

SUPPLEMENTAL MATERIAL

Data S1.

Search terms

Medline (n=2,851):

((("postoperative period"[MeSH Terms] OR ("postoperative"[All Fields] OR "post-operative"[All Fields] AND "period"[All Fields]) OR "postoperative period"[All Fields] OR "postoperative"[All Fields] OR "postsurgical"[All Fields]) AND recovery[All Fields] AND ("cardiac surgery"[All Fields] OR "cardiac surgical procedures"[MeSH Terms] OR "cardiac surgical"[All Fields] OR "CABG"[All Fields] OR "coronary artery bypass"[All Fields] OR "valve replacement"[All Fields] OR "valve repair"[All Fields])) AND English[Language]

Web of Science (n=1,921):

(ALL= ((Postoperative OR post-operative OR "post operative" OR postsurgical OR post-surgical OR "post surgical") AND recovery AND ("cardiac surgery" OR "cardiac surgical" OR CABG OR 'coronary artery bypass' OR 'valve surgery' OR 'valve repair' OR valve replacement)))AND LANGUAGE: (English)

Final list after de-duplication (n=3,432)

Table S1. Journal categorization by specialty.

Journal Name	Number of articles	Category
Anesthesiology	3	Anesthesiology
J Cardiothorac Vasc Anesth	3	Anesthesiology
Anaesthesia	1	Anesthesiology
Anesth Analg	1	Anesthesiology
Braz J Anesthesiol	1	Anesthesiology
J Clin Anesth	1	Anesthesiology
Circulation	2	Cardiology
Am Heart J	1	Cardiology
Br Heart J	1	Cardiology
Cardiovasc Revasc Med	1	Cardiology
Clin Cardiol	1	Cardiology
Eur Heart J	1	Cardiology
Heart	1	Cardiology
J Am Coll Cardiol	1	Cardiology
Heart Lung	9	Nursing
Int J Nurs Stud	4	Nursing
J Adv Nurs	3	Nursing
Am J Crit Care	2	Nursing
Appl Nurs Res	2	Nursing
Eur J Cardiovasc Nurs	2	Nursing
J Cardiovasc Nurs	2	Nursing
Nurs Res	2	Nursing
Aust J Adv Nurs	1	Nursing
Biol Res Nurs	1	Nursing
Clin Nurs Res	1	Nursing
J Transcult Nurs	1	Nursing
Prog Cardiovasc Nurs	1	Nursing
West J Nurs Res	1	Nursing
Health Psychol	4	Psych/behavioral
Psychosom Med	3	Psych/behavioral
J Psychosom Res	2	Psych/behavioral
Ann Behav Med	1	Psych/behavioral
Behav Med	1	Psych/behavioral
Br J Health Psychol	1	Psych/behavioral
Int J Behav Med	1	Psych/behavioral
J Behav Med	1	Psych/behavioral
Ann Thorac Surg	7	Surgical
Eur J Cardiothorac Surg	6	Surgical
J Thorac Cardiovasc Surg	6	Surgical
Interact Cardiovasc Thorac Surg	2	Surgical
Ann Thorac Cardiovasc Surg	1	Surgical
J Cardiothorac Surg	1	Surgical
J Surg Res	1	Surgical

Thorac Cardiovasc Surg	1	Surgical
Altern Ther Health Med	1	Other
Ann Intern Med	1	Other
BMC Complement Altern Med	1	Other
Chest	1	Other
Eur J Phys Rehabil Med	1	Other
Geriatr Gerontol Int	1	Other
J Am Diet Assoc	1	Other
J Am Geriatr Soc	1	Other
Medicine (Baltimore)	1	Other
N Engl J Med	1	Other
Outcomes Manag	1	Other
Pain Res Treat	1	Other
Qual Life Res	1	Other
Rev Lat Am Enfermagem	1	Other
Telemed J E Health	1	Other

Journals were categorized according to the inclusion of the specialty name in the journal title and the professional society that publishes the journal.

Table S2. List of included studies.

ID	Author	Year	Title	Journal
1	Newell, J. P.	1980	Physical training after heart valve replacement	Br Heart J
2	Kulik, J. A.	1989	Social support and recovery from surgery	Health Psychol
3	Engblom, E.	1992	Quality of life during rehabilitation after coronary artery bypass surgery	Qual Life Res
4	King, K. B.	1993	Social support and long-term recovery from coronary artery surgery: effects on patients and spouses	Health Psychol
5	Artinian, N. T.	1995	Sex differences in patient recovery patterns after coronary artery bypass surgery	Heart Lung
6	Bruggemans, E. F.	1995	Residual cognitive dysfunctioning at 6 months following coronary artery bypass graft surgery	Eur J Cardiothorac Surg
7	Moore, S. M.	1995	A comparison of women's and men's symptoms during home recovery after coronary artery bypass surgery	Heart Lung
8	Treasure, T.	1995	Survival and quality of life in patients with protracted recovery from cardiac surgery. Can we predict poor outcome?	Eur J Cardiothorac Surg
9	Jenkins, C. D.	1996	Predicting completeness of symptom relief after major heart surgery	Behav Med
10	Redeker, N. S.	1996	Sleep patterns in women after coronary artery bypass surgery	Appl Nurs Res
11	Edell-Gustafsson, U. M.	1999	Sleep and quality of life assessment in patients undergoing coronary artery bypass grafting	J Adv Nurs
12	Elizur, Y.	1999	Psychosocial adjustment and mental health two months after coronary artery bypass surgery: a multisystemic analysis of patients' resources	J Behav Med
13	Grossi, E. A.	1999	Comparison of post-operative pain, stress response, and quality of life in port access vs. standard sternotomy coronary bypass patients	Eur J Cardiothorac Surg
14	Arthur, H. M.	2000	Effect of a preoperative intervention on preoperative and postoperative outcomes in low-risk patients awaiting elective coronary artery bypass graft surgery. A randomized, controlled trial	Ann Intern Med
15	Heijmeriks, J. A.	2000	The incidence and consequences of mental disturbances in elderly patients post cardiac surgery--a comparison with younger patients	Clin Cardiol
16	King, K. M.	2000	Gender and short-term recovery from cardiac surgery	Nurs Res

17	Ovrum, E.	2000	Rapid recovery protocol applied to 5,658 consecutive "on-pump" coronary bypass patients	Ann Thorac Surg
18	Parent, N.	2000	A randomized, controlled trial of vicarious experience through peer support for male first-time cardiac surgery patients: impact on anxiety, self-efficacy expectation, and self-reported activity	Heart Lung
19	Ebert, A. D.	2001	Early neurobehavioral disorders after cardiac surgery: a comparative analysis of coronary artery bypass graft surgery and valve replacement	J Cardiothorac Vasc Anesth
20	Fearn, S. J.	2001	Cerebral injury during cardiopulmonary bypass: emboli impair memory	J Thorac Cardiovasc Surg
21	McCrone, S.	2001	Anxiety and depression: incidence and patterns in patients after coronary artery bypass graft surgery	Appl Nurs Res
22	Myles, P. S.	2001	Relation between quality of recovery in hospital and quality of life at 3 months after cardiac surgery	Anesthesiology
23	Newman, M. F.	2001	Longitudinal assessment of neurocognitive function after coronary-artery bypass surgery	N Engl J Med
24	Borkon, A. M.	2002	A comparison of the recovery of health status after percutaneous coronary intervention and coronary artery bypass	Ann Thorac Surg
25	Koivula, M.	2002	Fear and anxiety in patients at different time-points in the coronary artery bypass process	Int J Nurs Stud
26	Mahler, H. I.	2002	Effects of a videotape information intervention for spouses on spouse distress and patient recovery from surgery	Health Psychol
27	Shuldham, C. M.	2002	The impact of pre-operative education on recovery following coronary artery bypass surgery. A randomized controlled clinical trial	Eur Heart J
28	Zimmerman, L.	2002	Comparison of recovery patterns for patients undergoing coronary artery bypass grafting and minimally invasive direct coronary artery bypass in the early discharge period	Prog Cardiovasc Nurs
29	DiMattio, M. J.	2003	A longitudinal study of functional status and correlates following coronary artery bypass graft surgery in women	Nurs Res
30	Jarvinen, O.	2003	Changes in health-related quality of life and functional capacity following coronary artery bypass graft surgery	Eur J Cardiothorac Surg
31	Pierson, L. M.	2003	Recovery of self-reported functional capacity after coronary artery bypass surgery	Chest
32	Stygall, J.	2003	Cognitive change 5 years after coronary artery bypass surgery	Health Psychol
33	Vaccarino, V.	2003	Gender differences in recovery after coronary artery bypass surgery	J Am Coll Cardiol

34	Koch, C. G.	2004	Health-related quality of life after coronary artery bypass grafting: a gender analysis using the Duke Activity Status Index	J Thorac Cardiovasc Surg
35	Kulik, A.	2004	Postoperative naproxen after coronary artery bypass surgery: a double-blind randomized controlled trial	Eur J Cardiothorac Surg
36	Milgrom, L. B.	2004	Pain levels experienced with activities after cardiac surgery	Am J Crit Care
37	Miller, K. H.	2004	Comparison of symptoms of younger and older patients undergoing coronary artery bypass surgery	Clin Nurs Res
38	Tranmer, J. E.	2004	Enhancing postoperative recovery of cardiac surgery patients: a randomized clinical trial of an advanced practice nursing intervention	West J Nurs Res
39	Zimmerman, L.	2004	Symptom management intervention in elderly coronary artery bypass graft patients	Outcomes Manag
40	Doering, L. V.	2005	Depression, healing, and recovery from coronary artery bypass surgery	Am J Crit Care
41	Koch, C. G.	2005	Impact of prosthesis-patient size on functional recovery after aortic valve replacement	Circulation
42	Utriyaprasit, K.	2005	Recovery symptoms and mood states in Thai CABG patients	J Transcult Nurs
43	Barnason, S.	2006	Impact of a telehealth intervention to augment home health care on functional and recovery outcomes of elderly patients undergoing coronary artery bypass grafting	Heart Lung
44	King, K. M.	2006	A randomized controlled trial of women's early use of a novel undergarment following sternotomy: the Women's Recovery from Sternotomy Trial (WREST)	Am Heart J
45	Koch, C. G.	2006	Persistent effect of red cell transfusion on health-related quality of life after cardiac surgery	Ann Thorac Surg
46	Kortke, H.	2006	New East-Westfalian Postoperative Therapy Concept: a telemedicine guide for the study of ambulatory rehabilitation of patients after cardiac surgery	Telemed J E Health
47	Okkonen, E.	2006	Family support, living alone, and subjective health of a patient in connection with a coronary artery bypass surgery	Heart Lung
48	Phillips-Bute, B.	2006	Association of neurocognitive function and quality of life 1 year after coronary artery bypass graft (CABG) surgery	Psychosom Med
49	Ballan, A.	2007	A comparative study of patient perceived quality of life pre and post coronary artery bypass graft surgery	Aust J Adv Nurs

50	Koch, C. G.	2007	Effect of functional health-related quality of life on long-term survival after cardiac surgery	Circulation
51	Lopez, V.	2007	Physical, psychological and social recovery patterns after coronary artery bypass graft surgery: a prospective repeated measures questionnaire survey	Int J Nurs Stud
52	Miller, C.	2007	Impact of an early recovery management intervention on functioning in postoperative coronary artery bypass patients with diabetes	Heart Lung
53	Barnason, S.	2008	Relationships between fatigue and early postoperative recovery outcomes over time in elderly patients undergoing coronary artery bypass graft surgery	Heart Lung
54	Chiu, K. M.	2008	Local infusion of bupivacaine combined with intravenous patient-controlled analgesia provides better pain relief than intravenous patient-controlled analgesia alone in patients undergoing minimally invasive cardiac surgery	J Thorac Cardiovasc Surg
55	King, K. M.	2008	Women's Recovery from Sternotomy-Extension (WREST-E) study: examining long-term pain and discomfort following sternotomy and their predictors	Heart
56	Lena, P.	2008	Fast-track anesthesia with remifentanil and spinal analgesia for cardiac surgery: the effect on pain control and quality of recovery	J Cardiothorac Vasc Anesth
57	MacIntyre, B.	2008	The efficacy of healing touch in coronary artery bypass surgery recovery: a randomized clinical trial	Altern Ther Health Med
58	Panagopoulou, E.	2008	Symptoms of traumatic stress after coronary artery bypass grafting	Int J Behav Med
59	Sandau, K. E.	2008	Health-related quality of life and subjective neurocognitive function three months after coronary artery bypass graft surgery	Heart Lung
60	Chunta, K. S.	2009	Expectations, anxiety, depression, and physical health status as predictors of recovery in open-heart surgery patients	J Cardiovasc Nurs
61	Koster, S.	2009	The long-term cognitive and functional outcomes of postoperative delirium after cardiac surgery	Ann Thorac Surg
62	Rantanen, A.	2009	Health-related quality of life after coronary artery bypass grafting	J Adv Nurs
63	Routledge, F. S.	2009	The influence of coronary artery bypass graft harvest site on women's pain, functional status, and health services utilization throughout the first post-operative year: a longitudinal study	Int J Nurs Stud

64	Abbott, A. A.	2010	Symptom burden clusters and their impact on psychosocial functioning following coronary artery bypass surgery	J Cardiovasc Nurs
65	Hudetz, J. A.	2010	Preoperative dispositional optimism correlates with a reduced incidence of postoperative delirium and recovery of postoperative cognitive function in cardiac surgical patients	J Cardiothorac Vasc Anesth
66	Juergens, M. C.	2010	Illness beliefs before cardiac surgery predict disability, quality of life, and depression 3 months later	J Psychosom Res
67	Keith, M.	2010	Evaluation of taste sensitivity in patients undergoing coronary artery bypass graft surgery	J Am Diet Assoc
68	Morone, N. E.	2010	The impact of pain and depression on recovery after coronary artery bypass grafting	Psychosom Med
69	Rudolph, J. L.	2010	Delirium: an independent predictor of functional decline after cardiac surgery	J Am Geriatr Soc
70	Utriyaprasit, K.	2010	Recovery after coronary artery bypass surgery: effect of an audiotape information programme	J Adv Nurs
71	Caputo, M.	2011	Thoracic epidural anesthesia improves early outcomes in patients undergoing off-pump coronary artery bypass surgery: a prospective, randomized, controlled trial	Anesthesiology
72	Fedak, P. W.	2011	Adhesive-enhanced sternal closure to improve postoperative functional recovery: a pilot, randomized controlled trial	Ann Thorac Surg
73	Rosenfeldt, F.	2011	Physical conditioning and mental stress reduction- a randomised trial in patients undergoing cardiac surgery	BMC Complement Altern Med
74	Zimmerman, L.	2011	Gender differences in recovery outcomes after an early recovery symptom management intervention	Heart Lung
75	Chapman, C. R.	2012	Postoperative pain trajectories in cardiac surgery patients	Pain Res Treat
76	Guo, P.	2012	A preoperative education intervention to reduce anxiety and improve recovery among Chinese cardiac patients: a randomized controlled trial	Int J Nurs Stud
77	Hirschhorn, A. D.	2012	Does the mode of exercise influence recovery of functional capacity in the early postoperative period after coronary artery bypass graft surgery? A randomized controlled trial	Interact Cardiovasc Thorac Surg
78	Kopp, M.	2012	Psychomotor car-driving abilities after robotically assisted totally endoscopic coronary artery bypass grafting	Thorac Cardiovasc Surg
79	Martin, L. M.	2012	Health-related quality of life after coronary artery bypass grafting surgery and the role of gender	Cardiovasc Revasc Med

80	Bruce, K. M.	2013	Recovery of cognitive function after coronary artery bypass graft operations	Ann Thorac Surg
81	Cook, D. J.	2013	Functional recovery in the elderly after major surgery: assessment of mobility recovery using wireless technology	Ann Thorac Surg
82	Fontes, M. T.	2013	Predictors of cognitive recovery after cardiac surgery	Anesth Analg
83	DiMaria-Ghalili, R. A.	2014	Inflammation, functional status, and weight loss during recovery from cardiac surgery in older adults: a pilot study	Biol Res Nurs
84	Jonsson, M.	2014	Self-reported physical activity and lung function two months after cardiac surgery--a prospective cohort study	J Cardiothorac Surg
85	Mello, L. C.	2014	Assessment of pain during rest and during activities in the postoperative period of cardiac surgery	Rev Lat Am Enfermagem
86	Poole, L.	2014	Preoperative sleep complaints are associated with poor physical recovery in the months following cardiac surgery	Ann Behav Med
87	Ronaldson, A.	2014	Optimism measured pre-operatively is associated with reduced pain intensity and physical symptom reporting after coronary artery bypass graft surgery	J Psychosom Res
88	Min, L.	2015	Longitudinal functional recovery after geriatric cardiac surgery	J Surg Res
89	Monteleone, S.	2015	Recovery of deambulation after cardiothoracic surgery: a single center experience	Eur J Phys Rehabil Med
90	Yang, M.	2015	Comparison of postoperative quality of life for patients who undergo atrial myxoma excision with robotically assisted versus conventional surgery	J Thorac Cardiovasc Surg
91	Amofah, H. A.	2016	Sleep in octogenarians during the postoperative phase after transcatheter or surgical aortic valve replacement	Eur J Cardiovasc Nurs
92	Guimaraes-Pereira, L.	2016	Quality of recovery after anaesthesia measured with QoR-40: a prospective observational study	Braz J Anesthesiol
93	Kidd, T.	2016	Attachment anxiety predicts depression and anxiety symptoms following coronary artery bypass graft surgery	Br J Health Psychol
94	Lin, Y.	2016	Cardiac Valve Noise Reduction by Non-Drug Interventions Improves the Sleep Quality of Patients after Mechanical Cardiac Valve Implantation	Ann Thorac Cardiovasc Surg
95	Niemeyer-Guimaraes, M.	2016	Course of functional status in elderly patients after coronary artery bypass surgery: 6-month follow up	Geriatr Gerontol Int

96	Petersen, J.	2016	Physical and mental recovery after conventional aortic valve surgery	J Thorac Cardiovasc Surg
97	Rasmussen, L. A.	2016	Ultrashort acting remifentanyl is not superior to long-acting sufentanil in preserving cognitive function-a randomized study	J Clin Anesth
98	Hansen, L. S.	2017	Early, dedicated follow-up and treatment of pleural effusions enhance the recovery rate after open cardiac surgery: results from a randomized, clinical trial	Eur J Cardiothorac Surg
99	Knipp, S. C.	2017	Early and long-term cognitive outcome after conventional cardiac valve surgery	Interact Cardiovasc Thorac Surg
100	Royse, C. F.	2017	Impact of Methylprednisolone on Postoperative Quality of Recovery and Delirium in the Steroids in Cardiac Surgery Trial: A Randomized, Double-blind, Placebo-controlled Substudy	Anesthesiology
101	Salzmann, S.	2017	Effects of Preoperative Psychological Interventions on Catecholamine and Cortisol Levels After Surgery in Coronary Artery Bypass Graft Patients: The Randomized Controlled PSY-HEART Trial	Psychosom Med
102	Bowyer, A. J.	2018	Validation of the cognitive recovery assessments with the Postoperative Quality of Recovery Scale in patients with low-baseline cognition	Anaesthesia
103	Chen, Y. C.	2018	Validating the 6-minute walk test as an indicator of recovery in patients undergoing cardiac surgery: A prospective cohort study	Medicine (Baltimore)
104	Colella, T. J.	2018	The effect of a peer support intervention on early recovery outcomes in men recovering from coronary bypass surgery: A randomized controlled trial	Eur J Cardiovasc Nurs
105	Diab, M. S.	2018	The influence of prolonged intensive care stay on quality of life, recovery, and clinical outcomes following cardiac surgery: A prospective cohort study	J Thorac Cardiovasc Surg

Given few studies with extremely large samples compared to the median sample size, we qualitatively described studies with the largest sample sizes to evaluate whether we could make a strong inference on normative recovery pattern. The largest study (n= 7,321), Study 45, obtained measurements at only two time points, first of which was 180 days after the operation. The second largest study (n=5,658), Study 17, obtained measurements in a single-center setting at 7 time points but only within the first 7 days, and only assessed the proportion of patients ambulating on each day.

Table S3. Number of articles by journal category.

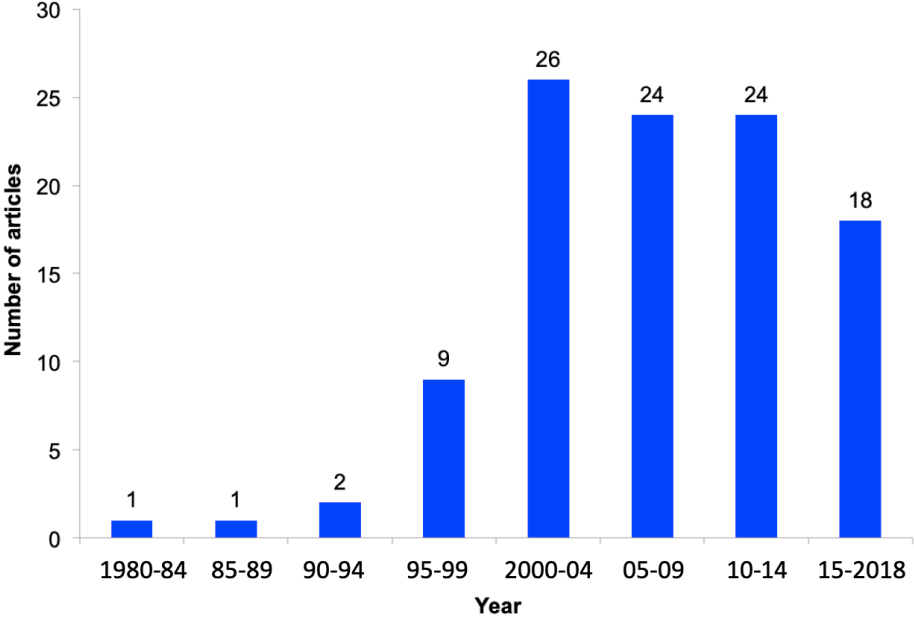
Journal category	N (105)	%
Nursing	32	30
Surgical	25	24
Psych/behavioral*	14	13
Anesthesia	10	10
Cardiology	9	9
Other	15	14

*Psych/behavioral category includes psychology, psychiatry, and behavioral medicine.

Table S4. Qualitative summary of predictors and interventions associated with improved recovery.

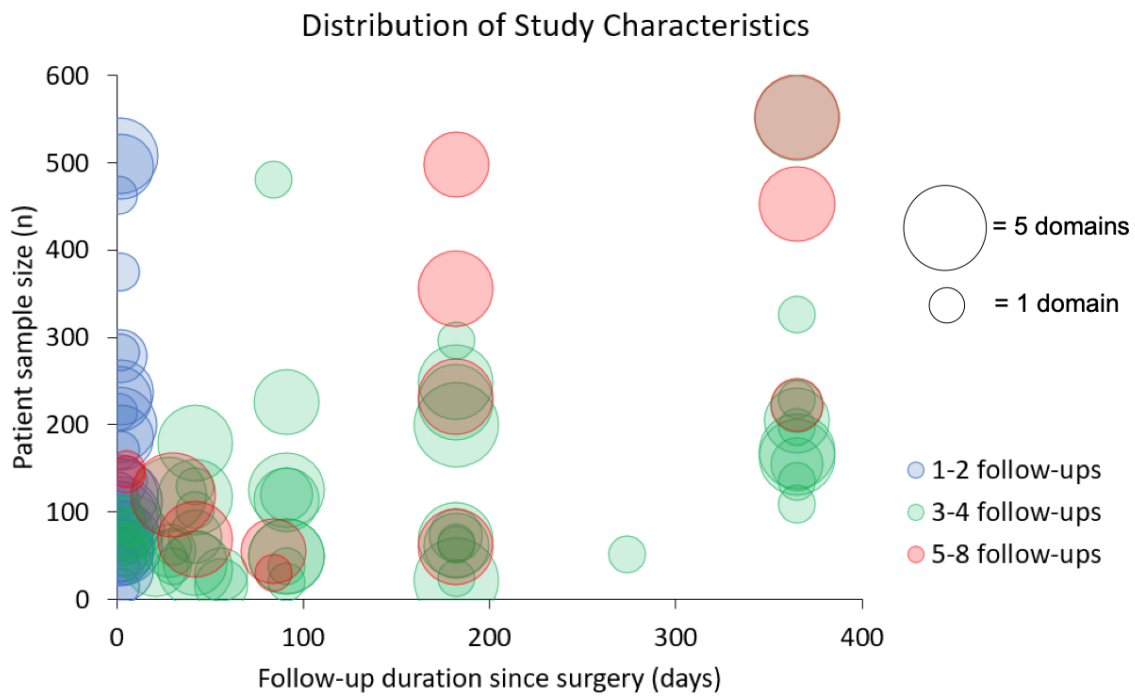
Factors related to better recovery	Categories	Predictors/Intervention
Interventions	Surgical	Adhesive-enhanced sternal closure, not using cardiopulmonary bypass, minimally-invasive access surgery, CABG without internal mammary artery use
	Medical	High-dose methylprednisolone, postoperative patient-controlled analgesia, postoperative naproxen, epidural anesthesia, fast-track anesthesia protocol, avoiding blood transfusion
	Other	Preoperative patient education, preoperative exercise training, use of special undergarment for women, telehealth follow-up, rehabilitation facility use compared to hospital rehabilitation, ear plug use after mechanical valve replacement, dyadic support, discharge instruction audiotape, additional follow up, healing touch, preoperative psychological intervention
Predictors		Men, women, younger age, shorter ICU stay, better baseline physical and cognitive function, higher number of steps taken after operation, lack of depression and baseline pain, better early recovery (predicts better late recovery), having social support, lower number of microemboli during operation, lower symptom burden, lower stress/anxiety/depression, lack of postoperative delirium, preoperative optimism, lack of preoperative sleep problems

Figure S1. Number of publications by year.



Number of articles published by 5-year increment of calendar year. No publication published prior to 1980 met the inclusion criteria. The latest bin (2015-2018) includes only 4-year period.

Figure S2. Bubble chart of studies by the study characteristics up to 400 follow-up days.



Studies by the duration of follow-up (x-axis) up to 400 days, sample size (y-axis) up to 600 patients, number of domains evaluated (bubble size), and number of follow-ups at which time the measurements were obtained (color). Six possible domains are: nociceptive symptoms, activity of daily living, cognitive, sleep, mental health, and physical function.