in both groups. Day before surgery informed of the path by the surgeon, anaesthetist, nurse. Post treatment: Zofran for control	During treatment: Intravenous antibiotics (ceftriaxone 1g) at induction of anaesthesia.: 500mg tranexamic acid during wound closure and further 500mg 3h following surgery unless contraindicated. Tourniquet inflated immediately prior to procedure, deflated at end. Intermittent calf compression on non-operated limb during operation post-treatment: Venous thromboembolic prophylaxis:

			Enoxaparin (40 mg) was administered subcutaneously in the evening following surgery and for the duration of the in-patient stay only. Discharge plans confirmed. At discharge, escorted to the hospital exit by physiotherapist/ nurse and shown how to get in and out of a car safely	return to a dedicated elective ward. Laminated cards of daily care and rehabilitation goals by the bedside. Wound protocol: dressings not disturbed until day of discharge unless heavily soiled. Senior nurses have discharge authority. Post-discharge: Pre-prepared analgesia packs dispensed on discharge. Patients discharged on combination therapy.	Post-operatively, geriatrician + nurse reviewed patients in the surgical wards providing direct intervention and staff education including: early detection/ treatment of medical complications, bowel-bladder function and discharge planning. Post-discharge: After follow up, patients linked with pre-existing services as needed		attend a patient education class Patients counselled that pain could be expected. Uniform blood transfusion policy. Supplementary oral iron prescribed with or without laxatives if Hb is between 90 and 100 g/L. Onsite orthogeriatric rehabilitation. Post treatment: Intravenous fluids continuing until POD1, No thrombo-modulator	of nausea. Magnesia for elimination. OT: instruction regarding performance of personal needs for THA patients. Patients' own clothes during stay vs hospital clothes for whole stay	rivaroxaban unless patient taking warfarin preoperatively
Further detail of content of carbohydrate drinks found in Dwyer 2012,[1] See Figure 1 in Gordon 2011, *[2]except for the last patient on the operating list, who was mobilised the following morning. Black text=Experimental Group; Blue text=1st Comparator Group; Green text=2nd Comparator Group; Red text=Both Experimental and Comparator Group; AMTS=Abbreviated Mental Test Score; BI=Barthel Index; CA=Consultant Anaesthetist; DVT=Deep Vein thrombosis; ER=Early Recovery; GDS=Geriatric Depression Scale; h=hours; JRS=Joint Replacement School; ON=Orthopaedic Nurse; OT=Occupational Therapist; PEFR=Peak Expiratory Flow Rate; PO=Post-Operative; POD=Post-Operative Day; POPS=Proactive Care of Older People Undergoing Surgery; PONV=Prevention of Nausea and Vomiting; PrO=Pre-Operation; PT=Physiotherapist; SW=Social Worker; THA=Total Hip Arthroplasty; TKA=Total Knee Arthroplasty									

Table 6. Details of Enhanced Recovery Programmes/Enhanced Recovery After Surgery interventions for lower-limb arthroplasty: Studies M-Z

		Maempel 2016[32]	Malviya 2011[33]	Mertes 2013[34]	Pour 2007[35]	Reilly 2005[36]	Siggeirsdottir 2005[37]	Starks 2014[38]
Pre-admission to hospital	**Assessment and Education**	Preoperative clinic: Issues likely to impede discharge data identified and estimated & discharge date adjusted	A common message transmitted by each member of the team at various stages of preoperative assessment. Information DVD provided to every patient at time of booking for surgery	Pre-assessment clinic 2-6 weeks prior to surgery: with surgeon/nurse specialist, blood tests and X-rays of joint. Questionnaire to identify need for adaptive equipment. Information leaflets on procedure and PO goals. Patient education programme: optional 2hr group session (10–20 patients), 2-4 weeks prior to surgery, led by orthopaedic nurse specialist, a PT and OT. Patients encouraged to bring relative. Patient's hospital journey and discharge arrangements described. Meeting with MDT to discourage patients from adopting the sick role/empowering to take an active role in treatment and rehabilitation	Assessment: outpatient office with family member. Informed would receive accelerated or 'fast-track' surgery. PO analgesia described, reassurance given pain would be controlled. Patients encouraged to comply with rehabilitation protocol. Informed that discharge based on ability of patient to walk independently/climb stairs and discharge to home preferred. Family members encouraged to care for patient at home. Patients operated on with standard incision seen in outpatient office alone or with a family member. Information on THA and that they would be placed on patient controlled analgesia PO. PO rehabilitation was discussed, and patients told walking with would commence on POD1. Patients told would either be discharged home or to skilled rehabilitation facility on POD3/4. Incision size not discussed		Preoperative education and training program: Delivered by PT and/or an OT approx.. 1 month before planned operation Informed about PO rehabilitation and became familiar with exercises to practise before and after the operation and PO devices to be used for assistance. Devices provided prior to operation. Illustrated brochure on how to move and exercise after the operation	Pre-existing medical conditions identified and optimised (e.g. hypertension, anaemia, ischemic heart disease). Education class to help reduce anxiety and manage expectations. Discharge planning: Begins at preoperative clinic.

	Physio-therapy and Occupational Therapy	Reviewed by OT. Any PO equipment needed identified and delivered before surgery. Reviewed individually by PT at pre-operative clinic. Focus on setting patient expectations for mobilisation on POD0 and discharge from hospital on POD3. Physiotherapy regime explained and patients shown how to use elbow crutches. Patients told about mobilisation plan: progression to use of two sticks and climbing stairs on POD2. Patients leaflet with advice about exercises, wound care and frequently asked questions		Consultations with PT and OT at pre-assessment clinic	Seen by a physical therapist for 2-3 sessions for gait training and familiarization with postoperative exercises			
Pre-treatment	**Day of admission**	Traditionally admitted day before surgery.		Day of surgery				Day of surgery
	Nutrition and Carbohydrate			Nil by mouth 6 hour for food, 3h for clear fluids Nutrition risk assessment				Staggered admission and fasting times

	Analgesia							Spinal epidural with regional nerve block
During treatment	**Anaesthesia**	All patients had a spinal anaesthetic unless it failed/ contraindicated	Anaesthesia involved the use of low-dose spinal anaesthesia combined with sedation, or light general anaesthesia with patient breathing spontaneously. Low-dose spinal anaesthesia: –2–3 mL of 0.25% Bupivacaine (plain) or 2 mL of 0.5% Bupivacaine (heavy). No intrathecal opioids. Propofol intravenous infusion (0–2.5 µg/mL) ± Ketamine (0.5 mg/kg, slow intravenous bolus).Paracetamol (1 g intravenously) ± Parecoxib (40 mg intravenously). Intra- and postoperative infiltration of local anaesthetic (100 mL levobupivacaine 1.25 mg/mL). Tranexamic acid (15 mg/kg slow intravenous bolus at induction of anaesthesia. Anaesthesia involved the use of low-dose spinal anaesthesia combined with sedation, or light general anaesthesia with the patient breathing spontaneously vs General anaesthesia, spinal, or epidural according to anaesthetist preference and consent of patient		All patients received spinal anaesthesia Intravenous Propofol, Midazolam, the narcotic analgesics such as morphine, fentanyl, or meperidine were administered at the discretion of the anaesthesiologist	Day case general anaesthesia with no regional nerve block…An intra-operative local anaesthetic injection of 300 mg Ropivicaine (40 ml 0.75%), 30 mg Ketorolac, 0.5 mg Adrenaline (0.5 ml 1:1000) in 100 ml normal saline Injected using 2x50 ml syringes with a 19-gauge spinal needle. Anaesthetic injected into any damaged soft tissue and 3 cm out under the skin before cementing the components		

	Surgical technique	All patients operated on by a consultant surgeon or by a middle grade orthopaedic surgeon with the consultant assisting. THA performed through a Hardinge type approach or posterior (Southern) approach. Various implants used including: cemented Lubinus SP2 femoral components and Lubinus acetabular components uncemented. Corail femoral components Pinnacle uncemented acetabular components and Mathys RM Pressfit acetabular components. Choice of components in both groups was at the discretion of the surgeon. No infiltration of the skin or subcutaneous tissues was undertaken. Patient in the lateral decubitus position for surgery			Seven consultant surgeons and their trainees performed operations. The Genesis II knee implant and the Exeter hip system implant used. Position: supine with a flat bump under the back. Skin incision based on the greater trochanter. Length of incision 7 to 10cm for small incision group and 11 to 19cm for standard incision group. An uncemented total hip arthroplasty with use of proximally coated tapered stem and a plasma sprayed acetabular component was performed in all patients. The type of bearing surface utilized at discretion of the surgeons and dependent on the age of the patient. All TKAs received a low-vacuum drain and autologous reinfusion system	Minimally invasive approach	First institution: posterior approach and the Howse Mk. II implant Second institution: hip prostheses implanted using the Hardinge approach	Not prescribed

	Fluid management	Same surgical technique in both groups, except for the addition of a peri-articular injection of 4 mg morphine, 20 ml of 0.5% bupivacaine with adrenaline (1:200 000) and 30 mg of Ketorolac made up to 50 ml volume using normal saline	Judicious intraoperative fluid and vasopressor administration Intraoperative infiltration of 80 mL 0.125% levobupivicaine. During closure, an epidural catheter placed within the joint to exit away from the surgical field, through which a further 20 mL of levobupivicaine is infiltrated after closure Vs standard I.V. fluid until the next day					
After treatment	**Intravenous fluid management and drain removal**	Drains not used		POD1: Remove drain and dress site	No drains used. Blood management: re-administration of one unit of pre-donated blood to patients who had donated pre operatively . Allogenic transfusion for patients with a haemoglobin level of < 8 g/dL or for symptomatic patients with a haemoglobin level of between 8 and 10 g/DL. Symptoms triggering transfusion included persistent tachycardia (heart rate of > 1000 for at least four	For both groups: Redivac drain. Removed once blood had ceased draining. Removal time varied; usually the following morning (approx. 18 h after surgery)		

					hours), lassitude (an inability to comply with physical therapy exercises), chest pain, dyspnea, and hypotension			
	Analgesia	Regular paracetamol, oxycontin and additional oxynorm, as required. No PCA	A microbiological filter is attached and catheter used to infuse 3 PO boluses of Levobupivicaine 4–6 h postoperatively, again after a further 6-to 8-h interval, and lastly on the morning of day 1, before removal of the catheter. Postoperative boluses: 20 mL Levobupivacaine (1.25 mg/mL) for THR and 40 Ml Levobupivacaine (1.25 mg/mL) for TKR. Gabapentin (300 mg BD for 5 days) and Oxycontin (5–20 mg twice daily for 2 days) followed by tramadol (50–100 mg every 4–6 h) vs Patient-controlled opioid analgesia intravenously	Same for both Experimental and Control groups: No intra-articular pain relief used. POD0: PCA. POD-1: PCA discontinued and step-down analgesia prescribed (Regular oral paracetamol + regular weak opiod + Oramorph as required for breakthrough pain). POD-3: Analgesia reviewed	For patients in both the experimental and control groups: The cumulative dose and type of analgesic medications administered during the hospital stay and for up to six weeks postoperatively were recorded in detail for each patient. The equianalgesic dose for all drugs was calculated. The standard equianalgesic conversion based on pain relieving efficacy equivalent to 10 mg of morphine was used. Patients in this group were placed on an oral narcotic medication (5 mg of OxyContin [oxycodone] every four to six hours as need) and, if they were able to tolerate it, a selective cyclooxygenase-2 inhibitor medication (200mg of celecoxib	Medication for both Experimental and Control groups: 800 mg Ibuprofen for 5 days, 150 mg Ranitidine for 5 days, 1000 mg Paracetamol taken regularly for 5 days, 30–60 mg Codeine taken PRN. Tramadol, 50–100 mg supplied in case the patient remained in pain. Tramadol prescribed in place of the Codeine, not as an addition		Standardised analgesic ladder: opiates avoided where possible

					once daily) on the day or surgery. Supplemental intravenous medication was also provided ad libitum			
	Mobilisation and Resuming Normal Diet/Fluid intake	POD1: Mobilised when possible*[2] Post-operative exercises remained unchanged and consisted of supine active hip flexion, extension and abduction on a low friction sliding board, inner range quadriceps exercises over a block, and toe and ankle pumps. These were followed by standing exercises with active hip flexion, extension and abduction	POD0: Mobilisation. started within the first 3–5 h vs Mobilisation on POD1	POD1: Oral fluid intake. Aggressive physiotherapy and occupational therapy from POD1 remained standard. The ICP was used to formalise mobilisation goals. Patients mobilised with full weight bearing unless specific contraindications in the PO instructions. Therapy adjusted according to patient's clinical condition/ pain. POD1: Bed physiotherapy exercises, mobilise out of bed and transfer bed to chair with assistance. POD2: Bed physiotherapy exercises, sit to stand from chair, Mobilise 10m to toilet with aids. POD3 independent standing balance without aids, independent with transfers, negotiate one step with aids. POD4: Independent mobilisation (including sideways, backwards) with aids. Negotiate stairs with aids. Knee flexion to 90 degrees whilst sitting (TKA only)	POD0: Patients seen by a physical therapist a few hours after arrival on ward and helped to sit in a chair or walk with assistance if possible. Physical therapy occurred at least 2 x daily thereafter vs POD1: Patients seen by physical therapist and assisted out of bed and into a chair. They were also encouraged to walk, if they were able. Sitting in a chair at least three times a day and assisted walking once a day was carried out thereafter. Patients were evaluated by the physical therapist to determine their potential for stair climbing on the third postoperative day	Early nutrition and hydration encouraged. Operated limb placed in a crepe and wool bandage. Patients given extension splint to help mobilise 2-4 hr PO providing patient was alert and sufficiently pain free. Walking frame used prior to safe progression to elbow crutches and practice of stairs vs Physiotherapy: No deadlines/urgency		Early physiotherapy and mobilisation

Post discharge	**Telephone /Face to face follow up**		All patients given ward contact details and recommendations if they had any concerns			Patients given written advice on potential problems with 24-h emergency contact mobile telephone number (Specialist Registrar) and one back-up number. The Registrar visited the patient on the ward prior to discharge and arranged to make a courtesy telephone call once the patient arrived home		Discharge home with appropriate level of support
	Out-patient follow up			Removal of clips in the community 2 weeks post-surgery and outpatient follow-up at 6 weeks, 3-6 months if required, and one year	All patients were examined by a senior surgeon around six weeks postoperatively. Clinical examination and radiographic evaluation were performed during the follow up visit	1x PT outpatient appointment 5 days post discharge for wound check and range of movement assessment. Extension splint usage was discontinued at this time. 10–14 days post-treatment: both groups appointment with PT for: suture removal, ROM check, progression to one or two sticks as required		
	Exercise regimen						During the first 2 weeks post discharge, the PT or OT visited the patient to check rehabilitation scheme being followed. Median visits: 4, range 2–9 times	

Additional Components	**Other**	Pre-treatment: Protocol about pre-operative Hb was the same for both groups. Patients with a pre-operative Hb < 12 g/dl were referred back to their GP for investigation and correction and surgery was delayed unless considered urgent. During treatment: Antibiotic prophylaxis: single intravenous dose of 1g ceftriaxone unless contraindicated	Pre-admission medication: Gabapentin (300 mg) night before surgery (to continue twice daily for 5 days). Dexamethasone 10 mg orally night before surgery and 4 mg intravenously at induction. During treatment: Tranexamic acid (15 mg/kg—slow intravenous bolus at induction; withheld in cases of thromboembolic event in the last 6 months).Perioperative urinary catheterisation as per clinical indication. Knee replacements received a single wool and crepe bandage and a Cryo-Cuff. Perioperative urinary catheterisation Post-treatment: Patients educated to expect some discomfort, and required to be active participants in their recovery. Positive encouragement from all team members was considered	TED stockings + LMWH prescribed. Discharge planning with patient and relatives, return of home situation questionnaire. POD0: assess need for catheter, Autologous blood reinfusion. IV fluid. Referral to community-supported orthopaedic discharge team if indicated, provision of home adaptive equipment. POD0 post op: 3 x IV antibiotics. POD1: Radiograph.POD1: Wound-site dressing checked, POD2: Wound-site dressing change if heavily soiled + Drain site dressing checked, Postoperative blood tests. Check pressure areas. Deep breathing exercises. POD2: Dressed in own clothes. POD3: Teach self-administration of lmw heparin. Regular communication with patients and relatives POD3: Check OT equipment in place at home. POD4: Discharge documentation ready, including community referrals if indicated. POD5:30min observations. Variance mapping: Daily colour-coded documentation of progress: Amber = problems (pain, vomiting	Pre-admission: 200mg of celecoxib 1x daily and pre-emptive analgesia starting at least seven days prior to surgery vs no pre-emptive analgesia. Told to discontinue use of nonsteroidal anti-inflammatory medications two weeks prior to surgery. During treatment: Approximately 0.2mg of DepoMorphine (morphine) was administered intrathecally at the time of spinal anaesthesia for all patients. Post-treatment: Prophylaxis against infection (ancef 'cefazolin] preoperatively and for twenty four hours after the surgery) and thromboembolism (Coumadin [warfarin] for six weeks) administered to all patients. All patients received a social service consultation to discuss social circumstances. Need for skilled rehab	Pre-treatment? For both groups? A pain diary was commenced in the peri-operative unit and continued on ward. Post-treatment: Radiographs to check position of implant. X-rays organised, and a take-home medication pack provided by the pharmacy. Vs Post-operative X-rays and home medication: no deadlines/urgency. Patients instructed on home use of pain diary. Booklet giving comprehensive rehabilitation instructions supplied. vs PO booklet identical except for instruction regarding the first 5 days At Discharge: Advice to rest limb in extension but regularly flex knee within the limits of the bandage. Extension splint supplied for use walking for first 5 days	Post discharge: Outpatient Nurse: daily anti-thrombosis injections, changed wound dressings, removed skin staples and assisted the patient as long as it was needed vs discharged when rehabilitated, or could be transferred to another rehabilitation facility	During treatment: Normothermia maintained with warming blankets Single combined dose of cefuroximine and gentamacin at induction for antibiotic prophylaxis. Post treatment: Promotion of independence and wellness

			important. Discharged with appropriate walking aids. Post-discharge pain treatment similar for both groups: paracetamol, NSAIDs, and weak opioids only	or mobility issues); green=good progress; blue=fitness for discharge; pink=actual discharge. Variance mapping discussed at daily meetings to identify patients in need of extra support. Discharge home	facility was determined on the basis of the degree of home support, the layout of the home, and the physical ability of the patient			

Black text=Experimental Group, Blue text=First Control Group; Red text=Both Experimental and Control Groups
ER=Enhanced Recovery; GP=General Practitioner; JRS=Joint Replacement School; HA=Hip Arthroplasty; Hb=Haemoglobin; ICP=Integrated Care Pathways; IV=Intravenous; LMWH=Low Molecular Weight Heparin; NSAIDs=Non-Steroidal Anti-Inflammatories; OT=Occupational Therapist; PCA=Patient Controlled Analgesia; PO=Post-Operative; POD=Post-Operative Day; POPS = Proactive care of Older People undergoing Surgery; PRN=Pro Re Nata (when required); PT=Physiotherapist; ROM=Range Of Movement; THA=Total Hip Arthroplasty; TKA=Total Knee Arthroplasty

Table 7. Description of Prehabilitation programmes for patients undergoing lower-limb arthroplasty

	Study (First Author, Date)				
Intervention Component	**Crowe 2003[39]**	**Hoogeboom 2010[40]**	**Huang 2012[41]**	**McGregor 2004[42]**	**Williamson 2007[43]**
Assessment and Education	Assessment: OT/PT/nurse. Referred to parts of program to meet individual needs. Day therapy program: Conducted at day hospital- patients screened by physiatrist, received physiotherapy (strengthening exercises and pool program), occupational therapy. If environmental changes needed, home visit conducted vs 1x 7hr preoperative clinic visit approx.1-2 weeks before surgery (laboratory tests/physician and nursing assessments). Education/information: what to bring to hospital, instructions about preoperative medication and bowel preparation, hospital stay and the immediate PO phase	1x Group-based education session about early mobilization, surgery and anaesthesia techniques, restricted movements, benefits of activity and proper use of crutches approx. 1 wk before surgery	Knee X-ray radiography, ECG, blood cell counts before admission. 2-4 weeks before admission: Referral to physical medicine and rehabilitation department for preoperative education- Taught by PT 1x40-min meeting. Information included: protocol for TKA hospitalization and discharge program, post-TKA rehabilitation program, safe transferring technique, device-using guide for crutches and canes, and fall prevention information. All the content delivered in educational booklet and provided to group and given after session.	Information booklet: surgery and all preoperative and PO stages, rehabilitation stages including exercise regimes, and answers to common questions vs description of the surgery, risks and estimated LOS. No information booklet Preoperative class: Booklet. Ensured patients could do exercises, use walking aids and allow for any home adaptations required vs No class	Exercise and advice leaflet, designed by physiotherapy, rheumatology and orthopaedic departments.
Physiotherapy	Outpatient physiotherapy clinic/in home PTs: Program focus on improving strength and endurance (especially in non-arthroplasty joints including the upper extremity) to improve PO mobility Patients who needed multidisciplinary rehabilitation attended a day-care hospital. Physiotherapy focused on upper and lower extremity muscle strengthening and pain control	Min. 2xweekly supervised visits to physiotherapy outpatient department for 3-6 weeks: 60 min of supervised exercise with 4 phases. 5-minute walk to warm up. Lower extremity training: leg-press (sets of 10–20). 20-30 min aerobic capacity training on a bicycle ergometer. Tailor-made training integrating physical activities into the patient's lives Exercise intensity set to 13–14 (moderate to high) on a 15-point rated perceived exertion scale. If an exercise was rated 'somewhat hard' (12 on rated perceived exertion scale), participants increased weight	Home exercise program: thigh muscle strength training. Exercises included: straight leg raising, knee setting, ankle pumping and hip abduction with resistance. Vs usual leisure activities and exercises not prohibited		Physiotherapy Group: 6–10 patients, hourly, 1xweek for 6 weeks. PT devised/supervised exercise circuit: Static quadriceps contractions; inner range quadriceps contractions; straight leg raises; sit to stands, stair climbing; calf stretches; theraband resisted knee extensions; wobble board balance training; knee flexion/extension sitting on gym ball and freestanding peddle revolutions

		carried, number of repetitions and/or the distance walked Use of pedometer on non-training days to increase normal activity. Progression monitored to aid adherence Spouse/family included in the exercises.			
Other	Counselling: Dietician advice re: weight loss/protein intake, pharmacist: for complex medication needs. SW input: financial assistance for home alterations or equipment rental/finding alternative temporary living arrangements Day therapy programme: Dietitian, nursing and social work available for patients attending day hospital. 2-3 weekly 1-2 hr sessions OT: Assistive devices/advice on small home alterations to optimize PO function and independence. Adaptive equipment provided Home assessment if needed. Telephone number for additional information Preoperative clinic visit for laboratory, physician and nursing assessments. Patients who could not attend outpatient facility received home based nursing, OT and PT		1 week prior to admission, telephone call from PT to answer questions about the home exercise program or educational booklet. At time of surgery, standard rehabilitation program 1x day for 40 min. Structure dependent on the patient's post-TKA functional status	All patients received the same cemented prosthesis	
Black text=Experimental group; Blue text=Control group; Red text=Both Experimental and Comparator Groups *Details of acupuncture points reported in Williamson et al (2007); ECG=Electrocardiography; LOS=Length of Hospital Stay; OT=Occupational Therapist; PO=Post-operative; PT=Physiotherapist; SW=Social Worker; THA=Total Hip Arthroplasty; Total Knee Arthroplasty					

Table 8. Description of Rehabilitation programmes for patients undergoing lower-limb arthroplasty

	Study (First Author, Date)		
Component of Care	**Den Hertog 2012[44]**	**Pengas 2015[45]**	**Vesterby 2017[46]**
Preoperative care			All patients 2-hour group information approx. 14 days before surgery. Introduced to telemedicine platform/how to use it. Information re: goal of one day of hospitalization, and motivation from staff. Told using telemedicine support was voluntary but some films would be relevant for them to see before surgery
Peri and Post-Operative Care	Patients admitted to 3 bed hospital unit and received patient-focused care included: positive messages to patient from case manager, e.g. 'yes, you can', competitive care (comparing progress with other patients). Patients told discharge scheduled for POD6 if discharge criteria fulfilled vs Standard postoperative care based on existing protocols. Individual care based on patient's subjective demands, including I.V. fluid program for 1st 24hr PO		Hospitalized at the same ward on the day of surgery Received pre- and PO radiographs Same surgeon performed all operations. Spinal anaesthesia used. Wound infiltration during final stage of the operation. Goals regarding treatment of blood loss, pain, and nausea, nutritional advice and mobilization according to Danish guidelines for THR
Physiotherapy	Early mobilization; POD: getting up, group therapy, POD2: climbing stairs. Standard intensive physiotherapy (2h daily) focusing on ADL in a living room environment Vs POD2: First mobilization, daily PT in single exercises (1 h): walking exercises, passive flexion–extension of the knee, strengthening of the lower limb muscles, respiratory training. Exercises similar Experimental group. Differences between the groups mainly when began after surgery and duration of sessions	Weekend PT programme introduced: 1xdaily 3hr PT session for 15 weekends. Provided by PT assistant.vs no physiotherapy at weekends	POD3: visit at home by PT All patients visited outpatient clinic POD 21 and 90 patients seen by PT Patients using TMS returned the equipment on day 90 and internet connection terminated
Support Post-Discharge	Daily exercise program, for 18 days in a single rehabilitation centre		POD 2 AND 6: Video conference at home. Video conference initiated by either patient or hospital. Mobile camera and could be used for close-ups Telemedicine solution worked as a TV box and covered: Interactive written information with added speak, animations and visualizations. Included: narrative story with elements of exposure, description of the

			background of primary hip arthritis, anatomy of hip, the surgical procedure, and importance of rehabilitation, risks and limitations, Films of recommended exercises and how to use supplementary aids. Aimed to address as many patient needs as possible.
Black text=Intervention group; Blue text=Comparator Group; Red text=Both Experimental and Comparator Groups; ADL=Activities of Daily Living; h=hour; I.V.=Intravenous; PO=Post-Operative; POD=Post-Operative Day; PT=Physiotherapist; THR=Total Hip Replacement; TMS=Telemedicine Support; TV=Television			

Table 9. Description of other interventions received by patients undergoing lower-limb arthroplasty

	Study (First Author, Date)	
	Barlow 2013[47]	**Huddleston 2004[48]**
Name of Intervention	**Ring-Fenced Orthopaedic Ward**	**Hospitalist–Orthopaedic Team (Co-management care)**
Description of Intervention	Specialist orthopaedic ward: Ring-fenced ward for elective orthopaedic surgery. Ward protocol: Admitted to hospital between the time of the preoperative assessment clinic and theatre assumed MRSA positive until had repeated negative swabs. No patient with MRSA history was admitted, instead nursed on general orthopaedic ward Dress code and behavioural policy: The ward was locked and only opened by special cards or staff on the ward. Medical staff changed into freshly laundered white coats in a changing room and left bags and jackets behind before entering ward. Alcohol gel was readily available and used before entering the ward/patient contact. Nursing and auxiliary staff wore a gown and gloves for patient interaction. Staff used sterile gloves and trolley when dealing with any wounds Visitor's policy: Max. 2 visitors, no flowers, minimal presents, and restricted visiting hours. Visitors were required to clean their hands on admission to the ward, and sit on chairs rather than the beds vs nursed on general orthopaedic ward. Mix of trauma patients, elective orthopaedic patients, and medical outliers. Patients treated using standard infection precautions	Hospitalist-Orthopaedic Team: Composition: Hospitalist faculty (no residents); consultative medical specialty teams (faculty and resident). Mean length of postgraduate clinical experience: 6.2 years Aim: Integrate general internal medicine faculty hospitalists with the orthopaedic surgical team and the orthopaedic surgery nurses Functioning: 3x hospitalists rotated throughout study year to provide clinical care. Duties: medical consultation for non-orthopaedic patients, care of patients in a transitional skilled-nursing facility, Hospitalists (vs orthopaedic surgeons) provided all indicated postoperative medical care after the surgical team completed initial postoperative orders e.g for laboratory tests, fluid and electrolyte management, and medications). Patients seen > once daily
Perioperative Care	Admitted day before surgery and managed by same surgical teams. Operations carried out in laminar flow theatres with standard theatre precautions and prophylactic antibiotics	Same orthopaedic surgical team; nursing personnel; aesthetic care; deep venous prophylaxis, initial postoperative recovery care, room allocation of the patients In both Experimental and Control groups: patients undergoing THA/TKA placed on respective postoperative clinical pathway, developed by the orthopaedic surgical department. Pathway includes: recommendations for routine postoperative laboratory studies, initiation of physical therapy, and nursing education

	Study (First Author, Date)	
	Barlow 2013[47]	**Huddleston 2004[48]**
		Standard nurse protocol for urinary catheter management: suprapubic ultrasound determination of urinary retention and guidelines for nursing-initiated urinary catheterization Standard postoperative order: vital sign/temperature monitoring, pain control medication regimens, pulmonary hygiene, diet, and activity
Black text=Experimental Group, Blue text=Control Group; Red text=Both Experimental and Comparator Groups; MRSA= Methicillin-resistant Staphylococcus; THA=Total Hip Arthroplasty; TKA=Total Knee Arthroplasty		

Table 10. Description of Prehabilitation programmes for patients undergoing cardiac surgery

	Study (First Author, Date)			
	Arthur 2000[49]	**Furze 2009[50]**	**Goodman 2008[51]**	**Rosenfeldt 2011[52]**
Education and Counselling	Supportive education: PrO teaching at study entry, 1 week before surgery and monthly telephone contact by nurse cliniciansContent: standardised written/videotaped information about cardiac risk factors in both videotaped. Opportunity to ask questions provided 1wk before surgery: information about the surgery and sequencing of hospitalization events. Details provided on what to expect in early post-surgery recovery and roles of health care providers involved in PO care. Spouses/family members informed of what to expect when they saw the patient after surgery Patients and family members viewed a videotape showing former clinic patients discussing their experiences with CABG. vs Videotape at their intake appointment 1 week before surgery Nurse clinicians discussed psychological issues related to waiting for surgery with both patients and families at study entry and during telephone calls. Patients were referred to clinic psychologist if necessary vs Followed by their primary care physicians, cardiologists, or surgeons	The HeartOp Programme: 2-part patient held booklet: cardiac myths and misconceptions, reducing risk factors for secondary prevention, and what to expect during the hospital stay and recovery period Interview: Outpatients clinic with nurse facilitator (45-60 min). Aim: dispel specific cardiac misconceptions, work with patient to agree goals to reduce cardiovascular risk/increase activity levels and introduce intervention. Goals recorded in diary, in which patient record daily progress Telephone follow-up with nurse to check misconceptions, set new goals and discuss progress. Frequency: 1, 3, 6 (+/- 1 week) and then monthly. Duration: 10-15 minutes vs Written information (British Heart Foundation booklets). Specific misconceptions not elicited, but if patient asked questions including these misconceptions, they were dispelled. General advice on reducing risk factors provided Interview: patients were asked to describe their illness and offered verbal advice on their risk factors and a description of the operation and after-care	Monthly pre-operative appointment with the cardiac homecare nurse: - Cardiac risk assessment* to assist patients to make lifestyle changes. - Given a copy of the manual. Nurses guided them through the sections covering risk factors, preparation for surgery and what to do if they encounter chest pain. - Given opportunity to ask questions and voice concerns about individual needs and operation. Advice on lifestyle changes in response to the risk factor assessment using motivational interviewing techniques. Vs Baseline assessment and pre-surgery information day.	
Physiotherapy and Occupation	Exercise training: 2 x group sessions per week, supervised by kinesiologists and exercise specialists in hospital environment			Physical exercise program: outpatient sessions for first 2x weeks on waiting list supervised by a PT. 2x60-minute exercise sessions/week

	Individual exercise prescription based on individual exercise test results; exercise intensity 40% - 70% of functional capacity Each 90 min session included: walking warm-up of 5 to 10 min with general range-of- motion exercises; 10 min of stretching; minimum of 30 min of aerobic interval training on stationary cycles, treadmills, arm ergometers, and stair climbers; 5 to 10 min of cooldown and stretching			First session (physician supervised): gentle stretching, cycling on a stationary bicycle (15 min), walking on a treadmill (10=15 min).*[1] ECG and HR monitoring for safety Subsequent sessions: 40 min of endurance-type exercise circuit including 3 exercises: cycle-ergometry, treadmill walking and arm ergometry. HR rate monitored by the PT 30-60 min continuous aerobic exercise 2xweek After 2 week program: continues regular physical exercise for minimum 30 min x 4 days/week until surgery Participants provided with heart rate monitor to ensure desired level of exercise intensity achieved Vs Awaited surgery at home without receiving additional therapy
Relaxation/Stress Reduction		Programme also included a relaxation programme on audiotape or CD.		OT conducted mental stress reduction therapy: 4x60 min individual outpatient sessions for first two weeks on the waiting list. Family members invited Each session consisted of: education on effects and management of stress, relaxation techniques e.g. deep breathing and meditation how to recognise and manage situations that caused them stress Homework and handouts provided after each session Patients encouraged to practise relaxation techniques daily at home until time of surgery

				CD of relaxing music provided. Patients encouraged to listen to this for 20 min daily as part of relaxation practice
Post-Operative and Post-Discharge Support	Smoking cessation programs part of the PO rehabilitation program Patients in both Experimental and Comparator groups had opportunity to take part in existing cardiac rehabilitation programme	Patients in both E+C groups: written and verbal advice prior to discharge on self-management in the first 6 weeks, including advice on increasing activity, wound care, diet and responding to common concerns about their recovery All patients offered a cardiac rehabilitation programme commencing at 6 weeks PO		.
Other	Encouraged to stop smoking at study entry and again 1 week before surgery. Smoking cessation encouraged but not overemphasized during the waiting period. Reminders given of potential immediate postoperative benefits of smoking cessation before surgery			

Table 11. Description of surgical ward interventions for patients undergoing cardiac surgery

		Study (First Author, Date)	
		Probst 2014[53]	**Salhiyyah 2011[54]**
During Treatment	**Anaesthesia**	Anaesthesia induction: fentanyl (0.2 mg), ~~and~~ Propofol (1.5 to 2 mg/kg). Intubation: 1x~~Single dose o~~f Rocuronium (0.6 mg/kg) ~~to facilitate intubation~~, ~~maintaine~~maintenance: ~~d with~~ continuous infusion ~~of~~ remifentanil (0.2 mcg/kg/min). Pre/Post-CBP ~~H~~hypnosis ~~during the pre- and post-CBP~~: sevoflurane (0.8 to 1.1 ~~minimum~~ min. alveolar concentration). During CPB: continuous Propofol infusion (3 mg/kg/h). Recruitment manoeuvre carried out prior to weaning from CPB to prevent atelectasis	Experimental and Control Groups: Short-acting inhalation agents and sedation with Propofol and morphine-based analgesia used. No epidurals
	Surgical Technique		P atients underwent their operations with cardiopulmonary bypass and cardioplegic arrest
	Temperature Regulation	External convective warming system with an underbody blanket used after weaning from CPB to maintain minimum core temp. of 36°C	All operations performed either at normal temperature or with moderate hypothermia (32C)

	Other	Oral premedication: Clorazepate dipotassium (20 to 40 mg) the evening before and midazolam (3.75 to 7.5 mg) on day of surgery	Blood preservation through routine use of cell saver procedures
Post-Operative Care	**Ward Description**	All patients transferred to the PACU, intubated mechanically ventilated with a remifentanil infusion of 0.1 mcg/kg/min. Administration of hypnotic agents was discontinued in the OR Vs Patients arrived in the ICU intubated, mechanically ventilated with a remifentanil infusion of 0.1 µg/kg/min. Treatment determined by ICU physician according to guidelines for intensive care treatment in cardiac surgery patients. Criteria for suitability to transfer to IMC identical to those in the PACU. Physician-to patient-ratio 1:12. Nurse-to- patient ratio was 1:2. Physician's specialisation: diverse (e.g. cardiac surgeon), 21 bed unit, unlimited opening, 24 hours. Patient population: Mixed as in the PACU but additional patients with multi-morbidity and severe diseases Discharge to the step-down unit dependent on need for ICU beds	TRU: independent of the cardiac ICU 1:1 nursing provision. 2 bed capacity, operating between 0800 and 1830 hours on weekdays only. Last admission time: 1430 hours. vs CICU for minimum of 1 day, and then either directly to the general ward or first to the PCU, if indicated Patients transferred on POD0 to an intermediate care unit when they exhibited cardiovascular stability, a fraction of inspired oxygen 70% and a PO2 value of 75mm HG after extubation were transferred to the PCU. The PCU is a 6 bed high dependency unit within the cardiac ward with a 1:2 nursing policy PCU has facilities for continuous monitoring of vital signs. Patients not satisfying PCU criteria were transferred to CICU Patients then transferred to general ward. Patients in both Experimental and Control groups treated according to standard practice. Nursed on a 1:4 or 1:5 nurse to patient ratio. Patients assessed for discharge after consideration of their clinical and social situations
	Extubation Criteria	Conscious and obeyed commands, had stable spontaneous ventilation with pressure support of 10 to 12 cmH2O, positive end-expiratory pressure of 5 cmH2O, fraction of inspired oxygen of ≤0.4, were haemodynamically stable, not bleeding (≤100 ml/h), and with no significant electrocardiographic abnormalities. Vs According to physicans' estimation under consideration of overall situation on the ICU presupposed that extubation criteria were met. Weaning protocol mainly nurse-driven, compliance to the weaning protocol depended on the actual workload. Remifentanil stopped according to disposition of the intensivist under consideration of overall situation in the ICU. Non-invasive ventilation performed in only 4% of our population	Exhibition of cardiovascular stability (HR 60-100 beats/min; mean arterial pressure, 60-95 mm Hg), chest drain drainage of <100mL/hour, and a Glasgow Come Score of 15
	Other	Early PO analgesia: 1 g paracetamol administered IV before skin closure. All patients received fast-track anaesthesia in the OR: mide (0.1 mg/kg) on discontinuation of the remifentanil infusion, followed by bolus doses as required in 2 to 4 mg aliquots, plus regular paracetamol (1 g every six hours) facilitated by use of pain scale vs Bolus of piritramide (0.1 mg/kg) on discontinuation of the remifentanil infusion, followed by bolus doses as required in 2 to 4 mg aliquots, plus regular paracetamol (1 g every six hours). A pain scale was not used on a regular basis for assessing pain. The need for an analgesic medication was estimated by nurses	Cardiovascular support available: inotropes and vasoconstrictors Mechanical ventilation was not provided, but some respiratory support was given via a continuous positive airway pressure

Table12. Description of ERP intervention for patients undergoing cardiac surgery

	Fleming 2017[55]
Assessment and Education	Preoperative assessment clinic: patient information regarding anaesthesia and perioperative fluid intake
Carbohydrate loading/Nutrition	Evening before surgery: carbohydrate drink, 2-4 200 mL Day of surgery: Clear fluids and clear carbohydrate drink, 2 x 200 mL until 2 hours preoperatively
Anaesthesia and Surgical technique	Both Experimental and Control groups: In operating room: intravenous midazolam (0.02-0.05mg/kg) before induction of general anaesthesia. Insertion of arterial cannulae. Induction of anaesthesia: included analgesia with fentanyl (3-5 mg/kg), hypnosis with propofol (1-2mg/kg), and muscle relaxation with atracurium (0.5to0.7mg/kg). Central catheter in the right internal jugular vein, trans-oesophageal echocardiography probe placed in the oesophagus of most patients. Anaesthesia maintained with 1-1.25 minimal anaesthetic concentration (1.15-1.5vol% of endtidalisoflurane) continued during bypass, or with a propofol infusion during bypass. Analgesia maintained with fentanyl or morphine boluses and /or remifentanil infusions.
Pain and Fluid Management	Morphine infusion stopped after extubation. Regular IV ondansetron for 48hr PO. After extubation: regular paracetamol and codeine with additional oral solution of morphine sulphate, if required. Monitoring included continuous arterial blood pressure, central venous pressure, leads and V5 of the electrocardiogram, and nasopharyngeal temperature. TEE monitoring included assessments of left/right ventricular filling and myocardial contractility. Volume and inotropes were given to optimize preload, afterload, and myocardial contractility
Early Mobilisation	Early PO mobilization (e.g. sitting regularly in chair from POD1 AM onwards
Other	Pre-op: Gabapentin, 600mg preoperatively. During treatment: Both Experimental and Control groups: Central catheter in the right internal jugular vein, and a TEE probe placed in the oesophagus of most patients. Monitoring included continuous arterial blood pressure, central venous pressure, leads I andV5 of the electro cardio-gram, and nasopharyngeal temperature. TEE monitoring included assessments of left/right ventricular filling and myocardial contractility. Volume and inotropes given. Cardio-protection: mild hypothermia of 32 degrees C and by intermittent cold blood St Thomas' cardioplegia, administered anterogradely after cross-clamping of the aorta, via aortic root into the coronary arteries. After cardio-pulmonary bypass discontinued: protamine administered to reverse the heparin PO: Lactulose 15mL(10g) twice daily, until opening of bowels
Black text=Experimental Group; Red text=Both experimental and control groups; C=Control, E=Experimental, IV=Intravenous, NSAIDs= Nonsteroidal Anti-Inflammatory Drugs, OD=Outpatient department, PCEA=Patient Controlled Epidural Analgesia, PO=Post-operatively, POD=Post-operative day; TEE=Trans-oesophageal echocardiography *core temperature 36 C, hemodynamic stability without need for catecholamine therapy, and exclusion of residual paralysis.	

Table 13. Description of Rehabilitation programmes for patients undergoing cardiac surgery

Study (First Author, Date)	Intervention Description	Control Description
Van der Peijl 2004[56]	Range of motion, muscle strengthening and coordination exercises, walking, and stair climbing. POD1: Active ROM and muscle strengthening exercises for upper and lower extremities bed in 60° angle. (for individual exercises; see paper) POD2:Active ROM and muscle strengthening exercises for upper and lower extremities transfer bed to chair. HF 2: transfer bed to chair, active ROM and muscle strengthening exercises while sitting in the chair. POD3: Walking in the room and a longer distance on the ward if tolerated. HF 2: walking on ward and active ROM and muscle strengthening exercises sitting in the chair. POD4: 20 min exercise group HF 2: walking on the ward POD5: 20 min exercise group, climbing stairs (20 steps) HF 2: 15 minutes exercise group POD 6 and following days until discharge: same as POD5 but with increased intensity Frequency: 2xday, including the weekend, starting the first day after surgery, regardless of the day of the week	Same exercise as Experimental group. Frequency: 1x day, not at weekend. Started on first weekday. Patient encouraged to repeat the exercises on their own.
HF 2=second exercise time for the high frequency group on the same day; ROM=Range of Motion		

Table 14. Description of Enhanced Recovery Programmes/Enhanced Recovery After Surgery for patients undergoing upper abdominal surgery

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
Pre-Admission	**Assessment, Education and Counselling**		Pre-op Counselling	Detailed explanation of perioperative course. Received checklist and information booklet about operation, PO rehabilitation, and daily mobilization and nutrition goals	Information about FT protocol provided	Introduction to ERP, Ward routines explained, postoperative pain control explained, advice regarding immediate PO diet and nutrition, planned thrombo-prophylaxis explained, referrals if required	Standard pre-op counselling Additional information re: ERP*[1]	
	Other			1x 125-ml of Fortisip 3xday for 3 days before surgery in addition to normal diet. 800 ml pre-op at 21.00 hours on evening before, and 400 ml at 06.00 hours on morning of surgery				
During Treatment	**Day of Admission**			Day of Surgery	Day before surgery			Day before surgery*[2]

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
	Nutrition and Carbohydrate loading	No solid diet from 2am. Nil by mouth from 6am. vs Nil by mouth from midnight	Minimal pre-op fasting and carbohydrate loading			Normal diet 24 hr before surgery. Day of surgery: no solid diet from 2am, Nil by mouth from 6am. Carbohydrate loading 5.30 and 6am vs Nil by mouth from midnight	Carbohydrate loading with 400 ml Nutricia at midnight before surgery and at 06:00 on the day of surgery	Normal diet day before surgery. Intake of 250 ml oral carbohydrate solution night before surgery and 2 h before anaesthesia vs No intake of food and drink after dinner on day before surgery. Clear fluid until 21:00
	Other	Phosphate enema vs no phosphate enema	All patients discussed at MDT meeting before surgery. No anxiolytic pre-medication	No bowel prep or pre-op pain relief	No pre-anaesthetic medication No bowel prep or pre-op pain relief	Thrombo-prophylaxis 6.00pm day prior to surgery and anti-embolic stockings fitted Phosphate enema 8.00pm day before surgery or 8am day of surgery vs no specific protocol. Decided by surgeon Each patient discussed at MDT before surgery	Stratified as low/high risk for PF on POD1*[3]	No bowel preparation or pre-medication for anaesthesia vs Oral laxative night before surgery. No pre-medication

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
During Treatment	**Anaesthesia and Analgesia**	No epidural (regional and local anaesthesia) vs Epidural pain control	Both groups: Standardised anaesthetic regimen with fentanyl and propofol used for induction, then atracurium or rocuronium dependent on clinician preference Depending on age and co-morbidities, plain levobupivacaine (0.125%) alone was used according to individual anaesthetist preference. Patients undergoing laparoscopic minor liver resections: bolus injection of diamorphine (300 lg) with bupivacaine (0.25%) into the spinal canal after induction of anaesthesia, rather than an epidural, according to individual anaesthetist preference	Both groups: Anaesthesia induced with 2–4 mg/kg propofol, 2–3 μg/kg fentanyl and 0·15–0·30 mg/kg cisatracurium Anaesthesia maintenance: sevoflurane in oxygen-enriched air, with I.V. remifentanil (0·05–0·10 μg per kg per min), phenylephrine (0·05–0·20 μg per kg per min to maintain mean arterial blood pressure above 55mmHg) and glyceryl trinitrate (1–5mg/h to maintain central venous pressure at 0–2 mmHg) 10 ml of 0·125 per cent levobupivacaine at start of the operation, followed by an infusion of 0·1 per cent levobupivacaine and 2 μg/ml fentanyl that was continued into the PO period				

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
	Surgical Technique	For both groups: Upper abdominal laparotomy, distal gastrectomy (no pylorus preservation) and standard lymphadenectomy. Reconstruction of gastrointestinal continuity: Rouxen-Y fashion with end-to-side duct-to-muscosa pancreatico-jejunostomy and end-to-side hepatico-jejunostomy on a retrocolic defunctined limb of jejunum, and side-to-side antecolic gastro-jejunostomy on the other limb, with a side-to-side jejuno-jejunastomy to complete the intestinal continuity	Both groups: Either a laparoscopic or open liver resection, according to surgeon's preference. Parenchymal transection performed using a combination of CUSA, and an ultrasonic dissector				Surgeon preference	All patients had open or laparoscopic gastrectomy performed by the same team of 5 surgeons

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
	Fluid Management and Drains	1-2 Abdominal drains vs 3 abdominal drains	Both groups: Low central venous pressure (0–5 cm water), anaesthetic-induced systemic hypotension and selective hepatic inflow occlusion Intra-abdominal drains inserted at the time of surgery at discretion of operating surgeon	Routine abdominal drains only placed if deemed necessary by operating surgeon No perioperative fluids administered until hepatic resection completed and haemostasis obtained Patients in both groups: 1000 ml compound sodium lactate for initial I.V. fluid resuscitation All patients: 500 ml 6 % hydroxyethyl starch			Peri-anastomotic drainage+ nasogastric drains	All patients received sterile lactated Ringer's solution at a rate of 10–12 ml/kg per hour throughout intraoperative period 1xdrainage tube in patients undergoing total gastrectomy or proximal gastrectomy No drain in other procedures

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
	Other	Both groups: prophylactic antibiotics at induction. Prevention of intra-operative hypothermia by routine monitoring of patient's temperature and use of air warming system and I.V. fluid warmers	Both groups: intermittent pneumatic calf comp-ression during surgery	Trachea intubated and lungs ventilated mechanically. Routine antibiotic prophylaxis Both groups: Normothermia achieved with forced-air warming blanket. Nausea and vomiting treated with 25mg Intra-muscular or I.V. cyclizine, or 4mg intravenous ondansetron. Intermittent pneumatic leg compression devices were applied to all patients			Nasojejunal feeding tube inserted	Both groups: Antibiotics: Before skin incision and every 3 h during surgery. 1x after surgery. Nasogastric tube removed in operating room after surgery
Post-Treatment	**Admission to Specialist Unit**		All patients transferred to a HDU for invasive arterial and central venous pressure monitoring, and then stepped down to acute surgical ward on/after POD1	All patients extubated and transferred to a level 2 HDU for further observation.				

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
	Drain/ Catheter removal	POD4 if amylase negative vs POD6-7 if amylase negative	Standardised early drain removal (if no evidence of bile leak) and early removal of urinary and epidural catheters vs Surgical drains removed at discretion of consultant surgeon, usually on or after POD4	Central venous and urinary catheters removed within 4 h of epidural being removed vs Urinary catheter removed 12 h after epidural in accordance with current guidelines Abdominal drains removed on POD 1 or 2	Nasogastric tube removal as early as possible after surgery, Removal of urinary drainage by POD1 vs no plan	POD1: Drain amylase sent at 6am. POD2: Drain amylase sent at 6am, drain removed if negative, discharge if drain required. Urinary catheter removed, Discharge if possible POD3/4: If drain amylase positive drain to remain, discharge with drain if required, Discharge if possible vs Urinary catheter removed when able to mobilize to toilet. Drain removed on POD5 if no evidence of a pancreatic leak	NG/NJ tubes removed on POD2 if nasogastric output \500 ml/day; perianastomotic drain removed on POD3 vs Remove NG/NJ tubes Drain removal: High risk POD6, Low risk POD3 vs Remove drain (if DFA5<300 U/l) POD6.	For both Experimental and Control groups: Removal of urinary catheters planned for POD1. Drainage catheters removed POD2*[4]

	Fluids, nutrition and/or mobilization	Nutrition: POD0: sips of water, POD1: 60-100 ml/h to include energy drinks; POD2: clear fluids, POD3: soup and jelly/soft diet. POD4: diet as tolerated vs Enteral (nasojejunal tube), 10 ml/h to 70 ml/h in 7 days with oral intake introduction as tolerated Mobilization: POD 1: 2h out of bed to increase daily vs as tolerated	Nutrition: All patients allowed free oral fluids and diet as tolerated Mobilization: encouraged to mobilize with PT Experimental group had defined daily mobilization targets	Nutrition: Oral intake encouraged and maintenance fluid stopped as soon as adequate intake achieved. All patients were allowed to eat and drink a normal diet Experimental group: oral supplements immediately on waking vs no plan for POD0, POD1: Oral intake after bowel mobilization. POD2-3: Continue as on first postoperative day. POD4-6: resumption of normal meals Mobilization: Physiotherapy twice a day vs once a day, until independently mobile. Encouraged to mobilize as soon as possible. POD0 Chest physiotherapy. POD1-4: Physiotherapy/ mobilization 2xday vs mobilized by bedside nurse or PT 1xday. Mobilisation on POD4-6	Nutrition: POD0: Oral fluids intake (0.5 L) 6 hr after operation. POD1: Patient starts hydric diet (tea–soup–gelatin). Normal diet by POD2-3 Mobilization: 4 hr after surgery, Progressive mobilization at least 8 times out of bed by POD1	Nutrition: POD1: Nasogastric tube clamped, start light diet including energy drinks and juices. POD2: Nasogastric tube removed. POD2: normal diet including energy drinks and juices vs Oral intake introduced as tolerated. Nasogastric tube removal when started normal food Mobilisation: POD1: Sit out of bed for 4h and walk up to 2x100ml. POD2 free mobilityPOD3: Sit out of bed for 6h total and walk up to 4x100m POD 4: Sit out of bed for 6h total and walk up to 4x100m. vs mobilization as tolerated, physiotherapy if required	Nutrition: low-risk patients (DFA1 <350 U/l): free oral fluids on POD1; diet on POD2, NJ feed POD1, Oral fluids POD1 pm, Diet POD2 am, Fortisips extra TDS (oral nutritional supplements 3xday) Remove NG/NJ: High risk POD0-5, Low risk: POD 2 vs NJ feed POD1-5, Sips water, I.V. fluids, Oral fluids/diet POD6(if DFA5<300 U/l) Mobilisation: Low and High risk: Chair POD1, Walk POD2 vs None	Nutrition: POD1: Water and 500 ml oral carbohydrate solution. POD2: liquid diet and 4 steps leading to regular food intake on POD 6 POD1: Total of 2000 ml of 4.3% glucose solution and vitamins. Peripheral parenteral nutrition continued until POD 4. Dose of solution tapered off to 1500, 1000, and 1000 ml on PODs 2, 3, and 4 respectively vs Parenteral nutrition until POD5. Water on POD 1 (< 100ml). POD3: liquid diet, 5 steps leading to regular food intake on POD 8. Total of 2000 ml of 4.3% glucose solution and vitamins every 24 h administered continuously until POD 2, Dose tapered off to 1500, 1000, and 1000 ml on PODs 3, 4, and 5 respectively Both Experimental and Control groups: Mobilisation: POD1: Independent walking encouraged. Patients 65 years or older saw PT to promote mobilization

	Pain Management		Both groups: Thoracic epidural infusion of levobupivacaine (0.125%) and fentanyl (2–4 lg/ml) in the majority of patients. PCA pumps delivering boluses of intravenous morphine used for a minority of patients who declined, or an epidural was either not possible or non-functioning. Oral codeine 30–60 mg QDS (instead of tramadol); vs regular oral Paracetamol 1 g QDS and Tramadol 50 mg TDS, and Oramorph 5–10 ml for breakthrough pain as required	Oral morphine prescribed for breakthrough analgesia as required Thoracic epidural (between levels T10 and T6) was placed in all patients for postoperative analgesia POD1: Oral paracetamol 1 g x 4 daily, (reduced in patients with extended right-sided resections) and tramadol hydrochloride (50–100mg 4xdaily) POD2: 3mg diamorphine via the epidural catheter before its removal by the bedside nurse. Avoidance of I.V. opioids and excess I.V. fluids Additional oral analgesics only if requested. Epidural catheter in managed by an acute pain team, removed on POD 3 or 4	From POD1: Paracetamol. Avoidance of opioid drug as much as possible vs POD0 and 1: opioid drug. POD 4-6: analgesic administration by mouth	POD0: PCA: paracetamol. POD2: PCA discontinued POD3and 4: Pain managed with oral analgesia vs PCA until oral analgesia	Epidural removed for both high/low risk groups and control group on POD4	Analgesics administered when patient reported pain. Epidural analgesia for 3 days after open surgery. No routine additional analgesics

	Other	POD3: I.V. maintenance fluid discontinued vs discontinued when patient tolerating food POD4: NG tube removal, unless output over 1L. vs removal when start normal food Metoclopramide/ Magnesium hydroxide from POD1 vs as needed Discharge planning from day of surgery vs when starts oral intake	Hypotension managed either by I.V. fluid boluses or a vasoconstrictor (noradrenaline). Intravenous fluids were discontinued when oral intake satisfactory All patients thromboprophylaxis using thromboembolic deterrent stockings, daily subcutaneous low-molecular-weight heparin injections. Regular sublingual prochlorperazine	Deep vein thromboembolism prophylaxis post op POD1: LiDCOrapid 250 ml colloid boluses. : POD2/3/4: Blinded assessment of discharge criteria Nausea and vomiting were treated initially with 25mg intramuscular or intravenous cyclizine, or 4mg intravenous ondansetron if this failed Fluid optimization: ~~by the admitting intensive care team, using~~ used- traditional markers of hypovolaemia eg.; ~~such as~~ pulse rate, central venous pressure, urine output, arterial lactate and mixed venous saturations from the central line. Maintenance fluids: ~~were then started at~~ 1–2 ml per kg/h, ~~per h and continued~~ until satisfactory oral intake POD0-1: Fluid therapy at discretion of intensive care team		POD0: I.V. maintenance fluids. POD1: I.V. maintenance fluids as directed by consultant. POD2: Discontinue I.V. maintenance fluids if tolerating oral intake. POD0: Start meto-clopramid I.V. 10mgx3 vs metaclopramide as needed POD1: Commence pancreatic enzymes if indicated Refer to dietician. Plan to discharge from POD0. Vs Discharge planning when oral intake tolerated. Regular medications: octreotide 100mcg x3 until day 2, proton-pump inhibitor 40mg x 1, metoclopramide 10mg x3	Prophylactic s.c. octreotide: Low risk - POD 0-1, High risk - POD 0-5. Vs POD0-5	Additional analgesics administered when patient reported pain. Epidural analgesia for 3 days after open surgery Acetaminophen 2xday orally until POD 5 Each patient: Received nutritional guidance to explain post-gastrectomy syndrome before hospital discharge Routine pharmacological thrombo-prophylaxis not administered unless preoperative venous ultrasonography had shown DVT

Stage of Care	Component of Care	Abu Hilal 2013[57]	Dasari 2015[58]	Jones 2013[59]	Kapritsou 2017[60]	Richardson 2015[61]	Sutcliffe 2015[62]	Tanaka 2017[63]
Post-Treatment	**Post-Discharge Support**					Enhanced recovery specialist nurse: contacted patients after discharge to ask for any problems with general health, pain control and assess return to normal diet and normal bowel function. POD 5/6: Outpatient clinic appointment for patients discharged before POD5 with drains in-situ. Clinical assessment and drain amylase measurement taken. Drain removed if no leak or retracted seriallyin case of pancreatic leak during clinic attendances		

Black text=Experimental Group; Blue text=Comparator group; Red text=Both Experimental and Comparator groups; CUSA=?; DFA5=?; ERP=Enhanced Recovery Pathway; FT=Fast-track; HDU=High Dependency Unit; IV=Intravenous; MDT=Multi-Disciplinary Team; NG=Nasogastric; NJ; Nasojejunal; PCA=Patient Controlled Analgesia; PO=Post-Operative; POD=Post-Operative Day; QDS= quater die sumendus (4xday)

Table 15. Description of Prehabilitation programme for patients undergoing upper abdominal surgery

Study	Name of Intervention	Description of Intervention
Dunne 2016[64]	**Prehabilitation Exercise Programme**	12 interval exercise sessions over 4 weeks. 2xrecovery exercise sessions included at the end of the first and fourth weeks (sessions 3 and 12). Included a warm-up and warm-down, and 30min of interval training alternating between exercise of moderate and vigorous (intensity. Sessions delivered using a cycle ergometer. Exercise programme tailored to patients based on the work rate at their anaerobic threshold on baseline CPET. No restrictions placed on candidates in either arm of the study, who were encouraged to follow clinical advice on exercise before surgery vs no restrictions were placed on candidates in either arm of the study, and they were encouraged to follow clinical advice on exercise before surgery.
Black text=Experimental Group; Blue text=Comparator Group; CPET= cardiopulmonary exercise testing; VO2=Oxygen uptake		

Table 16. Description of Enhanced Recovery Programmes for patients undergoing pelvic surgery

		Study (First Author, Date)			
Stage of Care	**Care Component**	**Arumainayagam 2008[65]**	**Gralla 2007[66]; Magheli 2011[67]*2**	**Jensen 2015[68]**	**Mukhtar 2013[69]*2**
Pre-Admission	**Assessment and Education**			Information: goals for patient involvement concerning: mobilization, exercise training and managing urinary diversion. Vs education on alcohol, smoking and PO care Information on interactions among lifestyle, nutritional status, physical activity, alcohol, smoking, and postoperative care. Written information provided. Discussion of mutual expectations and motivation All patients: Optimizing comorbid conditions	Patients informed actively of the ERP when seen in clinic and again at preoperative assessment Preoperative education*
	Other			All patients: Nutritional screening and counselling; oral supplements when recommended. Counselling on choice of urinary diversion	

		Study (First Author, Date)			
Stage of Care	**Care Component**	**Arumainayagam 2008[65]**	**Gralla 2007[66]; Magheli 2011[67]*2**	**Jensen 2015[68]**	**Mukhtar 2013[69]*2**
				Physiotherapy: 2 weeks before surgery. PT introduced home-based daily exercise programme: Exercises included 2xdaily step trainer 15 min and 6 different muscle strength and endurance exercises. Number of repetitions individualized and increased over time. Step-trainer provided. Activities 2xday achievements documented in personal diary T/C after 1 week to ensure adherence to programme. For questions patients could contact the MDT	
Pre-Treatment	**Day of Admission**	Day before surgery vs 2 days before	Both Experimental and Control groups: Day before surgery		Day of surgery*1
	Nutrition and Carbohydrate Loading	Day before surgery: Normal breakfast, Refer to dietician. Day of surgery: Start food chart. Unrestricted clear fluids up to 4hr before surgery, then nil by mouth	Oral nutrition management: Breakfast, lunch, soup for dinner. Drinking until 24:00 vs cease food intake breakfast, no further oral nutrition	All patients: Fasting from midnight. Carbohydrate loading 4 h before	Nursing staff gave patients preoperative energy drinks to be taken 2 hours before surgery
	Bowel Preparation	None vs 2xsachets of bowel-cleansing solution e.g. sodium picosulphate	2x enema at night before surgery vs received colonic irrigation: 3,000 ml Klean prep		
	Other	Day before surgery: Stoma therapist sees patient. Assess social circumstances and refer if needed	All patients: Preoperative diagnostics. Advised discharge POD3 vs POD6-8 All patients: Cefuroxime/ metronidazol, 12 mmHg pneumoperitoneum	All patients: Evening before surgery: rectal ampulla emptied Infection prophylaxis (single doses)	
During Treatment	**Anaesthesia and Analgesia**	Epidural analgesia in-situ	Adapted opioid-free analgetic treatment that incorporated high-dose COX-2 inhibitors PO	All patients: Standardised anaesthesia and analgesia throughout surgery using Sevofluran (sedative) and Bupivacaine and Ultiva for pain management	At discretion of the anaesthetist.

		Study (First Author, Date)			
Stage of Care	**Care Component**	**Arumainayagam 2008[65]**	**Gralla 2007[66]; Magheli 2011[67]*2**	**Jensen 2015[68]**	**Mukhtar 2013[69]*2**
			A balanced anaesthesia with desXurane (3–5 vol%, minimal Xow) and remifentanil (0.1–0.5 g/kg/min) was used. DesXurane administration guided by EEG (spectral entropy, Datex entropy module) vs total intravenous anaesthesia with propofol (4-) 6–8 mg/kg/h and remifentanil 0.1–0.5 g/kg/min		
	Fluid Management		Restrictive infusion therapy performed during ablative phase of the operation		At discretion of the anaesthetist
	Drain/ Catheters/ Tubes		Both Experimental and Control groups: Tubes or drains inserted only if PO bleeding considered likely by the operating surgeon	Infection prophylaxis (single doses)	At discretion of the anaesthetist. At time of placement, morphine and bupivacaine used. Nasogastric tubes and unnecessary drains avoided
	Other		Surgical procedure for all patients: LRPE was performed in a descending manner. To minimize intraoperative bleeding, surgery usually performed in a moderate to enhanced anti-Trendelenburg positioning to decrease the blood pressure in the lower pelvic region Dexamethasone (4 mg I.V.) applied routinely to prevent postoperative nausea and vomiting All patients: 15 mmHG Cefuroxim/metronidazole as a single-shot antibiotic. Piritramid, metamizol, parecoxib, 200 mg erythromycin Operated with an intraabdominal pressure of 12 mmHg. Insufflate dated gas pre-heated to 37°C with warming	Mini-laparotomy or robot-assisted radical cystectomy	Intraoperatively, care taken to avoid large incisions

		Study (First Author, Date)			
Stage of Care	**Care Component**	**Arumainayagam 2008[65]**	**Gralla 2007[66]; Magheli 2011[67]*[2]**	**Jensen 2015[68]**	**Mukhtar 2013[69]*[2]**
			device vs 15 mmHg, the insulated gas had a temperature of about 18°C Piritramid, metamizol, PCA-device End of procedure: received a scrotal jockstrap		
Post-Treatment	**Drain, Catheter and/or Tube Removal**	Post op day 1: Remove drain if draining < 50 mL in 24 h	Removal of catheter before discharge	All patients: Early removal of intravenous and urinary catheters	
	Pain Management	POD 3: Remove epidural	All patients: Piritramid at end of the operation, and 2 g Metamizol I.V. Experimental group: Parecoxib 40 mg I.V. in the PACU for immediate pain relief. COXII-inhibitors PO as analgesic treatment and oral Metamizol. Piritramid as rescue medication vs Piritramid bolus doses and PCA device with piritramid for PO pain treatment POD0: PCA, metamizol During the first 4 weeks of the study, 50 mg rofecoxib was administered PO. daily. This was changed to 120 mg etoricoxib PO once daily High-dose COX-2 inhibitors PO	All patients: Analgesia within the first 72 h: continuous infusion of bupivacaine. Peripheral pain treatment: oral paracetamol	Bupivacaine used alone
	Mobilisation	POD 1: Mobilise and refer to PT. POD2: Mobilise and self-care encouraged (catheter care/flushing and stoma bag emptying), POD3 and 4: Mobilisation and self-care	Encouraged to ambulate as soon and as much as possible. Walking with members of the medical, nursing and physio staff whenever communicating. Leaflet with ambulation rates to be achieved PO. POD0: walking in patient's room and ward. POD1: out of bed for minimum 8 h, POD2: In bed just for sleeping vs POD0: upright position, POD 2: Mobilization in patients room, POD2-4: Mobilization on the ward; POD5:	POD0-7. Mobilization and instructions for getting out of bed. PT supervised exercise programme 2xdaily, 30min. Goal orientated and recorded in diaries Mobilization plans, included: Scheduled time out of bed, increasing from 3 h on POD1 to 8 h on POD4. Walking distance: increasing from 125 m on POD1 to 1000 m on POD4. POD 1-7: Physical therapy 2xday, including: respiratory and	

		Study (First Author, Date)			
Stage of Care	**Care Component**	**Arumainayagam 2008[65]**	**Gralla 2007[66]; Magheli 2011[67]*2**	**Jensen 2015[68]**	**Mukhtar 2013[69]*2**
			mobilization on the ward for anastomosis tightness	circulator exercises, supervised standardised progressive muscle strength and endurance training, evaluation. Vs walking activity in every ward shift and supervised by a PT 1xday. PO mobilization encouraged in every ward shift as a standard procedure	
Post-Treatment	**Nutrition and Fluids**	POD0 and 1: Restart clear fluids as tolerated. POD2, 3, 4: Light diet as tolerated, POD5: Dietician to assess nutritional needs. If patient not eating or drinking after 5–6 days but with bowel activity, nasogastric feeding started. If no bowel activity: total parenteral nutrition started	2 h PO tea/water; 4 h PO: yoghurt. POD1: "light" hospital diet, POD2: Normal nutrition vs POD1: No oral nutrition, 600 ml tea/water in 24 h; POD2: 500 ml I.V. volume; tea/water; POD3: No I.V. volume; tea/soup; POD4 No I.V. volume; "light" hospital diet; POD5 No I.V. volume; normal nutrition	All patients: Early oral intake: daily goals: minimum 6300 kJ, protein 1.2 g/kg including oral supplements	
	Other	POD1: Female patients remove vaginal pack, Ranitidine 3x daily I.V. or 2xdaily orally, Metoclopramide regularly, Flush 20 mL into neobladder, 2-hourly for 12 h and then 4-hourly POD3 and 4: Start planning for discharge POD8: Stents out (no stentogram); patient to stay at least 24 h after stent removal POD10: remove clips. POD11–14: Continue and schedule for return to home	POD0:1 500 ml I.V. volume. POD 1+2: No I.V. volume vs POD0: 2,500 ml I.V. volume. POD1: 2,000 ml I.V. volume, POD3: No I.V. volume To stimulate bowel function: 200 mg erythromycin I.V. in PACU, second dose on the ward if needed POD0:200 mg Erythromycin; 40 mg Parecoxib. POD 1: 120 mg Etoricoxib. POD2: 120 mg Etoricoxib POD3: Debriefing, discharge Debriefing and discharged 1 day after MCU (POD6)	Both groups: Prevention of nausea. Thromboembolism prophylaxis: compression stockings and Fragmin injections Discharged with a home training exercise programme	
Post Discharge	**Follow-up Support**		POD5: Ambulatory MCU for anastomosis tightness POD 1-7: Outpatients department for MCU and leakage test		Within first week after discharge: routine telephone. Medical and nursing staff available in case of PO concerns.

		Study (First Author, Date)			
Stage of Care	**Care Component**	**Arumainayagam 2008[65]**	**Gralla 2007[66]; Magheli 2011[67]*[2]**	**Jensen 2015[68]**	**Mukhtar 2013[69]*[2]**
	Other				CNS trained to remove ureteric stents and deliver practical stoma education

Black text=Experimental Group; Blue text=Comparator Group; Red text=Both Experimental and Comparator groups; *Not described,*[1]Assumed, *[2]Control group not described
CNS=Community Nursing Staff; ERP=Enhanced Recovery Pathway; I.V.=Intravenous; LRPE=Laparoscopic Radical Prostatectomy; MCU=Medical Care Unit; MDT=Multi-Disciplinary Team; PACU=Post-Operative Care Unit; PCA=Patient Controlled Anaesthesia; PO=Post-Operatively; POD=Post-Operative Day; PT=Physiotherapist; T/C=Telephone call

Table 27. Description of Enhanced Recovery Pathway for patients undergoing vascular surgery

Stage of Care	Care Component	Study (First Author, Date): Muehling 2008[70];2009[71];2011[72]
Pre-Admission	**Assessment and Education**	All patients: Patients seen in outpatient department, where need for aneurysm repair confirmed. Cardiovascular risk assessment performed by anaesthesiologists. Preoperative patient education provided
Pre-Treatment	**Day of admission**	All patients: Admitted 1-2 days before surgery
	Fasting	Preoperative fasting limited to 2h preoperatively vs 6h
	Bowel Prep	None vs Washout
	Pain Management	Preoperatively inserted thoracic epidural catheter which was placed in the intervertebral spaces at the level between T5 and T9/T7-T10 with the loss-of-resistance technique. Patients received 10 ml of Ropivacaine 1%. All patients: oral benzodiazepine premedication with Clorazepate dipotassium (20 mg) in the evening and midazolam (7.5 mg) 1 hr before induction of anaesthesia
During Treatment	**Other**	All patients: Regular medication (in particular b-blockers) was continued peri-operatively
	Surgical Technique	Both Experimental and Control groups: Both the trans-peritoneal and the retro-peritoneal approach used for open aneurysm repair. Trans-peritoneal approach via a midline incision is preferred in patients with concomitant iliac aneurysms.
	Fluid Management	Both groups: Intraoperative fluid administration (crystalloids, colloids) adjusted to blood loss and cardiovascular parameters without preassigned restriction
	Other	All patients: 20 min before procedure began: single I.V. injection of antibiotic therapy with cefuroxime (1.5 g). Insertion of bladder catheter and nasogastric tube after induction of general anaesthesia. Heat loss prevented by warm I.V. fluids and external heating using air heaters in preparation room and on operative table Temperature of OR 22 degrees. Gastric tube removal at end of operation. All patients extubated immediately after operation if: core temperature 36 C, hemodynamic stability without need for catecholamine therapy, and exclusion of residual paralysis
Post-Operative	**Specialist Unit**	All patients: Routinely transferred to ICU and observed for one night and transferred to the surgical floor on POD
	Catheter and Tube Removal	Catheter removed when mobilized, usually POD1–2 days. Removal of gastric tube at end of operation vs when secretion is less than 300 ml/24 h
	Pain Management	PO PCEA Ropivacaine 0.2% and Sufentanil (2 mg/ml) accompanied by NSAIDs vs opioids (Piritramide) via PCEA, NSAIDs (Diclophenac 75 mg twice daily + Metamizole 1 g, IV 4Xdaily)
	Nutrition and Mobilisation	POD0: Enteral feeding and ambulation vs Enteral feeding from POD2 following start of bowel movements. POD1: Ambulation
	Other	I.V. fluids restricted to 1000 ml/24 h vs 3000 ml/24 h

Black text=Intervention Group; Blue text= Control group; Red text=Both Experimental and Control Groups; h=hour; ICU=Intensive Care Unit; IV=Intravenous; NSAIDs= Nonsteroidal Anti-Inflammatory Drugs; OR=Operating Room; PCEA=Patient Controlled Analgesia; PO=Post-Operative; POD=Post-Operative Day

Table 38. Description of a Pre-Operative Assessment interventions for patients undergoing vascular surgery

Stage of care	Component of care	Study (First Author, Date): Partridge 2017[73]
Pre-treatment	**Assessment**	CGA and optimization in outpatient clinic based on agreed protocols based on evidence, national and hospital guidelines, and expert opinion. Conducted by a MDT (geriatrician, clinical nurse specialist, SW, OT) based on patient need. Referrals to other specialities e.g. physiotherapy, O.T. when needed. Assessment documented in electronic individualized care plan available to all healthcare professionals. Care plan provided information on: prevention and management of anticipated PO complications vs Preoperative assessment clinic led by nurses. Assessment of anaesthetic, medical issues and identifying if patient fit for anaesthesia/surgery. Patient fitness not optimised. Any issues identified that might affect surgery meant a more detailed specialist medical or anaesthetic evaluation was requested, or referral of patients back to their general practitioner
	Other	Medications changed before surgery, Level 2/3 care advised where necessary. Onward referral to other specialty for long-term (non-preoperative) management suggested if needed and advice to ward teams provided
Post-treatment		, PO care delivered by surgical teams unaware of patient's involvement in the study. Routine care: junior surgical staff and clinical nurse specialists using all electronic clinical documents available to them. Protocols used to provide care for patients with: cognition difficulties, anaemia, cardiac issues, frailty, aneurysm repairs
Post-Discharge		Longer-term GP follow-up recommended

Black text=Experimental Group; Blue text=Comparator group; Red text=Both Experimental and Comparator groups; CGA= Comprehensive Geriatric Assessment; GP=General Practitioner; MDT=Multi-Disciplinary Team; OT=Occupational Therapist; PO=Post-Operative; SW=Social Worker

Table 49. Description of Enhanced Recovery Programmes/Enhanced Recovery After Surgery for patients undergoing thoracic surgery

		Study (First Author, Date)			
Stage of Care	**Component of Care**	**Brunelli 2017[74]**	**Gatenby 2015[75]**	**Karran 2016[76]**	**Muehling 2008[77]**
Pre-Admission	**Assessment and Education**	Health and risk assessment: 20-25–min at time of booking for surgery. 2h patient information program: emphasis on self-help. ERP education session: Active role of the patient explained. Written information package and patient diary. Begin incentive spirometry before surgery; continue into postoperative period vs education session without ERP focus or theme of active patient involvement	Assessment: cancer surgery options/suitability for radical surgery Seen by: critical care physician, dietitian, physiotherapist. Aim to maximise nutritional status, address specific eating difficulties and optimise cardiopulmonary fitness. Potential impact of co-morbidities on surgery assessed; including specialist cardiac/respiratory review and cardiopulmonary exercise testing vs Surgeons/clinical nurse specialists referred patients for assessment by surgeons and clinical nurse specialists to other members of the multidisciplinary team as needed	All pathways: Dietitian and Clinical nurse specialist led pre-assessment clinic; Cardiopulmonary exercise test, Post-op level of care requirement predicted (usually HDU). Patient education	Preoperative patient education
	Other		Clinical nurse specialist: support and counselling. 750ml of immune-nutrition to be consumed daily for 5 days before surgery vs none 3x daily drinks of 250ml Oral IMPACT (enteral feeding tube if patient unable to swallow)	Nutritional assessment/consideration for pre-operative nutritional support	
Pre-Treatment	**Day of admission**	Same day as admission for some patients			
	Fasting and Carbohydrate loading	6x 200 mL bottles preoperative Nutricia drinks and instruction leaflet: 4 to be drunk 6 PM-12 midnight evening before surgery + 2 before 6:30 AM morning of surgery. No prolonged fasting: Clear fluids when possible	Day of surgery: 50g of glucose 2 hrs preoperatively		Preoperative fasting limited to 2h vs 6h
	Other	45min before surgery: Start preoperative warming. Patient educated regarding benefits. Warming continued in pre-wait and anaesthetic room. Warming gown used as blanket and converted to Bair Hugger	Antiemetic given as premedication	Pathway booklets created for a multidisciplinary patient record, centralising all documentation. No premedication.	Pain control: preoperatively inserted thoracic epidural catheter, between T5 and T9. 10 ml of ropivacaine 1% preoperatively vs intercostal nerve blockade

		Study (First Author, Date)			
Stage of Care	**Component of Care**	**Brunelli 2017[74]**	**Gatenby 2015[75]**	**Karran 2016[76]**	**Muehling 2008[77]**
		Motivational talks by ERP nurse daily both before and after operation.			intraoperatively using 5 ml of ropivacaine 0.75%
During Treatment	**Anaesthesia and Analgesia**	Short-acting aesthetic agents. Use of nerve or paravertebral blocks as part of multimodal analgesia	General anaesthesia vs discretion of anaesthetist (majority: thoracic epidural)	All patients: Thoracic epidural followed by a general anaesthetic. An arterial and central venous line used in all patients	
	Surgical technique		Open approach consisting of subtotal or total gastrectomy (with D2 lymphadenectomy) for gastric cancer or Ivor–Lewis oesophagogastrectomy with radical two-field lymphadenectomy for lower third oesophageal and oesophagogastric junctional cancer	Gastric cancer: subtotal gastrectomy and total gastrectomy, all with extended D2 lymphadenectomy. Oesophageal cancer: most underwent standard subtotal oesophagectomy. Adenocarcinoma of the lower third of the oesophagus with significant cardiorespiratory co-morbidity, T1/2 N0 or T3 N0 disease: Transhiatal resection used selectively. All procedures performed using an open approach.	All procedures used antero-lateral thoracotomy. Wedge resection: 6, Lobectomy: 18, Bilobectomy: 2, Pneumonectomy: 3, Sleeve resection: 1 vs antero-lateral thoracotomy. Wedge resection: 5, Lobectomy, 19, Bilobectomy, 1, Pneumnectomy: 1, Sleeve resection: 2
	Fluid Management	Avoidance of fluid overload	Goal directed. Measurement of cardiac output. Aimed for neutral fluid balance.	Goal directed fluid therapy monitored using lithium dilution cardiac output rapid.	
	Other	Antibiotic prophylaxis at anaesthetic induction and 2 doses postoperatively)	Thoracic epidural, arterial line and central venous cannula. Used lung protective ventilation strategies. Feeding jejunostomy routinely used in patients undergoing oesophagogastrectomy and total gastrectomy	Insertion of feeding jejunostomy. Surgical resection: Surgery in patients with gastric cancer included subtotal gastrectomy and total gastrectomy, all with extended D2 lymphadenectomy. Most oesophageal cancer patients received standard subtotal oesophagectomy. Patients with adenocarcinoma of the lower third of the oesophagus and significant cardio respiratory co-morbidity, T1/2 N0 or T3 N0 disease selectively received trans-hiatal resection. All procedures performed using an open approach*	Intraoperative normothermia: Operating theatre temperature 24 degrees C, warm I.V. fluids, air heater

		Study (First Author, Date)			
Stage of Care	**Component of Care**	**Brunelli 2017[74]**	**Gatenby 2015[75]**	**Karran 2016[76]**	**Muehling 2008[77]**
Post-Treatment	**Specialist ward**	Extubated in operating room and transferred for monitoring to level 2 care unit. POD1 AM: stepped down to a dedicated thoracic surgery ward unless clinically contraindicated	Patients extubated and admitted initially to the CCU (level 3 facility) vs CCU for immediate PO care. No formalised pathway for postoperative course	POD0: Oesophagectomy pathway: Level 2-3 care, Total Gastrectomy: Level 1-2 care, Subtotal Gastrectomy: Level 1 care	
	Drain and Catheter removal	For both Experimental and Control groups: 1 chest drain connected to a digital chest drainage system. Chest drains removed when the drain output <400 mL in 24hr and air flow is less than 20 mL/minute > 6 hrs without air leak	Protocol specified timings re: removal of chest and wound drains but modified according to patient clinical progress. POD 2: Chest drain (oesophagogastrectomy only). Remove apical chest drain after review by surgical team and intensivists. POD4: Remove urinary catheter if haemodynamically stable POD 4: Remove abdominal drain if drained <100ml in 24h POD 5: Monitoring/maintenance of equipment in situ, Remove remaining chest drain(s) (oesophagogastrectomy), Remove central venous catheter	Oesophagectomy pathway: POD2: Remove apical chest/abdominal drains. POD5: Removal of epidural (dependent on APTT), urinary catheter and basal chest drain Total Gastrectomy: POD2: Removal of drains	
	Nutrition and Fluid Management	POD1: IVI down after ward round Nutrition: Early postoperative oral intake including regular nutritional supplement drinks. Supplements given 3xday (if not diabetic)	POD 2: If receiving inotropes, use of jejunostomy tube could be delayed. Flush with 30ml sterile water. 25ml of sterile water hourly via jejunostomy tube. Dietitian informed if patient unable to tolerate. (Standard care plan for newly sited jejunostomy tube.). If abdominal distension, bloating or abdominal pain: stop feed and contact team. Day 0: Oesophagogastrectomy/total gastrectomy: Nil by mouth/jejunostomy tube POD 1: Nil by mouth/jejunostomy tube. POD2: All patients oral water and Jejunostomy feeding. POD 3: Oral intake: If tolerated, increase fluids. NGT to be spigotted as tolerated if <150ml in last 6h.	Oesophagectomy pathway: POD0: Commence sterile water at 10ml/hr via jejunostomy, POD1: Commence polymeric enteral feed; 40ml/hr. POD2: Achieve 80ml/hr enteral feed and reduce IVI, POD3: Reduce IVI, Target Enteral feeding regimen established, POD4: Reduce IVI, Continue enteral feeding. POD5: Gastrograffin swallow and oral fluid, continued enteral feeding, POD6: Soft diet as tolerated, overnight enteral feeding regimen. POD7: Dietetic assessment, education on post-operative diet, wean off enteral feeding. Feeding jejunostomy to remain in situ until outpatient follow up in feeding (2 weeks)	1000ml/24hr for both Experimental and Control groups. Enteral feeding started on the POD0 vs POD1

		Study (First Author, Date)			
Stage of Care	**Component of Care**	**Brunelli 2017[74]**	**Gatenby 2015[75]**	**Karran 2016[76]**	**Muehling 2008[77]**
			Continue jejunostomy feeding (oesophagogastrectomy and total gastrectomy) as per standard jejunostomy care plan. If abdominal distension, bloating or abdominal pain: see POD2 instructions. POD4: Free fluids. NGT to be spigotted as tolerated, Continue jejunostomy feeding POD 5: Light diet if tolerated. Keep food record chart. Continue jejunostomy feeding POD 6-10: Oral intake encouraged recorded on food chart. Feed reviewed by dietician who may consider overnight feeding. Teach patient how to administer jejunostomy feed.	Total Gastrectomy: POD0: Sterile water via feeding jejunostomy, POD1: Polymeric enteral feed 40ml/hr, POD2: 80ml enteral feed and reduce IVI POD3: Reduce IVI, POD4: Continue enteral feeding, POD5: Gastrografin swallow, removal of nasogastric tube, start oral fluids and continue enteral feeding, POD6: Soft diet as tolerated, POD7: Assessment by a dietician and education on post-operative diet. Slowly reduce enteral feeding. Keep feeding jejunostomy in place until outpatient follow up in 2 weeks Subtotal Gastrectomy: POD1: Commence oral fluids, POD2: Free oral fluids as tolerated. Removal of nasogastric tube. Oral nutritional supplements 2xday. Soft oral diet as tolerated. POD3: Soft diet as tolerated	
	Pain Management	Multimodal analgesia. combination of systemic (intravenous) opioid via a patient-controlled analgesia and paravertebral analgesia 0.5%bupivacaine bolus followed by 0.25%bupivacaine infusion). Minimal use of systemic opioids: POD1: Stop PCA POD1 and 2: OxyContin PR 10 mg BID POD2: Paravertebral removal, POD3 onwards: Dihydrocodeine vs Multimodal analgesia: variable I.V. opioid (via PCA) and paravertebral analgesia (0.5% Bupivacaine bolus followed by 0.25% Bupivacaine infusion).	Day 0: Epidural or patient controlled anaesthesia (PCA), POD3: Remove epidural or PCA. Make sure analgesia can be administered via alternative route. (Only consider via jejunostomy if patient is absorbing. Medication to be given in liquid form and flushed.) Remove epidural as per standard policy	POD4: Stop epidural, POD5: Remove epidural (APTT dependent) Total and subtotal gastrectomy: POD4: Stop epidural	Ropivacaine 0.2% and Sufentanil (2 mg/ml) postoperatively in a patient controlled manner (PCEA) accompanied by NSAIDs vs I.V. PCA opioids (Piritramide), NSAIDs (Diclophenac 75 mg 2x day, Metamizole 1g I.V. 4xday

		Study (First Author, Date)			
Stage of Care	**Component of Care**	**Brunelli 2017[74]**	**Gatenby 2015[75]**	**Karran 2016[76]**	**Muehling 2008[77]**
	Mobilisation	Mobilisation: All patients mobilized as early as possible, most frequently on POD1. PO chest PT and physical rehabilitation. Motivation to eat and drink.	POD1: Sit out of bed 1h am and pm (total 2h) > Pedals: two 10-minute periods > Incentive spirometer: 3 sets of 5 breaths each hour > Basic personal care tasks while sitting out of bed POD 2: Sit out of bed for 2h am and pm (total 4h) > Mobilise 30m am and pm (total 60m) > Pedals: 4x10-minute periods > Incentive spirometer: 3 sets of 5 breaths each hour > Basic personal care tasks while sitting out of bed POD 3: Sit out of bed for 3h am and pm (total 6h) > Mobilise 60m am and pm (total 120m) > Pedals: 4x10-minute periods > Incentive spirometer: 3x5 breaths each hour > Personal care tasks, increasing involvement as tolerated POD 4: > Sit out of bed for 3h am and pm (total 6h) > Mobilise 100m am and pm (total 200m) > Pedals: four 10-minute periods > Incentive spirometer: 3 sets of 5 breaths each hour > Personal care tasks, increasing involvement as tolerated POD 5: > Sit out of bed for 3h am and pm (total 6h) > Mobilise 100m 4x daily (total 400m)	Oesophagectomy: POD1: Sit out x2, Walk x1, POD2: Sit outx2, Walk x2, POD3: Sit out x4, Walk x3, POD4: Sit out x4, Walk x 3, POD 5: Sit out 6hr, Walk x3 Total Gastrectomy: POD 1: Sit out x2, Walk x2, POD2: Sit out x4, Walk x3, POD3-5: Sit out 6hr, Walk x3. Subtotal Gastrectomy: POD 1: Sit out x4, Walk x3, POD3-4: Sit out 6hr, Walk x3.	POD 0: Start mobilisation vs POD1

		Study (First Author, Date)			
Stage of Care	**Component of Care**	**Brunelli 2017[74]**	**Gatenby 2015[75]**	**Karran 2016[76]**	**Muehling 2008[77]**
			> Pedals: 4x10-minute periods > Incentive spirometer: 3x5 breaths each hour > Personal care tasks, increasing involvement as tolerated POD 6-10: > Sit out of bed for 3h am and pm (total 6h) > Mobilise 100m 4xdaily (total 400m) > Pedals: 4x10-minute periods > Incentive spirometer: 3 sets of 5 breaths three times a day > Engage in personal care tasks, increasing involvement as tolerated		
	Other	PO information at discharge. Motivational talks by ERP nurse preoperatively and on each PO inpatient day. Prevention of nausea and vomiting by antiemetic drugs	Patients reviewed daily to decide whether could proceed to the next stage of the pathway. POD0: Nasogastric tube– free drainage and 4-hourly aspirates. POD 1: Surgical procedure explained by surgeons. Benefits of enhanced recovery programme explained to patient and family. POD10: Remove clips if wound clean and dry	All pathways: Discharge when POMS=0	
Post Discharge	**Post-Discharge Support**	Telephone follow-up performed 3 and 7 days postoperatively.	On Discharge: Hospital team liaised with community dietetics team regarding jejunostomy. Dietary support. Education on: exercise, driving, sexual activity and return to work. Follow-up appointment at 2 weeks. Nutritional supplements if needed. Thromboprophylactic heparin continued for 6 weeks		

Black text=Experimental Group; Blue text=Comparator Group; Red text=Both Experimental and Comparator groups; *Timing not specified, *[1]Unclear if details reported in article are relevant to the control condition; APTT=Activated Partial Thromboplastin Time; CCU=Critical Care Unit; ERP=Enhanced Recovery Programme; h=hours; I.V.=Intravenous; NGT=Nasogastric Tube; OR=Operating room; PCA=Patient Controlled Analgesia; PO=Postoperative; POD=Post-Operative Day; PT=Physiotherapist

Table 20. Description of a Pre-operative Assessment for patients undergoing tumour removal

Study (First Author, Date) Hempenius 2013[78];2016[79]		
Name of Intervention (From Study)	**Category of Intervention**	**Description of Intervention**
Liaison Intervention in Frail Elderly	**Pre-operative assessment**	Admission: Day before surgery. Geriatric nurse assesses daily, using nine-item checklist: orientation, mobility, anxiety, senses, pain, sleep, intake, defecation and infection. Treatment team contacted if any problems to develop a treatment plan. Implementation of this plan checked daily. The Delirium Observation Scale used to screen patients for delirium 3 x day until POD10 by nurses. Geriatrician or psychiatrist confirm diagnosis Vs Additional geriatric care provided if requested by treating physician
Black text=Experimental group; Blue text=Comparator group; POD=Post-Operative Day		

Table 215. Details of Pre-Operative Assessment and Care Plan intervention for patients undergoing various different types of surgery

Stage of care	Component of care	Study (First Author, Date): Ellis 2012[80]
Pre-treatment	**Assessment**	All patients reviewed in nurse-led preoperative assessment service Experimental group: additional focused comprehensive review process for high-risk elderly. Led by nurse with background experience in care of frailer older people in hospital (1.0 WTE), and an Occupational Therapist (0.1 WTE) Protocols for assessment and referral and management of common conditions. Referral pathways created to deal with issues identified during screening. Appropriate onward referrals acted on. vs Existing pathways for onward referral to anaesthetics re: any concerns fitness for surgery exists, and PrO service operated in line with best available guidance Older peoples pre-assessment nurse performed reviews on all patients using standard assessment tools e.g. Barthel to assess activities of daily living or mini mental state examination (MMSE) to assess cognition in addition to basic investigations vs Older people's nurse collected routine data on consecutive patients who met the criteria but did not intervene in patient care. Recommendations for onward referral recorded but not acted on. Routine PO multidisciplinary care during this period. Existing systems for onward referral to anaesthetics when concerns regarding a patient's fitness for surgery exists. Preoperative service operated in line with best available guidance
Post-treatment	**Other**	Based on outcomes from assessment, remedial activities taking place/discharge planning Postoperatively the service: Existing proactive screening and multidisciplinary discussion regarding patients 65-year-old or over with review and rehabilitation when needed. Pre-assessment patients discussed with this multidisciplinary team where a specific need was identified relating to their rehabilitation needs or discharge planning. Referrals as appropriate
Black text=Experimental Group; Blue text=Comparator group; Red text=Both groups; PO=Post-Operative; PrO=Pre-Operative		

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