Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Effectiveness of communication strategies in the management of chronic postsurgical pain: a systematic review and meta-analysis

Asha-Naima Ferrante, M.Sc.
asha-naima.ferrante@students.unibe.ch
University Hospital of Bern
Julian S. Flury, MD
University Hospital of Bern
Barbara K. Keller
University Hospital of Bern
Joshua Ayoson, PhD
Kantonsspital Baden
Martin grosse Holtforth, PhD
University of Bern
Maria M. Wertli, Dr. med. and phil.
University Hospital of Bern

Article

Keywords: chronic postsurgical pain, communication, education, pain prevention, systematic review, psychological intervention, telehealth

Posted Date: September 10th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10196387/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Objective: Surgery is an important and iatrogenic cause of pain, and accounts for a substantial proportion of individuals suffering from chronic pain. This study assessed the effectiveness of communication strategies on chronic postsurgical pain (CPSP).

Patients and Methods: We searched Medline, Embase, Cochrane Library, CINAHL, PsycINFO, and Web of Science from the inception to November 24, 2024. Included were randomized trials (RCTs) and observational studies assessing communication interventions in patients undergoing surgery on pain and/or function with ≥3 months follow-up. The primary outcome was the prevalence of CPSP. Additional outcomes were pain and pain-related disability at follow-up. We used random effects models when ≥3 studies examined the same intervention type and outcome.

Results: Of 5831 records, 80 publications of 68 studies were included (60 (88.2%) RCTs and 8 (11.8%) observational studies). Studies provided limited results for the prevalence of CPSP at follow-up without differences between intervention and control groups. Nurse-led interventions (NRS standardized mean difference (SMD) -1.27 [95% CI -1.89 to -0.64, I^2=72.2%]) and cognitive behavioral therapy (CBT) with education combined (SMD -1.02 [95%CI -1.90 to -0.14], I^2 92%) showed greater pain reduction than the control groups. Certainty of evidence was low due to small sample sizes, risk of bias, and heterogeneity.

Conclusion: Nurse-led interventions and combined CBT and educational interventions may reduce pain and improve function at follow-up. However, the effects remain uncertain due to methodological limitations and heterogeneity. No impact was found for education alone, mixed interventions, telehealth interventions, and photographs.

Study registration: The study protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO; CRD42021241596).

Introduction

Chronic postsurgical pain (CPSP) is defined as pain that develops or increases in intensity after a surgery or a tissue injury, and persists beyond the healing process (i.e., for at least 3 months) after the initiating event.[1] Surgery is an important and iatrogenic cause for pain and it accounts for a substantial proportion of individuals suffering from chronic pain.[2–4] The pooled prevalence of CPSP three months after surgery ranged from 9% for hernia repair[5] to 55% for surgeries involving thoracotomy[6]. Very high levels have been observed after limb amputation with 85% CPSP.[7]

Although pain perception is a life-saving sensory reflex aimed to prevent harm,[8] pain is also an aversive subjective experience that is influenced by various factors.[9] Thus, self-reported pain of comparable tissue damage varies from very little to extreme pain[3, 10] and is influenced by predisposing factors,[11] priming effects,[9] surgical and anesthetic techniques,[11] and the type of analgesic drugs used.[12] Core risk factors for CPSP include demographic (e.g., age),[8, 13] pain (e.g., severe acute pain in the first week after surgery),[10, 13–15] comorbidities, surgery-related (e.g., longer duration of surgery[13, 14] and specific surgical techniques),[8, 13–15] and psychological factors (e.g., depression, anxiety, fear, psychological vulnerability,[16] distress, and pain catastrophizing).[17, 18] Further, beliefs and behavioral factors such as self-efficacy, fearful and avoidant behavior,[19, 20] activation of pain concepts in memory,[21] and verbal suggestion[9] play an important role in the individual pain experience.

During recent years, pre- and post-operative management, including prehabilitation (a multimodal preoperative management strategy), has received increasing attention.[22] Preoperative education, nutrition counselling, and prehabilitation have been widely investigated, and the introduction of Enhanced Recovery After Surgery (ERAS) has changed surgical practice.[23–25] A recent systematic review showed that prehabilitation showed benefits in postoperative functional outcomes across various surgical specialties from orthopedic surgery to surgery in oncology, thoracic and abdominal surgery.[26] The ERAS protocol has been shown to decrease hospital days and post-surgical complication rates compared to standard care across 74 randomized clinical trials with a total of 9'076 surgical patients.[27] Pre- and postoperative management should address potentially modifiable factors for CPSP. In particular behavioral and psychological factors may be mitigated by education and effective communication.[19, 20] Verbal suggestion may have priming effects and influence pain perception after surgery.[9] Although guidelines recommend to screen for risk factors for CPSP before and after surgery and provide preoperative education including a pain management plan[28, 29] to reduce the risk for CPSP,[30] recommendations are less specific on how to effectively communicate with patients.[28, 29] Language is the main tool for communication between clinicians and patients.

To date, there are a variety of education strategies that aim to reduce CPSP and improve function in different fields.[31, 32] No systematic review has comprehensively summarized current education and communication strategies in the pre- and postoperative settings, along with key determinants of these strategies. Further, it remains unclear how communication influences pain perception and the risk for CPSP. Therefore, the aim of this systematic review and meta-analysis was to summarize the current evidence on communication strategies in the pre- and postoperative settings and their impact on CPSP. Further, we aim to identify promising or successful elements in patient-centered communication that may be recommended for clinical use.

Material and methods

The systematic review was developed and reported according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 statement.[33] The protocol of this systematic review was registered to the International Prospective Register of Systematic Reviews (PROSPERO) database on May 14, 2021 (Registration number CRD42021241596) and published.[34]

Data Sources and Searches

We developed the search strategy by consulting the relevant literature, through discussion within the research team, and with the help of an experienced librarian (SK). The search strategy consisted of keywords and index terms related to "clinician", "communication" or "post-surgical pain". We searched

Medline (EBSCO), Embase (Elsevier), the Cochrane Library (Wiley), Cinahl (EBSCO), PsycINFO (EBSCO), and Web of Science from the inception to November 24, 2024. For the full search strategy for all databases see **Appendix 1**. Bibliographies of primary studies meeting the inclusion criteria, review articles, and guidelines on the topic were manually searched to identify further eligible studies. Further, we screened trial registries, conference proceedings, and searched the grey literature for potentially relevant studies. In case insufficient information was provided, we contacted the authors of potentially eligible studies.

Eligibility Criteria

Inclusion and Exclusion Criteria

The systematic review included randomized clinical trials (RCTs), prospective observational, and retrospective studies using a parallel group design that assessed the efficacy of communication interventions in patients undergoing surgery on postsurgical pain and/or function with a postsurgical follow-up of at least 3 months. We also considered studies using a pre- and post-intervention design to improve clinical outcomes. We included all types of communication approaches (verbal, written, visual, and non-verbal communication) with a therapeutic intention. Communication may have an educational, psychological, or informative intent. Interventions should be compared to a control group that may include standard care, waiting lists, and other types of communication (e.g., information sheet and pamphlet). We included languages for which the research team had sufficient language proficiency (i.e., English, French, German, Italian, Spanish, Swedish, and Dutch).

Excluded were studies with patients not undergoing surgery, age < 18 years, and other populations (e.g., general population and health survey). Further, we excluded observational studies without a comparison group, studies with other designs (e.g., case series, cross-sectional studies, and retrospective chart reviews), studies that did not assess pain and/or function as an outcome, and studies published in a language that the research team had insufficient language proficiency in (e.g., Chinese and Korean).

Outcomes

Outcome measures considered in this systematic review were based on the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) recommendations.[35] The primary outcome measure was pain intensity and pain-related disability. CPSP was defined as pain persisting for three or more months after surgery.[1] Chronic postsurgical disability was defined as disability persisting for three or more months after surgery. Secondary outcomes included global improvement, quality of life, emotional functioning, satisfaction with treatment, adverse events, adherence to the treatment, and pain medication use. All outcome measures for pain and pain-related function were extracted as reported in their primary studies and operationalized.

Study Selection

EndNote (V.20) was used for reference management during the review. All titles and abstracts were screened for eligibility independently by two reviewers (AF and BK, or JF). All potentially relevant references were then read in full text by the two reviewers (AF and BK, or JF). The study selection process was reported using the PRISMA flow diagram.[33] Any disagreements between the reviewers were resolved through discussion or by third-party arbitration (MMW).

Data Extraction and Quality Assessment

Extracted data included all details specific to the research question and were extracted using a predefined spreadsheet. We extracted information on the following domains: population and study setting, study design, follow-up duration, type of surgery, type of intervention, and control group. Outcome measures were operationalized. One reviewer extracted the information from all studies, and a second reviewer verified the information. We also contacted corresponding authors for additional information if outcome data were ambiguous or missing from the published study. The quality of individual studies included in the systematic review were independently rated by two reviewers with the Scottish Intercollegiate Guidelines Networks (SIGN) checklists for RCTs and cohort studies as high quality (++), acceptable (+), or low quality (-).[36] Disagreements between the reviewers were discussed and resolved by consensus within the research team. We summarized the quality of the best available evidence by using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach.[37–39] Levels of certainty were graded in accordance with the **GRADE Working Group grades of evidence: High certainty**: further research is unlikely to change our confidence in the effect estimate; **Moderate certainty**: further research is unlikely to have an important impact on our confidence in the effect estimate; **Low certainty**: further research is very likely to have an important impact on our confidence in the effect estimate; **Very low certainty**: we are very uncertain about the estimate.

Content of interventions

We extracted elements on the types of interventions and categorized the interventions into interventions using education, video/audio elements, psychological interventions combined with education, nurse-led interventions, mirror therapy, prehabilitation, mixed interventions, and telehealth.

Statistical Analysis

Data from the included studies were reported as continuous variables (mean and standard deviation (SD)) or median and interquartile range (IQR) or ranges (minimum to maximum), as appropriate. For dichotomous variables absolute numbers and percentage were reported. Given the expected heterogeneity across study populations, interventions, and outcomes, meta-analyses were performed only for comparisons where at least three studies assessed the same

outcome using comparable interventions. Meta-analysis was conducted using random-effects models (DerSimonian-Laird) to account for the expected variability across studies. The pooled effect sizes are presented as mean differences (MD) for continuous outcomes and risk ratios (RR) for dichotomous outcomes, with 95% confidence intervals (CIs). Heterogeneity was assessed using I^2 statistics with values above 75% indicating a substantial heterogeneity between studies. When pooling was not possible, we reported qualitative results of the studies.

Potential publication- and small sample size bias were assessed by visual inspections of funnel plots and Egger's test. All of the statistical analysis was performed with the R statistical software.[40] A p value < 0.05 was considered statistically significant for all analyses.

Results

Out of 5831 records identified through the searches, 239 references were read in full text and 80 publications based on 68 studies were included in the systematic review (Fig. 1, **Study Flow**). Main reasons for exclusion were follow-up of less than 3 months (n = 85), and no pain or disability assessed as outcome (n = 43).

Figure 2 shows the pooled prevalence of CPSP three months after surgery, ranging from 9% for hernia repair to 55% for surgeries involving thoracotomy.

Study characteristics

Table 1 provides a comprehensive overview of included studies. In total, 5 studies assessed education interventions, 1 study mirror therapy, 13 studies mixed methods, 9 studies nurse-led interventions, 1 study photographic demonstration, 5 studies prehabilitation, 20 studies education and psychological interventions, 11 studies telehealth interventions, and 3 studies used videos. Surgical procedures included abdominal surgery in 5 studies, orthopedic procedures in 48 studies, cardiac surgery in 7 studies, cancer related surgery in 11 studies, and sinusitis surgery in 1 study. The study design was RCT in 60 (88%), prospective cohort study in 2 (3%), retrospective cohort study in 2 (3%), and prospective non-randomized study 4 (6%).

Table 1
Baseline characteristics

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
THA	Petersen MK et al, 2006 and 2008; 56.1[68], 56.2[69]	RCT	Department of Orthopedics, Aarhus University Hospital, Denmark	**Inclusion**: Patients with osteoarthritis, planned elective primary unilateral THR and perioperative epidural analgesia **Exclusion**: Chronic opioid use, chronic pain, RA, fractures, and mental disorders	61 (34)	Intervention n = 40, control n = 39	medi 85
Lumbar spine surgery	Louw A et al, 2014, and Louw A et al, 2016; 59.1[70], 59.2[71]	RCT	7 clinical sites in the US	**Inclusion**: aged 18 to 65 years, planned LS surgery for radiculopathy; **Exclusion**: surgery with instrumentation (e.g., fusion); participation in a back school or multidisciplinary pain program; other conditions (chronic pain conditions, cord compression)	67 (35.8), and 50 (58)	Intervention n = 32, control n = 35	49.62
Knee arthroskopy	Bayram JM et al, 2019; 7[72]	Prospective cohort study	Department of Orthopedics and Trauma, University of Edinburgh Medical School, Edinburgh, United Kingdom	**Inclusion**: Patients, who underwent surgery by one high volume surgeon between May 2017 and January 2018 (during implementation period) with at least 3 months follow-up assessment **Exclusion**: Additional procedures (e.g. ligament repair)	55 (72.5)	Intervention n = 28, control n = 27	46.1
THA	Moulton LS et al, 2015; 49[73]	Prospective cohort study	Department of Trauma and Orthopedics, Wrexham Maelor Hospital, Wrexham, UK	**Inclusion**: All rapid-recovered patients who were included in the database **Exclusion**: Revision surgery, incorrect records	318 (N.R)	Intervention n = 233, control n = 85	71

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
TKA	de Andrade MAP et al, 2021; 50[74]	RCT	Orthopedic Department of the Federal University of Minas Gerais, Brazil	**Inclusion**: Unilateral knee OA, > 45 years, indication of a primary TKA, signed IC. **Exclusion**: N.r.	79 (67)	Intervention n = 45, control n = 34	64
Mirror therapy							
Mastectomy	Roustaee S et al, 2023; 54[51]	RCT	Cancer center in Shiraz, Iran	**Inclusion**: Unilateral mastectomy and complain of shoulder pain and disability in affected side (self-reported), aged 18–65, ≥ 3 months after cancer treatments. **Exclusion**: Lack of cooperation to continue training, restrictions in the other extremity, breast reconstruction surgery	60 (100)	Intervention n = 46, control n = 44	49
Mixed methods							

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
Cervical cancer	Han DF et al, 2021; 15[75]	RCT	Department of Gynecology and Obstetrics, Hospital of Xi'an Jiaotong University, Xi'an, China	**Inclusion**: Planned surgery for cervical cancer; aged > 18 years; **Exclusion**: Metastasis; Organ dysfunction or systemic infectious diseases; history of mental illness or cognitive impairment;	132 (100%)	Intervention n = 66, control n = 66	44.95
Breast cancer surgery	Dams L et al, 2023, 2024; 22.1[76], 22.2[77]	RCT	Multidisciplinary Breast Center of the University Hospitals Leuven campus Gasthuisberg (Belgium)	**Inclusion**: Women (aged ≥ 18 years), histologically confirmed invasive or non-invasive primary breast cancer; planned for surgery (mastectomy with sentinel node biopsy or axillary lymph node dissection +/- breast reconstruction; or breast conserving surgery with axillary lymph node dissection); no distant metastasis; language proficiency, compliance with protocol. **Exclusion**: N.r.	184 (100%)	Intervention: n = 92, control: n = 92	55.3
CABG	Mahfouz Khalil et al, 2024; 40[78]	RCT	Four different settings in Alexandria, Egypt	**Inclusion**: aged ≥ 60 years, recommended first time elective CABG forCoronary artery disease (CAD), good cognitive function, no history of psychological disturbance, agreed to follow up at home, access to a computer/tablet/smartphone, and telephone calls for follow-up **Exclusion: N.r.**	118 (57.6)	Intervention: n = 57, control: n = 61	70.3

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sc **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (in sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
CABG	Arthur HM et al, 2000; 27[79]	RCT	Hamilton Health Sciences Corporation surgical center, Hamilton, Ontario, Canada	**Inclusion**: Patients scheduled for a first CABG no earlier than in 10 weeks; **Exclusion**: CABG and valve surgery; Left-ventricular ejection fractions < 40%; no attendance of exercise classes	246 (29.3)	Intervention n = 123, control n = 123	62.8
Hip fracture	Shyu YI et al, 2005; 10[80]	RCT	Chang Gung University, Kweishan, Taoyuan, Taiwan	**Inclusion**: aged ≥ 60; planned surgery for accidental single-side hip fracture; were able to perform full range of motion (ROM) against gravity and resistance; prefracture Chinese Barthel Index (CBI) score > 70; living in northern Taiwan **Exclusion**: Severe cognitive impairment, unable to follow orders (Mini-Mental State Examination; MMSE < 10), or terminal illness	137 (69.3)	Intervention n = 72, control n = 87	77.6
TKA	Chang HL et al, 2024; 63[81]	RCT	Northern regional educational hospital in Taiwan	**Inclusion**: Aged ≥ 65 years, planned unilateral TKA for degenerative arthritis, consent; **Exclusion**: Receiving bilateral or secondary TKA, unable to ambulate or perform exercise, serious neurological condition, unable to access YouTube visual guide.	52 (69)	Intervention: n = 26, control n = 26	73.5

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher scc **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
TKA	den Hertog A et al, 2012; 14[82]	RCT	Non academic hospital specializing in orthopedic surgery, North-west Germany	**Inclusion**: aged 40–85 years, elective TKA. **Exclusion**: No IC or cooperation, ASA score > 3, rheumatoid arthritis, cancer, alcohol or drug abuse, previous major surgery on the affected joint, neurologic or psychiatric disease, pregnancy.	147 (70.75)	Intervention n = 74, control n = 73	67.41
TKA	Ayalon O et al, 2011; 28[42]	Retrospective cohort study	Hospital for Special Surgery, New York, USA	**Inclusion**: entered into two databases one of which was an arthroplasty database and the other a database maintained by our physical therapy department. **Exclusion**: N.r.	390 (n.r.)	Intervention n = 208, control n = 182	N.r.
Lumbar spine surgery	Christensen FB et al, 2003; 41[50]	RCT	At home / physical therapy in the University Hospital of Aarhus, Denmark	**Inclusion**: Patients with lumbar spinal fusion 3 months previously **Exclusion**: Ages < 20 or > 60 years; one or more comorbidity (e.g., metabolic bone disease, osteoporosis), evidence for lumbar nerve root compression; and psychosocial instability	90 (66.7)	Intervention 1 (back-cafe group) n = 26, intervention 2 (training group) n = 26), control (video group) n = 29)	45
Lumbar spine surgery	Kulig K et al, 2009, and Beneck GJ et al, 2014;	RCT	Physical therapy outpatient clinics, Los Angeles, California, USA	**Inclusion**: Surgery (no AE during and within 4–6 weeks postsurgery) for a symptomatic, MRI confirmed	98 (45.9)	Intervention n = 51, control n = 47	40.3

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
	46.1[83], 46.2[84]			disc protrusion (radicular pain distribution); **Exclusion**: Previous back surgery, limitations to participate in physical activities (e.g., neurological disorders), uncontrolled diseases (e.g., cardiovascular, rheumatic), pregnancy			
Hip fracture	Tinetti ME et al, 1999; 47[41]	RCT	Two local hospitals, New Haven, Connecticut	**Inclusion**: Community living persons, aged ≥ 65 years, after surgical repair of a hip fracture between 05/1993 and 09/1995. **Exclusion**: Dementia, terminal illness, life expectancy < 1 year; living > 25 miles from the two hospitals	304 (18.09)		79.95
Lumbar spine surgery	Erdogmus CB et al, 2007; 48[44]	RCT	Department of Neurosurgery and Department of Physical Medicine & Rehabilitation, University of Vienna Hospital, Vienna Austria	**Inclusion**: First uncomplicated disc surgery for lumbar disc herniation; preoperative < 6 months symptoms. **Exclusion**: Postoperative local complications, muscle weakness in the legs (Low Back Pain Rating Scale (LBP-RS) > 100 points); spinal stenosis, spondylolisthesis; chronic pain; neurologic or psychiatric disorders.	120 (44.17)	PT group n = 40, ST group n = 40, control group n = 40	41.3
Lumbar spine surgery	Ostelo RWJG et al, 2003, and Ostelo RWJG et al, 2003; 60.1[45], 60.2[46]	RCT	Four hospital of the University Hospital, Maastricht, Maastricht, Netherlands	**Inclusion**: Aged 18–65 years, first disc surgery on one level; Complaints (e.g. residual leg / back pain) restricting ADL and/or work **Exclusion**: Complications; diseases that influenced ADL (e.g., stenosis, cancer); Contraindication for the treatments	105 (43)	Intervention n = 52, control n = 53	43.25

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
Nurse-led interventions							
Abdominal cancer surgery	McCorkle R et al, 2009; 21[85]	RCT	Yale School of Nursing, New Haven, Connecticut, USA	**Inclusion**: Suspected primary diagnosis of ovarian cancer; expected survival after surgery of ≥ 6 months; discharged home, planned chemotherapy; aged ≥ 21 years; and living in the State of Connecticut **Exclusion**: N.r.	123 (100)	Intervention n = 63, control n = 60	60.3
Lung Cancer Surgery	Ji X et al, 2023; 64[86]	RCT	Cancer Hospital Affiliated with Shandong First Medical University in China	**Inclusion**: Patients diagnosed with Lung cancer (LC); 18 to 60 years; thoracoscopic or thoracotomy lobectomy performed, life expectancy of > 6 months, had a forced expiratory volume in 1 second (FEV1) > 0.8. **Exclusion**: tumor with distant metastases; a previous history of thoracic surgery; LC combined with malignant tumors in other parts of the body; LC combined with chronic obstructive pulmonary disease (COPD), asthma or other respiratory diseases; LC combined with severe cardiovascular or cerebrovascular diseases	64 (40.6)	Intervention: n = 32, control: n = 32	44
Head and neck cancer surgery	Hong YL et al, 2022; 53[87]	RCT	Medical center in eastern Taiwan	**Inclusion**: aged > 20 years, new head and neck cancer (HNC) scheduled for surgery, no serious complications, history of mental illness, comorbidities, or sensory–cognitive problems. **Exclusion**: Previous shoulder disorder, cannot follow study	40 (25)	Intervention n = 20, control n = 20	58.2

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
				procedures; pre-existing disorders that influence physical activity; chemoradiotherapy.			
Mastectomy	Maguire P et al, 1983; 43[47]	Cluster-RCT	Departments of Psychiatry and Surgery, University Hospital of South Manchester, Manchester, England	**Inclusion**: Women admitted for mastectomy. **Exclusion**: N.r.	152 (100)	Intervention n = 75, control n = 77	N.r.
Hip fracture	Zuo J et al, 2021; 17[88]	RCT	The First People's Hospital of Chuzhou, Anhui, China	**Inclusion**: Aged ≥ 65 years; hip fracture requiring surgery; independently walking before fracture; **Exclusion**: aged < 65 years; unable to walk independently before fractures; pathological fractures; ASA Classifications: Class IV or V.	75 (42.67)	Intervention n = 38, control n = 37	75.35
Hip fracture	Sun Z et al, 2019; 32[89]	RCT	Department of Obstetrics and Gynecology, Shandong, China	**Inclusion**: Supracondylar femur fracture, planned minimal invasive retrograde intramedullary nail surgery **Exclusion**: Contraindications against intramedullary nail surgery; severe limiting diseases (e.g., liver or kidney dysfunction)	128 (31.25)	Intervention n = 64, control n = 64	38.84
Hip fracture	Lin P-C et al, 2009; 11[90]	RCT	4 orthopaedic wards at a	**Inclusion**: aged ≥ 65 years, hip fracture; before fractur, able to walk and Barthel	50 (36.0)	Intervention n = 26, control n = 24	78.75

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sc **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (in sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effic Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
			medical centre in Taipei	score ≥ 70 points; able to communicate; living in Taipei region **Exclusion**: Cognitive impairment or terminal disease.			
THA	Hørdam B et al, 2010; 30[91]	RCT	Two orthopedic departments, University Hospital of Arhus, Denmark	**Inclusion**: Aged ≥ 65 years, admitted to elective total hip replacement (THR) in the hospital's two departments of orthopedic surgery **Exclusion**: No surgery	161 (65)	Intervention n = 82, control n = 93	74.9
Endoscopic surgery for sinusitis	Wang Z et al, 2020; 5[92]	RCT	Departments of Otolaryngology, and of Orthopedics, The First People's Hospital of Fuzhou, Jiangxi, China	**Inclusion**: Diagnostic criteria of sinusitis fullfilled and surgical treatment indicationed **Exclusion**: Allergic rhinitis; concurrent malignant tumors; and diseases in the nervous system, heart, liver, or kidneys; pregnant and lactating women	80 (46.25)	Intervention n = 40, control n = 40	44.72
Photo							
Diagnostic laparoscopy	Onwude JL et al, 2004; 23[93]	RCT	St. John's Hospital, Chelmsford, and St. James's University Hospital, Leeds, United Kingdom	**Inclusion**: Women undergoing diagnostic laparoscopy for the investigation of chronic pelvic pain **Exclusion**: N.r.	233 (100)	Intervention n = 109, control n = 124	32.45
Prehabilitation							
Lumbar spine surgery	Lindbäck Y et al, 2018; 36[94]	RCT	Spine Clinic at a University Hospital in Linköping, Sweden	**Inclusion**: Aged 25–80 years, planned lumbar spine surgery (MRI confirmed); high pain level LBP or leg pain because of disc herniation, spinal stenosis, spondylolisthesis (grades 1–2), degenerative disc disease; and fluency in Swedish **Exclusion**: Acute surgery or resurgery on the same level;	197 (53.3)	Internvention n = 99, control n = 98	59.5

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sc **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (in sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
				severe spinal pathology (e.g., osteoporosis, fusion > 4 levels); or other severe diagnoses			
Lumbar fusion surgery	Lotzke H et al, 2019, Kemani MK et al, 2024; 65.1[95], 65.2[96]	RCT	1 university hospital and 2 spine clinics in Gothenburg, Sweden	**Inclusion**: Aged 18–70 years, degenerative chronic LBP in 1 to 3 segments, additional minor radiating symptoms, reproducible pain at clinical examination in the relevant segment(s), scheduled for lumbar fusion surgery **Exclusion**: previous decompression surgery for spinal stenosis, spinal malignancy, dominating radiculopathy, confirmed neurological or rheumatic disorder, deformities in the thoracolumbar spine, poor understanding of Swedish	118 (53.3)	Intervention: n = 59, control: n = 59	45.7
TKA	Beaupre LA et al, 2004; 38[97]	RCT	University of Alberta Hospitals, Edmonton, Alberta, Canada	**Inclusion**: Noninflammatory arthritis, planned primary TKA; aged 40 to 75 years, willing to undertake the intervention and follow the study procedures; English proficiency or have a translator. **Exclusion**: N.r.	131 (55)	Intervention n = 65, control n = 66	67
THA	Vukomanović A et al, 2008; 39[98]	RCT	Department of Orthopedics of Military Medical Academy, Belgrade, Serbia	**Inclusion**: Osteoarthritis; aged ≤ 70; ability to walk up and down stairs; no crutches; no previous experience in walking with crutches; and no comorbidities. **Exclusion**: Complications including postoperative disorientation, anemia, orthostatic hypotension, chest pain.	45 (66.7)	Intervention n = 23, control n = 22	58.1

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
THA	Gocen Z et al, 2004; 42[99]	RCT	Department of Orthopedics and Traumatology in a university hospital, Turkey	**Inclusion**: Planned hip surgery due to osteoarthritis or hip fracture. **Exclusion**: Chronic diseases or other joint involvement requiring treatment	60 (63)	Intervention n = 30, control n = 30	51.3
Psychological & education							
Colorectal surgery	Koet LL et al, 2021; 29[100]	RCT	Albert Schweitzer Hospital, Dordrecht, The Netherlands	**Inclusion**: Primary colorectal cancer and eligible for curative surgical resection; aged ≥ 18 years; able to comprehend, speak, and write Dutch. **Exclusion**: N.r.	75 (37.33)	Intervention n = 36, control n = 39	71.55
Mastectomy, lumpectomyes, other	Boesen EH et al, 2011; 31[101]	RCT	University Hospital of Copenhagen, Copenhagen Denmark	**Inclusion**: Aged 18–70 years; stages I–IIIA primary breast cancer diagnosed and treated at the University Hospital of Copenhagen, Herlev, Denmark **Exclusion**: N.r.	210 (100)	Intervention n = 102, control n = 103	Rang 30–7
CABG	Lin C-Y et al, 2017; 66[102]	RCT	Multiple centers across Iran (five academic centers in Tehran, two in Qazvin and Ahvaz each, one in Semnan, Zanjan, and Tabriz each)	**Inclusion**: aged ≥ 65 years, undergone CABG surgery, ability to read and write Persian/Farsi, informed consent, access to a mobile phone. **Exclusion**: Use of boxes (or similar) to improve medication adherence, another study, significant dysphasia, severe uncontrolled diseases (e.g., kidney disease, oxygen for COPD, hepatic failure), abuse, allergy, expected survival of < 6-month, CABG was conducted as an emergency surgery.	288 (33.7)	Intervention: n = 144, control: n = 144	75.5
CABG	Shuldham CM et al, 2002; 24[103]	RCT	Royal Brompton and Harefield Trust, Sydney Street, London	**Inclusion**: Aged ≥ 18 years, first coronary artery bypass graft (CABG) surgery at the study hospital; willing and able to attend the education	329 (12.5)	Intervention n = 188, control n = 168	62.5

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sc **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (in sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effic Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
				clinics. Language proficiency in English. **Exclusion**: N.r.			
CABG	Lenz ER et al, 2000; 37[104]	RCT	Major urban academic medical center	**Inclusion**: Non-emergent CABG surgery at a major urban academic medical center, living within a 1-hour drive of the facility. **Exclusion**: N.r.	45 (29)		60.2
Lumbar spine surgery	Archer KR et al, 2016; 2[105]	RCT	Vanderbilt University Medical Center, Nashville, Tennessee, USA	**Inclusion**: Aged ≥ 21 years; English language; back and/or lower extremity pain > 6 months; no neurological disorder or psychotic disease; high fear of movement (TSK score ≥ 39) **Exclusion**: Surgery for spinal deformity, pseudarthrosis, trauma, infection, or cancer; microsurgical technique	86 (55.8)	Intervention n = 43, control n = 43	57.6

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pain stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
Lumbar spine surgery	Rolving N et al, 2015, and Rolving N et al, 2016; 57.1[106], 57.2[107]	RCT	Aarhus University Hospital, Aarhus, and Regional Hospital, Silkeborg, Denmark	**Inclusion**: Degenerative disc disease, stenosis or spondylolisthesis grade 1–2; fusion maximum 3 levels, aged 18–64 years; Danish language **Exclusion**: Waiting time < 4 weeks; distance > 80 km; psychiatric, inflammatory or malignant disease	90 (57)	Intervention n = 63, control n = 33	49.5
TKA	Piva SR et al, 2017; 26[43]	RCT	Physical Therapy Clinical and Translational Research Center, University of Pittsburgh	**Inclusion**: aged ≥ 50 years, 3–6 months unilateral TKR, medical clearance from the knee surgeon to participate, and English speaker **Exclusion**: bilateral or revision TKR, previous hip / ankle replacement, other > 2 times / week exercise programs, all conditions that prevent from exercising (e.g., visual impairment, falls comorbidities)	44 (70.45)	Intervention n = 22, control n = 22	68.2
Lumbar spine surgery	Monticone M et al, 2014; 35[108]	RCT	Salvatore Maugeri Foundation's Scientific Institute in Lissone (Italy)	**Inclusion**: Patients aged > 18 years selected for lumbar fusion +/-decompression due to degenerative or isthmic spondylolisthesis and/or LSS; LBP and/or sciatica > 12 months and unresponsive to conservative treatment; fluency in Italian. **Exclusion**: Previous spinal fusion or CBT, mental or neuromuscular conditions	130 (60.77)	Intervention n = 65, control n = 65	57.3
Lumbar spine surgery	Abbott AD et al, 2010; 44[109]	RCT	Karolinska University Hospital's Orthopedic Clinic, Stockholm, Sweden	**Inclusion**: Patients aged 18–65 years undergoing lumbar fusion with or without decompression for back pain and/or sciatica > 12 months without improvement with conservative treatment due to spinal stenosis,	107 (100)	Intervention N = 53, control n = 54	50.7

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
				spondylosis, spondylolisthesis or degenerative disc disease; Swedish language competency **Exclusion**: Previous lumbar fusion, rheumatoid arthritis, and ankylosing spondylitis			
Lumbar spine surgery	Johansson AC et al, 2009; 45[52]	RCT	Two neighboring orthopedic clinics (one university hospital and one community hospital), Sweden	**Inclusion**: planned first-time lumbar disc surgery (aged 18–60 years); for confirmed, symptomatic (pain, root compression) lumbar disc herniation. **Exclusion**: comorbidity influencing ADL; no Swedish language	59 (40.68)	Intervention n = 29, control n = 30	40.5 (med
Cervical spine surgery	Wibault J et al, 2018 and Peolsson A et al, 2019; 61.1[48], 61.2[49]	RCT	4 spinal centers in Sweden	**Inclusion**: Surgery for confirmed cervical disc disease (aged 18–70 years) with persistent symptoms ≥ 2 months; between 02/2009 and 11/2012 **Exclusion**: Previous surgery; traumatic etiology; Myelopathy; cancer; infection; contraindication for rehabilitation; generalized pain; mental disorder; no Swedish	202 (48)	Intervention n = 101, control n = 79	50
THA	Siggeirsdottir K et al, 2005; 25[110]	RCT	Landspitalin University Hospital in Reykjavik, and Akrankes Hospital, Iseland	**Inclusion**: Community dwelling adults with hip OA, RA, primary segmental collapse of the femoral head, and sequelae after developmental diseases and hip trauma. **Excluded**: Hip fracture, metastastatic tumors, and dementia	50 (52)	Intervention n = 27, control n = 23	68

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
Hip fracture	Shyu YI et al, 2013; 33[53]	RCT	School of Nursing, Chang Gung University, Taiwan	**Inclusion**: Hip surgery for one-sided hip fracture (aged ≥ 60 years); full range of motion against gravity / resistance at admission, Chinese Barthel Index score > 70; living in northern Taiwan **Exclusion**: unable to follow orders; MMS score < 10; or terminally ill	299 (63.45)	Comprehensive group n = 99, Subacute group n = 101, UC group n = 99	76.54
Lumbar spine surgery	Huysmans E et al, 2023; 51[111]	RCT	University Hospital Brussels (Brussels, Belgium), AZ SintDimpna (Geel, Belgium), and AZ Sint Maarten (Mechelen, Belgium)	**Inclusion**: Aged 18 to 65 years, Dutch language proficiency, and continued UC for the past 3 weeks. **Exclusion**: pregnancy during the last year; rheumatic, neurological, or psychiatric disorders; or chronic illness characterized by uncontrolled pain.	120 (48)	Intervention n = 58, control n = 62	48.5
THA or TKA	Smith TO et al, 2022; 52[112]	RCT	Eight UK NHS hospitals	**Inclusion**: Adults scheduled for primary unilateral THR or TKR for degenerative joint pathology (no trauma). Charlson Comorbidity Index ≥ 1 point. Activity level 'moderately inactive' or	224 (63) (sample size calculation 250)	Intervention n = 139, control n = 85	68.4

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
				'inactive'). **Exclusion**: Abbreviated Mental Test Score < 8/25 points); living in a care home; no communication.			
TKA	Lluch E et al, 2018; 55[113]	RCT	Hospital Universitario La Ribera (Alzira, Spain)	**Inclusion**: Planned TKA for knee OA, > 3 months pain. **Exclusion**: Previous surgery of same knee/ lower limb, chronic disease or widespread pain, cognitive impairment, or no language proficiency	54 (63.5)	Intervention n = 22, control n = 22	70.25
Lumbar spine surgery	Skolasky RL et al, 2015, and Skolasky RL et al, 2018; 62.1[114], 62.2[115]	Prospective non-randomized	The Johns Hopkins University School of Medicine, Baltimore, Maryland, USA	**Inclusion**: Aged ≥ 18 years, scheduled surgery for lumbar degenerative spine conditions (i.e., instability or deformity); informed consent; aged; English proficiency. **Exclusion**: Previous spine surgery	122 (63.11)	Intervention n = 63, control n = 59	59
Esophageal surgery	Pool MK et al, 2012; 4[116]	Prospective, non-randomized	Oncology centers in Babol, Iran	**Inclusion**: Esophageal cancer surgery and under chemotherapy for > 1 month	105 (49)	Intervention n = 55, control n = 50	65

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
				Exclusion: Chronic debilitating disease (i.e., diabetes, stroke, or epilepsy); previous educational program for self-care, audiovisual or psychological problems			
Spine surgery	Eastwood D et al, 2019; 6[117]	Retrospective cohort study	Canada East Spine Centre, Saint John, New Brunswick, Canada	**Inclusion**: Adults (aged ≥ 18 years), elective thoracolumbar spinal fusion surgery by one of two fellowship-trained spine surgeons, consent for the CSORN registry **Exclusion**: Previous spine surgery and involvement in spine-related litigation	206 (46)	Intervention n = 103, control n = 103	58.98
Telehealth							
Oral cancer surgery	Wang T-F et al, 2020; 18[118]	RCT	Department of Oral Surgery, Oncology, Hematology, Otolaryngology, Far Eastern Memorial Hospital in New Taipei City, Taiwan	**Inclusion**: One week after oral cancer surgery; language proficiency (Mandarin/ Taiwanese); smartphone. **Exclusion**: No oral cancer surgery; unable to answer the questions / cognitive impairment	100 (8)	Intervention n = 61, control n = 59	57.01
CABG	Barnason S et al, 2003, and Barnason S et al, 2006; 58.1[119], 58.2[120]	RCT	University of Nebraska Medical Center, Nebraska, USA	**Inclusion**: Aged > 65 years undergoing CABG surgery, receive home health care (HHC) after discharge; connectivity to the Health Buddy© device, and available for follow-up calls, English language proficiency **Exclusion**: N.r.	50 (44)	Intervention n = 25, control n = 25	75.3

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
TKA	Crawford DA et al, 2021, Alexander JS et al, 2023; 67.1[54], 67.2[55]	RCT	15 sites, USA	**Inclusion**: Planned unilateral primary TKA or partial KA, aged ≥ 18 years, mobile with no more than a single walking stick/single crutch for assistance; **Exclusion**: Alcohol or drug abuse, mental disease; inflammatory arthropathies; other surgery	552 (62.6)	Intervention n = 256; control n = 296	63.9
TKA	Piqueras M et al, 2013; 8[121]	RCT	Acute care university hospital, Barcelona, Spain	**Inclusion**: Primary TKA; active ROM flexion - extension (80°–10°), ability to walk with a walking aid and follow procedures; language proficiency. **Exclusion**: limitations to rehab process; not discharged home; complications within 3-month	181 (72.4)	Intervention n = 91, control n = 90	73.3
TKA	Bini SA et al, 2017; 9[122]	RCT	Kaiser Permanente Oakland Medical Center, U.S.A.	**Inclusion**: Age ≤ 75 years; access to internet / send and receive email; English proficiency, intention to pursue post-operative care at the institution **Exclusion**: N.r.	28 (46.43)	Intervention n = 15, control n = 13	63.25
TKA	Moffet H et al, 2015; 19[123]	Non-inferiority RCT	Eight hospitals in three Quebec regions, Canada	**Inclusion**: planned primary TKA for OA; living < 1 hour driving distance; high-speed internet access. **Exclusion**: planned second surgery < 4 months; cognitive limitations; complications; weight-bearing restrictions > 2 weeks post-surgery	205 (51.22)	Intervention n = 104, control n = 101	66
TKA	Tousignant M et al, 2011 (pilot trial of Moffet 2015); 20[56]	RCT	University Hospital of Sherbrooke and the University Hospital of Quebec, Canada	Inclusion: After TKA surgery, before discharge; high-speed internet access, informed consent.	41 (N.r.)	Intervention n = 21, control n = 20	66

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sc **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (in sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
THA or TKA	Eichler S et al, 2019; 3[124]	RCT	Three inpatient rehabilitation centers (Potsdam, Germany)	**Inclusion**: THA or TKA for OA; aged 18 to 65 years; insured by the German Pension Insurance **Exclusion**: Patients not expected to achieve functional safety in walking with full load by the end of the rehabilitation; Insufficient verbal and written German-language skills	111 (54.1)	Intervention n = 56, control n = 55	54.9
Lumbar spine surgery	Guo Y-J et al, 2022; 16[125]	Prospective, non-randomized	First People Hospital of Nantong, China	**Inclusion**: Adult (> 18 years), first lumbar fusion surgery; routine nursing care; able to use smart phones and the WeChat app; **Exclusion**: previous spine surgery, pregnancy; serious diseases; inability to exercise; readmission / re-surgery (disease progression, improper treatment)	72 (52.78)	Intervention n = 36, control n = 36	59.96
Lumbar spine surgery	Master H et al, 2024; 63[126]	RCT	Vanderbilt University Medical Center, Nashville, Tennessee, USA	**Inclusion**: Aged ≥ 18 years, first time surgical laminectomy with/ without fusion for a lumbar degenerative condition. **Exclusion**: (re-) surgery for other spinal diseases; <3 months moderate to severe back and/or lower extremity pain	16 (50)	Intervention n = 8, control n = 8	64.2
Rotator cuff surgery	Kanat C et al, 2024; 68[127]	RCT	University Hospital located in Türkiye	**Inclusion**: Aged ≥ 18 years, first arthroscopic RCR for degenerative full-thickness tear of ≤ 3 cm, Turkish language proficiency, MMS ≥ 23 points, arm fixed with a sling for up to 3 weeks, consent, no rheumatological or upper extremity disease. **Exclusion**: Patients who did not meet these criteria	48 (58.3)	Intervention: n = 24, control: n = 24	54.9
Video							
Colorectal surgery	Ihedioha U et al, 2013; 1[128]	RCT	Department of Surgery, University of	**Inclusion**: Patients undergoing elective colorectal surgery	61 (31.1)	Intervention n = 31, control n = 30	64.5

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FA** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sc **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (in sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effic Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Surgery	Author, year, ID, ref	Design	Setting	Eligibility criteria	N (f %)	N groups	Age (years mean
Education intervention							
			Leicester, Leicester, United Kingdom	**Exclusion**: Severe physical disability; and not speak or understand English			
Inguinal hernia repair	Zieren J et al, 2007; 34[129]	RCT	Department of General, Visceral, Vascular and Thoracic Surgery, Humboldt University Berlin, Germany	**Inclusion**: Patients admitted for an elective inguinal hernia surgical repair **Exclusion**: N.r.	100 (6)	Intervention n = 50, control n = 50	N.r.
Hip fracture, hip repair or total hip replacement	Tappen RM et al, 2003; 12[130]	Prospective, non-randomized	Two rehabilitation units	**Inclusion**: Hip surgery, MMS ≥ 20 points; able to speak English and willing to be videotaped during physical therapy; planned return the community **Exclusion**: N.r.	82 (67)	Intervention n = 43, control n = 39	72.19

Legend: THA, total hip replacement; **WOMAC**, Western Ontario and McMaster Universities Osteoarthritis Index (score 0–96, higher scores = worse knee pair stay; **PT**, Physical therapy / physiotherapy; **UC**, Usual care; **NRS**, numeric rating scale (score 0–10); **ODI**, Oswestry disability index (score 0-100, higher scores total knee replacement; **SF-36**, short form 36 (score 0-100, higher scores = better health / functioning); **SPADI**, Shoulder pain and disability Index (score 0–1 **QLQ BR-23**, European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life Questionnaire; **SDS**, Self-Rating Depression Disabilities of the Arm, Shoulder and Hand questionnaire (score 0-100; higher scores = higher disability/worse symptoms); **PCS**, Pain Catastrophizing Scale the context of pain, and experienced helplessness in the context of pain; score 0–52, scores of 30 or more = clinically relevant degree of pain catastrophizin Questionnaire; **CABG**, Coronary Artery Bypass Grafting; **CROQv2**, Coronary Revascularization Outcome Questionnaire-Version Two; **CAD**, Coronary artery dis and **MCS**, Mental component score of SF-36 / SF-12; **ROM**, Range of motion; **CBI**, Chinese Barthel Index; **IADL**, Instrumental activities of daily living; **GDS(-SF** Outcome Score (pain, symptoms, functions, quality of life; score 0-100, 0 = extreme knee problems, 100 = no knee problems); **AKSS**, American Knee Society **LBP-RS**, low back pain rating scale (pain, disability, and physical impairment; score 0 (best) to 130 (worst); **STAI**, State-Trait Anxiety Inventory; **RDQ**, Roland D (score 17–68, higher scores = greater kinesiophobia); **APN**, Advanced Practice Nurse; **SMT**, Symptom Management Toolkit; **CES-D**, Center for Epidemiologic (score 13–65); **LC**, Lung cancer; **6MWT**, 6-Minute Walk Test; **HNC**, Head and neck cancer; **UW-QOL**, University of Washington Quality of Life Questionnaire; **E FMA**, Fungl-Meyer assessment; **HAMD**, Hamilton Depression Scale (score 0–8 = no depression, 8–20 = possible depression, 21–35 = depression, > 35 = seve possible anxiety, 14–20 = general anxiety, 21–28 = prominent anxiety, ≥ 29 = severe anxiety); **OMFAQ**, OARS Multidimensional Functional Assessment Questi Depression Scale (score 0–21, higher scores = greater anxiety and depression); **SES**, Self-Efficacy Scale (score 0-200, higher score = better self-efficacy). **FAI** score = more signs of fear avoidance); **HHS**, Harris Hip Score with 4 domains (with 4 domains: pain, function, deformity, and motion (score 0-100, higher sco **MI**, motivational interviewing; **GWBQ**, General Well-Being Questionnaire; **BPI**, Brief Pain Inventory (score 0–10); **PSEQ**, Pain Self-Efficacy Questionnaire (score catastrophizing subscale (score 0–36); **BBQ**, The Back Beliefs Questionnaire; **NDI**, Neck Disability Index; **NHP**, Nottingham Health Profile with 6 domains (inc sleep disturbance; score n.r.); **LEFS**, Lower Extremity Functional Scale; **GSES**, Generalized Self-Efficacy Scale (score 10–40, higher scores = greater self-effica Life Questionnaire-Oesophageal 18; **BEES**, Barnason Efficacy Expectation Scale; **VR-12**, Veterans-RAND 12 item health survey, **SEE-C**, Chinese version of the Functional Life Scale; **PASE**, Physical Activity Scale for the Elderly; **FIM**, Functional Independence Measure; **JCS**, Jalowiec Coping Scale

Quality Assessment

The full quality assessment is included in **Appendix 2** and **Appendix 3**. The overall quality was high in 16 (26.7%), acceptable in 32 (53.3%), and low in 12 (20.0%) RCTs. Domains of concern were underreported allocation concealment and high attrition (loss to follow-up). All observational studies were of acceptable quality (100%). Limitations included concerns regarding statistical analysis (residual confounding and missing confidence interval calculations). We acknowledged for both RCTs and for prospective cohort studies that blinding was often infeasible for communication-based interventions. Funnel plot indicated symmetry, suggesting no significant publication bias. Although a few studies fell outside the expected range of the funnel, the egger's test showed a p value (0.09) larger than 0.05, indicating a lack of small-study effects. (**Appendix Fig. 1**).

Impact on the prevalence of CPSP

In total, 5 studies reported the prevalence of CPSP (Fig. 3A) without differences between the interventions and the control groups. One study observed more pain and a higher proportion of participants that stopped exercising because of pain in the intervention group compared to the control group.[41]

Impact on the prevalence of chronic disability / functional improvement

In total, 7 studies reported the proportion of chronic disability or global improvement at follow-up (Fig. 3B). Findings were mixed. After the introduction of a new pathway, patients reported more muscle weakness at follow-up compared to the old pathway after total knee arthroplasty (TKA).[42] Another study showed that after TKA, there was a more clinically meaningful improvement in the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) function following CBT with intensive training compared to standard exercise.[43] PT was more likely to result in global improvement compared to the control group and to sham massage after spine surgery.[44] Others found no difference between groups: Behavioral graded activity vs. usual care with PT after spine surgery,[45, 46] nurse led counselling after mastectomy vs. usual care,[47] and structured PT vs. usual care after cervical spine surgery.[48, 49]

Impact on pain at follow-up

Studies using nurse-led interventions and cognitive behavioral therapy (CBT) combined with educational approaches were more likely to improve pain at follow-up (Table 2; **Appendix 4**). Most studies using education only, prehabilitation, video or photo, and telehealth, found no impact on pain compared to the control group. One study compared three groups after spine surgery including I) a physical therapy (PT)-led group training (back-café) with video self-training exercises to II) video only and III) in person training twice weekly (training group), showed more reduction in leg pain in the training group.[50] Mirror therapy after mastectomy showed an improvement in pain compared to sham therapy and may be an interesting therapeutic option also used in other pain conditions.[51]

Table 2
Number of studies with findings for pain and disability

Intervention	Pain			Function			Field of surgery
	Total	Positive	Negative	Total	Positive	Negative	
Education (n = 5)	4	0	4	5	0	5	Orthopedic (n = 5; knee, hip, spine)
Mirror therapy (n = 1)	1	1	0	1	1	0	Mastectomy (n = 1)
Mixed methods (n = 13)	9	3 less / 1 more pain in intervention	5	13	8 more / 2 less improvement	3	Cancer (n = 2), CABG (n = 2), orthopedic (n = 9)
Nurse-led (n = 9)	8	6	2	9	6	3	Cancer (n = 4), orthopedic (n = 4), sinus (n = 1)
Prehab (n = 5)	4	0	4	5	0	5	Spine (n = 2), hip (n = 2), TKA (N = 1)
Psychological & education (n = 20)	17	8 less / 2 more pain in intervention	7	19	11	8	Cancer (n = 2), abdominal (n = 1), CABG (n = 3), orthopedic (n = 14)
Telehealth (n = 11)	10	1	9	10	1 more / 2 less improvement	7	Cancer (n = 1), cardiac (n = 1), orthopedic (n = 7)
Video (n = 3)	2	0	2	3	0	3	Abdominal (n = 2), orthopedic (n = 1)
Photo	1	0	1	0	-	-	Abdominal (n = 1)

Positive=observed difference between the intervention and the control group (discrepancies in findings are indicated); No = no difference between the Intervention group(s) and the control group

Appendix 4 includes a detailed description of individual study results. The random effects model showed significantly more pain reduction for interventions using nurse-led interventions with a standardized mean difference (SMD) in NRS of -1.27 (95% CI -1.89 to -0.64, I^2 = 72.2%, Fig. 4) and for interventions that combined CBT and education (SMD − 1.02 [95%CI -1.90 to -0.14], I^2 92%). For nurse-led interventions, we downgraded the level of certainty twice for a high risk of bias and small sample size (n = 109 in the intervention and n = 109 in the control group). For CBT and educational intervention, we downgraded the level of certainty twice for high heterogeneity and inconsistent results. No difference was observed in mixed interventions, prehabilitation, and telehealth models (very low certainty due to limited numbers of high-quality studies). However, most telehealth studies were not designed to assess superiority but aimed at showing non-inferiority compared to in-person PT. Findings in nurse-led interventions were consistent across studies for cancer-related surgery and for orthopedic surgery. Large pain reduction was observed in a mirror therapy intervention after mastectomy.[51] However, no other study was available to confirm this finding.

Impact on disability at follow-up

Overall, studies using combined CBT and educational approaches more often showed greater improvement in disability compared to the control group (Table 2). Studies using mixed methods and nurse-led interventions also showed more often statistically significant improvement in disability compared to control groups.

Findings from negative studies

Several studies observed more improvement in the control group compared to the intervention group. In the mixed interventions, Tinetti ME 1999[41] observed more pain in patients in the intervention group after hip fracture related to exercise compared to the control group.[41] Comparable, a home-based PT with CBT approach was less effective to reduce pain compared to the clinic-based group training (once weekly PT department visit over 8 weeks).[52]

Shyu YI 2013[53] also reported more pain in patients undergoing comprehensive care including a geriatric assessment and training compared to the intervention group. Despite negative findings for pain, there was an overall improved function after 3 months.[53] Several studies observed better functional outcomes in the control group compared to the intervention group. After TKA, a new clinical pathway was associated with more perceived muscle weakness in a pre- and post- intervention study.[42] A study that compared behavioral graded activity after lumbar spine surgery found higher recovery rates in the control group compared to the intervention group without differences in pain.[45, 46] In a telehealth study using smartwatch applications after TKA, patients in the control group reported more improvement in knee function at 3 months.[54, 55] Comparable, a telerehabilitation by trained PTs resulted in lower functional improvement in the intervention group compared to the control group with a home PT training once weekly.[56]

Differences in intervention elements with and without impact on pain and/or pain related disability

When comparing interventions that observed a positive effect on pain and/or pain related disability, the median duration was 9 weeks (minimum 1 week, maximum 52 weeks) compared to 8 weeks (range 1 time to 52 weeks) in studies without effect. When comparing the total contact time in minutes in studies that compared active interventions to usual care or a waiting list, studies with a positive effect had a longer overall contact time with patients (median: 435, IQR 240 to 960) compared to studies that observed no effect (median 210, IQR 45 to 840; Fig. 5). However, the effect did not reach statistical significance due to large confidence intervals (P value = 0.068). Interventions with a positive effect used more education elements (93.6% vs. 89.5%), less exercise (21.4% vs. 63.2%), more CBT (18.7% vs. 13.2%), and more physical therapy (69.5% vs. 55.3%) compared to interventions without an effect.

Discussion

In this systematic review and meta-analysis of 68 studies, we found evidence of low certainty that nurse-led interventions and interventions that combine CBT and education are effective in decreasing CPSP. Most studies that used other forms of communication such as education only, telehealth, photographs, video, and mixed forms, found no impact on pain and functional recovery at follow-up. Although very high heterogeneity limited the generalizability of our findings, we were able to identify potential elements of communication that may decrease CPSP. Interventions that were more likely to be effective seemed to include longer contact time with patients, more education and PT elements, and more CBT. Interventions that used information material and education provided only once, were not effective. Surprisingly, few studies reported the prevalence of chronic pain at follow-up although the prevalence was as high as 50% according to the literature.

Results in light of existing literature

The transition of pain from acute to chronic pain involves complex interactions of central and peripheral mechanisms. Sensitization have been suggested as a risk factor for the development of CPSP.[57, 58] Sensitization refers to an increased responsiveness of nociceptive neurons to their normal input in the central nervous system and in the periphery.[59] As a result, patients may feel disproportionate and prolonged pain (hyperalgesia), feel pain elicited by normally innocuous stimuli (allodynia), and pain may spread beyond the surgical site (secondary hyperalgesia). In clinical practice it is challenging to distinguish persistent post-surgical pain – i.e., pain that developed after a surgical procedure and persists beyond expected tissue healing into a chronic pain – from pain as a result from pre-existing condition, and may not be affected by the post-surgical pain management.[60] Patients at risk for CPSP should be identified early, and a risk-based management has been suggested.[61] Comprehensive, multidisciplinary approaches to manage patients involve not only pain treatment but also addressing physical and psychological aspects.[62]

Comparable to our analysis, a systematic review and meta-analysis showed that nurse-led nonpharmacological interventions (especially education interventions), reduce postoperative pain in patients undergoing total hip arthroplasty (THA) and TKA.[63] However, generalizability was limited due to the heterogeneity of interventions and variable quality of included studies. A recent systematic review and meta-analysis focused on pain-relief nursing reported improvements in pain scores and functional recovery in orthopedic surgery (hip arthroplasty).[64] Perioperative cognitive behavioral interventions showed a beneficial effect on postoperative pain management according to another meta-analysis.[65] Our systematic review expands on these findings and suggests that interventions may require higher intensity and more professional guidance during follow-up care, such as nurse-led care or interventions combining CBT with education with or without PT. Our study further suggests that information material only, and exercise based on biomechanical principles without individualized approach and guidance, may be insufficient in reducing CPSP.

It is important to note that some interventions may increase pain while improving function. In particular, elderly patients may report more pain in more intensive rehabilitative settings but also have better overall outcome. The study by Shyu YI 2013[53] showed how comprehensive care with a geriatric assessment and training resulted in more pain but improved the overall function after 3 months.[53] Pain is an important factor that may result in poor adherence to exercises and other recommendations.[66] Given that adherence to exercise is important to improve function,[67] communication with patients addressing potential transient worsening of pain is important.

Limitations

Although we used vigorous methods to conduct this systematic review and followed current recommendations, there are several limitations that need to be discussed. First, even with a thorough systematic search (including the grey literature and bibliographies of in relevant articles on the topic), we may not have identified all studies that assessed efficacy of communication intervention on CPSP. Second, interventions between studies varied in both content and intensity, and resulted in high heterogeneity. Heterogeneity limited us to draw firm conclusions and resulted in a downgrading for the certainty of evidence. Third, many interventions were multifaceted, and it was difficult to determine the influence of communication per se. Thus, other factors than communication, such as personal relationship and trust, may have been more relevant. However, these factors are an important aspect during patient encounters and are often more relevant than medications or other interventions. Individual interactions between clinician and patient are also influenced by

trust and sympathy. Finally, most studies had methodological limitations and were of small sample size. Further, inconsistent reporting precluded us from conducting meta-analysis with high-quality RCTs. It is important that future studies should report a minimal set of standardized outcomes that allows for comparison between studies.

Implication for research

Future studies should assess how CPSP can be prevented or improved. Most promising results were found for nurse-led interventions and a combination between CBT and education. Further, mirror therapy may be an approach that could be used in more settings. However, high-quality studies including larger patient samples are necessary to confirm these findings.

Implication for clinical practice

Given the high proportion of CPSP, clinicians should be aware of this condition and refer patients with persisting pain beyond expected healing duration to multimodal treatment. Current evidence supports CBT-based interventions combined with education and PT. Nurse-led interventions may hold promise for the future also in settings with primary care physician shortage. Personal beliefs and expectations are important, and clinicians should address pain and potential risk factors in all patients undergoing surgery.

Conclusion

Given the high burden of CPSP, nurse-led interventions, combinations of psychological (CBT) and educational interventions, and PT may decrease chronic pain and improve function at follow-up. However, the effects remain uncertain due to limitations in the quality of the study and substantial heterogeneity. No impact was found for education alone, mixed interventions, telehealth interventions, and photographs.

Abbreviations

CPSP
chronic postsurgical pain
ERAS
Enhanced Recovery After Surgery
PRISMA
Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO
International Prospective Register of Systematic Reviews
RCT
randomized controlled trial
IMMPACT
Initiative on Methods,Measurement,and Pain Assessment in Clinical Trials
SIGN
Scottish Intercollegiate Guidelines Networks
GRADE
Grading of Recommendations,Assessment,Development and Evaluation
SD
standard deviation
IQR
interquartile range
MD
mean difference,RR,risk ratio
CI
confidence interval
CBT
cognitive behavioral therapy
PT
physical therapy
SMD
Standardized mean difference
TKA
total knee arthroplasty,WOMAC,Western Ontario and McMaster Universities Osteoarthritis Index
THA
total hip arthroplasty

Declarations

Conflict of interest

The authors declare that they have no competing interests.

Funding:

The systematic review was supported by UniBE [UniBE ID Grants 2019 of the University of Bern, Switzerland].

Author Contribution

AF, MMW, and MgH conceived the study. AF, BK, JF conducted screening. AF, BK, and JF conducted data extraction and quality ratings of studies. All extracted data was confirmed by MMW. AF, JA, and MMW conducted the data analysis and compiled the Table and Figures. AF wrote the first version of the manuscript. All authors contributed to the methods, interpreted the data, revised the manuscript, and contributed to the content and style of the study. All authors approved the final version.

Acknowledgement

The authors thank Sabine Klein (SK), Medical Library of the University of Zurich, for support in compiling the search strategy and conducting the systematic search.

Data Availability

All data supporting the findings of this study are available within the paper and its Supplementary Information.

References

1. Schug, S. A. et al. The IASP classification of chronic pain for ICD-11: chronic postsurgical or posttraumatic pain. *Pain* **160** (1), 45–52 (2019).
2. Johansen, A., Romundstad, L., Nielsen, C. S., Schirmer, H. & Stubhaug, A. Persistent postsurgical pain in a general population: prevalence and predictors in the Tromso study. *Pain* **153** (7), 1390–1396 (2012).
3. Glare, P., Aubrey, K. R. & Myles, P. S. Transition from acute to chronic pain after surgery. *Lancet* **393** (10180), 1537–1546 (2019).
4. Simanski, C. J. et al. Incidence of chronic postsurgical pain (CPSP) after general surgery. *Pain Med.* **15** (7), 1222–1229 (2014).
5. Alaverdyan, H. et al. Perioperative Risk Factors for Persistent Postsurgical Pain After Inguinal Hernia Repair: Systematic Review and Meta-Analysis. *J. Pain*. **25** (9), 104532 (2024).
6. Bayman, E. O. & Brennan, T. J. Incidence and severity of chronic pain at 3 and 6 months after thoracotomy: meta-analysis. *J. Pain*. **15** (9), 887–897 (2014).
7. Hsu, E. & Cohen, S. P. Postamputation pain: epidemiology, mechanisms, and treatment. *J. Pain Res.* **6**, 121–136 (2013).
8. Kehlet, H., Jensen, T. S. & Woolf, C. J. Persistent postsurgical pain: risk factors and prevention. *Lancet* **367** (9522), 1618–1625 (2006).
9. Lena, F. et al. How does semantic pain and words condition pain perception? A short communication. *Neurol. Sci.* **43** (1), 691–696 (2022).
10. Kehlet, H., Jensen, T. S. & Woolf, C. J. Persistent postsurgical pain: risk factors and prevention. *Lancet* **367** (9522), 1618–1625 (2006).
11. Rotbøll Nielsen, P., Rudin, Å. & Werner, M. U. Prediction of postoperative pain. *Curr. Anaesth. Crit. Care*. **18** (3), 157–165 (2007).
12. Baca, Q. et al. Predicting Acute Pain After Surgery: A Multivariate Analysis. *Ann. Surg.* **273** (2), 289–298 (2021).
13. Macrae, W. A. Chronic post-surgical pain: 10 years on. *Br. J. Anaesth.* **101** (1), 77–86 (2008).
14. Katz, J. & Seltzer, Z. Transition from acute to chronic postsurgical pain: risk factors and protective factors. *Expert Rev. Neurother.* **9** (5), 723–744 (2009).
15. Perkins, F. M. & Kehlet, H. Chronic pain as an outcome of surgery. A review of predictive factors. *Anesthesiology* **93** (4), 1123–1133 (2000).
16. Denk, F., McMahon, S. B. & Tracey, I. Pain vulnerability: a neurobiological perspective. *Nat. Neurosci.* **17** (2), 192–200 (2014).
17. VanDenKerkhof, E. G., Peters, M. L. & Bruce, J. Chronic pain after surgery: time for standardization? A framework to establish core risk factor and outcome domains for epidemiological studies. *Clin. J. Pain*. **29** (1), 2–8 (2013).
18. Sydora, B. C. et al. Identification of Presurgical Risk Factors for the Development of Chronic Postsurgical Pain in Adults: A Comprehensive Umbrella Review. *J. Pain Res.* **17**, 2511–2530 (2024).
19. Edwards, R. R., Dworkin, R. H., Sullivan, M. D., Turk, D. C. & Wasan, A. D. The Role of Psychosocial Processes in the Development and Maintenance of Chronic Pain. *J. Pain*. **17** (9 Suppl), T70–92 (2016).
20. Giusti, E. M., Lacerenza, M., Manzoni, G. M. & Castelnuovo, G. Psychological and psychosocial predictors of chronic postsurgical pain: a systematic review and meta-analysis. *Pain* **162** (1), 10–30 (2021).
21. Swannell, E. R., Brown, C. A., Jones, A. K. & Brown, R. J. Some Words Hurt More Than Others: Semantic Activation of Pain Concepts in Memory and Subsequent Experiences of Pain. *J. Pain*. **17** (3), 336–349 (2016).

22. Ma, W., Liu, Y., Liu, J., Qiu, Y. & Zuo, Y. Prehabilitation of surgical patients: a bibliometric analysis from 2005 to 2023. *Perioper Med. (Lond)*. **13** (1), 48 (2024).
23. Simpson, J. C., Bao, X. & Agarwala, A. Pain Management in Enhanced Recovery after Surgery (ERAS) Protocols. *Clin. Colon Rectal Surg.* **32** (2), 121–128 (2019).
24. Gillis, C., Ljungqvist, O. & Carli, F. Prehabilitation, enhanced recovery after surgery, or both? A narrative review. *Br. J. Anaesth.* **128** (3), 434–448 (2022).
25. Gabryel, P. et al. Prehabilitation as a key component of the Enhanced Recovery After Surgery (ERAS) program in patients with lung cancer: a narrative review. *Kardiochir Torakochirurgia Pol.* **22** (3), 206–211 (2025).
26. Kann, M. R. et al. The Impact of Surgical Prehabilitation on Postoperative Patient Outcomes: A Systematic Review. *J. Surg. Res.* **306**, 165–181 (2025).
27. Sauro, K. M. et al. Enhanced Recovery After Surgery Guidelines and Hospital Length of Stay, Readmission, Complications, and Mortality: A Meta-Analysis of Randomized Clinical Trials. *JAMA Netw. Open.* **7** (6), e2417310 (2024).
28. Aubrun, F. et al. Revision of expert panel's guidelines on postoperative pain management. *Anaesth. Crit. Care Pain Med.* **38** (4), 405–411 (2019).
29. Chou, R. et al. Management of Postoperative Pain: A Clinical Practice Guideline From the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. *J. Pain*. **17** (2), 131–157 (2016).
30. Huang, A. et al. Chronic postsurgical pain and persistent opioid use following surgery: the need for a transitional pain service. *Pain Manag*. **6** (5), 435–443 (2016).
31. Reaza-Alarcon, A. & Rodriguez-Martin, B. Effectiveness of nursing educational interventions in managing post-surgical pain. Systematic review. *Invest. Educ. Enferm* ;**37**(2). (2019).
32. Darville-Beneby, R. et al. The Impact of Preoperative Patient Education on Postoperative Pain, Opioid Use, and Psychological Outcomes: A Narrative Review. *Can. J. Pain*. **7** (2), 2266751 (2023).
33. Page, M. J. et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* **372**, n71 (2021).
34. Ferrante, A. N. et al. Effectiveness of Communication Strategies in the Management of Chronic Postsurgical Pain: Protocol for a Systematic Review and Meta-Analysis. *J. Pain Res.* **16**, 1907–1913 (2023).
35. Turk, D. C. et al. Core outcome domains for chronic pain clinical trials: IMMPACT recommendations. *Pain* **106** (3), 337–345 (2003).
36. Scottish Intercollegiate Guidelines Network (SIGN). A guideline developer's handbook. Edinburgh: SIGN: Scottish Intercollegiate Guidelines Network (SIGN). (2019). Available from: http://www.sign.ac.uk
37. Brozek, J. L. et al. Grading quality of evidence and strength of recommendations in clinical practice guidelines. Part 1 of 3. An overview of the GRADE approach and grading quality of evidence about interventions. *Allergy* **64** (5), 669–677 (2009).
38. Brozek, J. L. et al. Grading quality of evidence and strength of recommendations in clinical practice guidelines part 3 of 3. The GRADE approach to developing recommendations. *Allergy* **66** (5), 588–595 (2011).
39. Brozek, J. L. et al. Grading quality of evidence and strength of recommendations in clinical practice guidelines: Part 2 of 3. The GRADE approach to grading quality of evidence about diagnostic tests and strategies. *Allergy* **64** (8), 1109–1116 (2009).
40. Team, R. C. *R: A Language and Environment for Statistical Computing* (R Foundation for Statistical Computing, 2025).
41. Tinetti, M. E. et al. Home-based multicomponent rehabilitation program for older persons after hip fracture: a randomized trial. *Arch. Phys. Med. Rehabil*. **80** (8), 916–922 (1999).
42. Ayalon, O. et al. A multimodal clinical pathway can reduce length of stay after total knee arthroplasty. *HSS J.* **7** (1), 9–15 (2011).
43. Piva, S. R. et al. Effect of Comprehensive Behavioral and Exercise Intervention on Physical Function and Activity Participation After Total Knee Replacement: A Pilot Randomized Study. *Arthritis Care Res. (Hoboken)*. **69** (12), 1855–1862 (2017).
44. Erdogmus, C. B. et al. Physiotherapy-based rehabilitation following disc herniation operation: results of a randomized clinical trial. *Spine (Phila Pa. 1976)*. **32** (19), 2041–2049 (2007).
45. Ostelo, R. W. et al. Effectiveness of behavioral graded activity after first-time lumbar disc surgery: short term results of a randomized controlled trial. *Eur. Spine J.* **12** (6), 637–644 (2003).
46. Ostelo, R. W. et al. Behavioral graded activity following first-time lumbar disc surgery: 1-year results of a randomized clinical trial. *Spine (Phila Pa. 1976)*. **28** (16), 1757–1765 (2003).
47. Maguire, P., Brooke, M., Tait, A., Thomas, C. & Sellwood, R. The effect of counselling on physical disability and social recovery after mastectomy. *Clin. Oncol.* **9** (4), 319–324 (1983).
48. Wibault, J. et al. Structured postoperative physiotherapy in patients with cervical radiculopathy: 6-month outcomes of a randomized clinical trial. *J. Neurosurg. Spine*. **28** (1), 1–9 (2018).
49. Peolsson, A. et al. Postoperative structured rehabilitation in patients undergoing surgery for cervical radiculopathy: a 2-year follow-up of a randomized controlled trial. *J. Neurosurg. Spine*. **31** (1), 60–69 (2019).
50. Christensen, F. B., Laurberg, I. & Bunger, C. E. Importance of the back-cafe concept to rehabilitation after lumbar spinal fusion: a randomized clinical study with a 2-year follow-up. *Spine (Phila Pa. 1976)*. **28** (23), 2561–2569 (2003).
51. Roustaee, S., Roudi Rashtabadi, O., Tirgari, B., Jahani, Y. & Tahmasebi, S. Mirror therapy effect on shoulder pain and disability and quality of life of mastectomy women: a randomized clinical trial. *Disabil. Rehabil*. **45** (25), 4227–4235 (2023).

52. Johansson, A. C., Linton, S. J., Bergkvist, L., Nilsson, O. & Cornefjord, M. Clinic-based training in comparison to home-based training after first-time lumbar disc surgery: a randomised controlled trial. *Eur. Spine J.* **18** (3), 398–409 (2009).
53. Shyu, Y. I. et al. Comprehensive and subacute care interventions improve health-related quality of life for older patients after surgery for hip fracture: a randomised controlled trial. *Int. J. Nurs. Stud.* **50** (8), 1013–1024 (2013).
54. Crawford, D. A. et al. 2021 Mark Coventry Award: Use of a smartphone-based care platform after primary partial and total knee arthroplasty: a prospective randomized controlled trial. *Bone Joint J.* ; (2021). 103-B(6 Supple A):3–12 .
55. Alexander, J. S. et al. Use of a Smartphone-Based Care Platform After Primary Partial and Total Knee Arthroplasty: 1-Year Follow-Up of a Prospective Randomized Controlled Trial. *J. Arthroplasty*. **38** (7 Suppl 2), S208–S14 (2023).
56. Tousignant, M. et al. A randomized controlled trial of home telerehabilitation for post-knee arthroplasty. *J. Telemed Telecare*. **17** (4), 195–198 (2011).
57. Fregoso, G., Wang, A., Tseng, K. & Wang, J. Transition from Acute to Chronic Pain: Evaluating Risk for Chronic Postsurgical Pain. *Pain Physician*. **22** (5), 479–488 (2019).
58. Voscopoulos, C. & Lema, M. When does acute pain become chronic? *Br. J. Anaesth.* **105** (Suppl 1), i69–85 (2010).
59. Merskey, H. & Bogduk, N. *Classification of Chronic Pain* Second edn (IASP, 1994).
60. Fuller, A. M., Bharde, S. & Sikandar, S. The mechanisms and management of persistent postsurgical pain. *Front. Pain Res. (Lausanne)*. **4**, 1154597 (2023).
61. Thapa, P. & Euasobhon, P. Chronic postsurgical pain: current evidence for prevention and management. *Korean J. Pain*. **31** (3), 155–173 (2018).
62. Moka, E., Aguirre, J. A., Sauter, A. R., Lavand'homme, P. & Pain, A. European Society of Regional T. Chronic postsurgical pain and transitional pain services: a narrative review highlighting European perspectives. Reg Anesth Pain Med. ;50(2):205 – 12. (2025).
63. Moon, M., Oh, E. G., Baek, W. & Kim, Y. M. Effects of Nurse-Led Pain Management Interventions for Patients with Total Knee/Hip Replacement. *Pain Manag Nurs.* **22** (2), 111–120 (2021).
64. Xie, J., Bai, R., Lei, H., Bi, R. L. & Chen, Y. Effect of pain-relief nursing on activities of daily living in patients following hip arthroplasty: a systematic review and meta-analysis. *Front. Med. (Lausanne)*. **12**, 1680486 (2025).
65. Castano-Asins, J. R. et al. Effectiveness of peri-operative psychological interventions for the reduction of postsurgical pain intensity, depression, anxiety and pain catastrophising: A systematic review and meta-analysis. *Eur. J. Anaesthesiol.* **42** (7), 609–625 (2025).
66. Gilanyi, Y. L. et al. Barriers and enablers to exercise adherence in people with nonspecific chronic low back pain: a systematic review of qualitative evidence. *Pain* **165** (10), 2200–2214 (2024).
67. Jones, C. A. & Suarez-Almazor, M. E. Patient expectations and total knee arthroplasty. *J. Clin. Outcomes Manage.* **24** (8), 364–370 (2017).
68. Petersen, M. K., Madsen, C., Andersen, N. T. & Soballe, K. Efficacy of multimodal optimization of mobilization and nutrition in patients undergoing hip replacement: a randomized clinical trial. *Acta Anaesthesiol. Scand.* **50** (6), 712–717 (2006).
69. Petersen, M. K., Andersen, N. T. & Soballe, K. Self-reported functional outcome after primary total hip replacement treated with two different perioperative regimes: a follow-up study involving 61 patients. *Acta Orthop.* **79** (2), 160–167 (2008).
70. Louw, A., Diener, I., Landers, M. R. & Puentedura, E. J. Preoperative pain neuroscience education for lumbar radiculopathy: a multicenter randomized controlled trial with 1-year follow-up. *Spine (Phila Pa. 1976)*. **39** (18), 1449–1457 (2014).
71. Louw, A., Diener, I., Landers, M. R., Zimney, K. & Puentedura, E. J. Three-year follow-up of a randomized controlled trial comparing preoperative neuroscience education for patients undergoing surgery for lumbar radiculopathy. *J. Spine Surg.* **2** (4), 289–298 (2016).
72. Bayram, J. M., Lawson, G. M. & Hamilton, D. F. The impact of a preoperative information leaflet on expectation management, satisfaction and patient outcomes in patients undergoing knee arthroscopy. *Knee* **26** (5), 1026–1031 (2019).
73. Moulton, L. S., Evans, P. A., Starks, I. & Smith, T. Pre-operative education prior to elective hip arthroplasty surgery improves postoperative outcome. *Int. Orthop.* **39** (8), 1483–1486 (2015).
74. Percope de Andrade, M. A. et al. A new methodology for patient education in total knee arthroplasty: a randomized controlled trial. *Eur. J. Orthop. Surg. Traumatol.* **32** (1), 107–112 (2022).
75. Han, D., Wang, D., Yang, J. & Li, X. Effect of multidisciplinary collaborative continuous nursing on the psychological state and quality of life of patients with cervical cancer. *Am. J. Transl Res.* **13** (6), 6654–6661 (2021).
76. Dams, L. et al. Effect of pain neuroscience education after breast cancer surgery on pain, physical, and emotional functioning: a double-blinded randomized controlled trial (EduCan trial). *Pain* **164** (7), 1489–1501 (2023).
77. Dams, L. et al. Effectiveness of pain neuroscience education on somatosensory functioning after surgery for breast cancer: A double-blinded randomized controlled trial. *Anat. Rec (Hoboken)*. **307** (2), 248–272 (2024).
78. Mahfouz Khalil, M. I., El-Monshed, A. H., Shaala, R. S., El-Sherif, S. M. & Mousa, E. F. S. Home-based transitional cardiac telerehabilitation in older adults post coronary artery bypass grafting: A randomized controlled trial. *Geriatr. Nurs.* **59**, 139–149 (2024).
79. Arthur, H. M., Daniels, C., McKelvie, R., Hirsh, J. & Rush, B. 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.* **133**, 253–262 (2000).
80. Shyu, Y. I. et al. A pilot investigation of the short-term effects of an interdisciplinary intervention program on elderly patients with hip fracture in Taiwan. *J. Am. Geriatr. Soc.* **53** (5), 811–818 (2005).
81. Chang, H. L., Hsu, M. F., Wong, T. H., Chung, Y. C. & Huang, H. L. Effects of a Hybrid Teaching Program on Lower Limb Muscle Strength, Knee Function, and Depression in Older Adults After Total Knee Replacement: A Randomized Controlled Trial. *Res. Gerontol. Nurs.* **17** (1), 31–40 (2024).

82. den Hertog, A., Gliesche, K., Timm, J., Muhlbauer, B. & Zebrowski, S. Pathway-controlled fast-track rehabilitation after total knee arthroplasty: a randomized prospective clinical study evaluating the recovery pattern, drug consumption, and length of stay. *Arch. Orthop. Trauma. Surg.* **132** (8), 1153–1163 (2012).
83. Kulig, K. et al. An intensive, progressive exercise program reduces disability and improves functional performance in patients after single-level lumbar microdiskectomy. *Phys. Ther.* **89** (11), 1145–1157 (2009).
84. Beneck, G. J., Popovich, J. M. Jr., Selkowitz, D. M., Azen, S. & Kulig, K. Physical Therapy Clinical Research N. Intensive, progressive exercise improves quality of life following lumbar microdiskectomy: a randomized controlled trial. *Clin. Rehabil*. **28** (9), 892–901 (2014).
85. McCorkle, R. et al. Effects of a nursing intervention on quality of life outcomes in post-surgical women with gynecological cancers. *Psychooncology* **18** (1), 62–70 (2009).
86. Ji, X. & Yan, Y. Effect of Using the Active Cycle of Breathing Technique Combined with Watson's Theory of Human Caring in Rapid Patient Rehabilitation Following Lung Cancer Surgery. *Altern. Ther. Health Med.* **29** (2), 14–20 (2023).
87. Hong, Y. L., Hsieh, T. C., Chen, P. R. & Chang, S. C. Nurse-Led Counseling Intervention of Postoperative Home-Based Exercise Training Improves Shoulder Pain, Shoulder Disability, and Quality of Life in Newly Diagnosed Head and Neck Cancer Patients. *J. Clin. Med.* ;**11**(14). (2022).
88. Zuo, J., Qian, J., Wang, T., Ye, M. & Zhao, J. An analysis of implementation of evidence-based nursing model in health education for early fracture patients and its therapeutic influences. *Am. J. Transl Res.* **13** (5), 4868–4875 (2021).
89. Sun, Z. & Liu, Z. Postoperative comprehensive nursing care improved the prognosis and life quality of patients with minimally invasive retrograde intramedullary nail treatment for femur supracondylar fracture. *Int. J. Clin. Exp. Med.* **12** (7), 8782–8790 (2019).
90. Lin, P. C. et al. To evaluate the effectiveness of a discharge-planning programme for hip fracture patients. *J. Clin. Nurs.* **18** (11), 1632–1639 (2009).
91. Hordam, B., Sabroe, S., Pedersen, P. U., Mejdahl, S. & Soballe, K. Nursing intervention by telephone interviews of patients aged over 65 years after total hip replacement improves health status: a randomised clinical trial. *Scand. J. Caring Sci.* **24** (1), 94–100 (2010).
92. Wang, Z., Yang, L., Zeng, X. & Liu, Y. The effects of seamless nursing on the nursing quality and patient satisfaction in the perioperative nursing of sinusitis patients. *Int. J. Clin. Exp. Med.* **13** (3), 1596–1603 (2020).
93. Onwude, J. L. et al. A randomised trial of photographic reinforcement during postoperative counselling after diagnostic laparoscopy for pelvic pain. *Eur. J. Obstet. Gynecol. Reprod. Biol.* **112** (1), 89–94 (2004).
94. Lindback, Y., Tropp, H., Enthoven, P., Abbott, A. & Oberg, B. PREPARE: presurgery physiotherapy for patients with degenerative lumbar spine disorder: a randomized controlled trial. *Spine J.* **18** (8), 1347–1355 (2018).
95. Lotzke, H. et al. A Person-Centered Prehabilitation Program Based on Cognitive-Behavioral Physical Therapy for Patients Scheduled for Lumbar Fusion Surgery: A Randomized Controlled Trial. *Phys. Ther.* **99** (8), 1069–1088 (2019).
96. Kemani, M. K., Hanafi, R., Brisby, H., Lotzke, H. & Lundberg, M. Long-Term Follow-Up of a Person-Centered Prehabilitation Program Based on Cognitive-Behavioral Physical Therapy for Patients Scheduled for Lumbar Fusion. *Phys. Ther.* ;**104**(8). (2024).
97. Beaupre, L. A., Lier, D., Davies, D. M. & Johnston, D. B. The effect of a preoperative exercise and education program on functional recovery, health related quality of life, and health service utilization following primary total knee arthroplasty. *J. Rheumatol.* **31** (6), 1166–1173 (2004).
98. Vukomanovic, A., Popovic, Z., Durovic, A. & Krstic, L. The effects of short-term preoperative physical therapy and education on early functional recovery of patients younger than 70 undergoing total hip arthroplasty. *Vojnosanit Pregl*. **65** (4), 291–297 (2008).
99. Gocen, Z., Sen, A., Unver, B., Karatosun, V. & Gunal, I. The effect of preoperative physiotherapy and education on the outcome of total hip replacement: a prospective randomized controlled trial. *Clin. Rehabil*. **18** (4), 353–358 (2004).
100. Koet, L. L. et al. Effectiveness of preoperative group education for patients with colorectal cancer: managing expectations. *Support Care Cancer*. **29** (9), 5263–5271 (2021).
101. Boesen, E. H. et al. Psychosocial group intervention for patients with primary breast cancer: a randomised trial. *Eur. J. Cancer*. **47** (9), 1363–1372 (2011).
102. Lin, S-L. et al. Can a 10-Minute Questionnaire Identify Significant Psychological Issues in Patients With Temporomandibular Joint Disease? *J. oral maxillofacial surgery: official J. Am. Association Oral Maxillofacial Surg.* **75** (9), 1856–1865 (2017).
103. Shuldham, C. M., Fleming, S. & Goodman, H. The impact of pre-operative education on recovery following coronary artery bypass surgery. A randomized controlled clinical trial. *Eur. Heart J.* **23** (8), 666–674 (2002).
104. Lenz, E. R. & Perkins, S. Coronary artery bypass graft surgery patients and their family member caregivers: outcomes of a family-focused staged psychoeducational intervention. *Appl. Nurs. Res.* **13** (3), 142–150 (2000).
105. Archer, K. R. et al. Cognitive-Behavioral-Based Physical Therapy for Patients With Chronic Pain Undergoing Lumbar Spine Surgery: A Randomized Controlled Trial. *J. Pain*. **17** (1), 76–89 (2016).
106. Rolving, N. et al. Does a preoperative cognitive-behavioral intervention affect disability, pain behavior, pain, and return to work the first year after lumbar spinal fusion surgery? *Spine (Phila Pa. 1976)*. **40** (9), 593–600 (2015).
107. Rolving, N. et al. Preoperative cognitive-behavioural intervention improves in-hospital mobilisation and analgesic use for lumbar spinal fusion patients. *BMC Musculoskelet. Disord*. **17** (1), 217 (2016).
108. Monticone, M. et al. Management of catastrophising and kinesiophobia improves rehabilitation after fusion for lumbar spondylolisthesis and stenosis. A randomised controlled trial. *Eur. Spine J.* **23** (1), 87–95 (2014).
109. Abbott, A. D., Tyni-Lenné, R. & Hedlund, R. Early Rehabilitation Targeting Cognition, Behavior, and Motor Function After Lumbar Fusion A Randomized Controlled Trial. *Spine* ;**35**(8). (2010).

110. Siggeirsdottir, K. et al. Short hospital stay augmented with education and home-based rehabilitation improves function and quality of life after hip replacement: randomized study of 50 patients with 6 months of follow-up. *Acta Orthop.* **76** (4), 555–562 (2005).
111. Huysmans, E. et al. Effect of perioperative pain neuroscience education in people undergoing surgery for lumbar radiculopathy: a multicentre randomised controlled trial. *Br. J. Anaesth.* **131** (3), 572–585 (2023).
112. Smith, T. O. et al. Randomised controlled trial of a behaviour change physiotherapy intervention to increase physical activity following hip and knee replacement: the PEP-TALK trial. *BMJ Open.* **12** (5), e061373 (2022).
113. Lluch, E. et al. Preoperative Pain Neuroscience Education Combined With Knee Joint Mobilization for Knee Osteoarthritis: A Randomized Controlled Trial. *Clin. J. Pain*. **34** (1), 44–52 (2018).
114. Skolasky, R. L., Maggard, A. M., Li, D., Riley, L. H. 3, Wegener, S. T. & rd, Health behavior change counseling in surgery for degenerative lumbar spinal stenosis. Part I: improvement in rehabilitation engagement and functional outcomes. *Arch. Phys. Med. Rehabil*. **96** (7), 1200–1207 (2015).
115. Skolasky, R. L., Maggard, A. M., Wegener, S. T. & Riley, L. H. 3 Telephone-Based Intervention to Improve Rehabilitation Engagement After Spinal Stenosis Surgery: A Prospective Lagged Controlled Trial. *J. Bone Joint Surg. Am.* **100** (1), 21–30 (2018).
116. Pool, M. K., Nadrian, H. & Pasha, N. Effects of a self-care education program on quality of life after surgery in patients with esophageal cancer. *Gastroenterol. Nurs.* **35** (5), 332–340 (2012).
117. Eastwood, D. et al. Improving postoperative patient reported benefits and satisfaction following spinal fusion with a single preoperative education session. *Spine J.* **19** (5), 840–845 (2019).
118. Wang, T. F., Huang, R. C., Yang, S. C., Chou, C. & Chen, L. C. Evaluating the Effects of a Mobile Health App on Reducing Patient Care Needs and Improving Quality of Life After Oral Cancer Surgery: Quasiexperimental Study. *JMIR Mhealth Uhealth*. **8** (7), e18132 (2020).
119. Barnason, S. et al. Impact of a home communication intervention for coronary artery bypass graft patients with ischemic heart failure on self-efficacy, coronary disease risk factor modification, and functioning. *Heart Lung*. **32** (3), 147–158 (2003).
120. Barnason, S., Zimmerman, L., Nieveen, J. & Hertzog, M. 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*. **35** (4), 225–233 (2006).
121. Piqueras, M. et al. Effectiveness of an interactive virtual telerehabilitation system in patients after total knee arthoplasty: a randomized controlled trial. *J. Rehabil Med.* **45** (4), 392–396 (2013).
122. Bini, S. A. & Mahajan, J. Clinical outcomes of remote asynchronous telerehabilitation are equivalent to traditional therapy following total knee arthroplasty: A randomized control study. *J. Telemed. Telecare*. **23** (2), 239–247 (2017).
123. Moffet, H. et al. In-Home Telerehabilitation Compared with Face-to-Face Rehabilitation After Total Knee Arthroplasty: A Noninferiority Randomized Controlled Trial. *J. Bone Joint Surg. Am.* **97** (14), 1129–1141 (2015).
124. Eichler, S. et al. The Effectiveness of Telerehabilitation as a Supplement to Rehabilitation in Patients After Total Knee or Hip Replacement: Randomized Controlled Trial. *JMIR Rehabil Assist. Technol.* **6** (2), e14236 (2019).
125. Guo, Y. J., Hu, X. Y., Li, J. Y. & Yang, L. Effects of a WeChat-based individualized post-discharge rehabilitation program on patients with lumbar fusion surgery. *J. Back Musculoskelet. Rehabil*. **35** (3), 545–557 (2022).
126. Master, H. et al. Combining Wearable Technology and Telehealth Counseling for Rehabilitation After Lumbar Spine Surgery: Feasibility and Acceptability of a Physical Activity Intervention. *Phys. Ther.* ;**104**(2). (2024).
127. Kanat, C. et al. The effect of video-assisted training on upper extremity problems and functions after rotator cuff repair: a randomized controlled trial. *Turk. J. Med. Sci.* **54** (1), 165–174 (2024).
128. Ihedioha, U., Vaughan, S., Mastermann, J., Singh, B. & Chaudhri, S. Patient education videos for elective colorectal surgery: results of a randomized controlled trial. *Colorectal Dis.* **15** (11), 1436–1441 (2013).
129. Zieren, J., Menenakos, C. & Mueller, J. M. Does an informative video before inguinal hernia surgical repair influence postoperative quality of life? Results of a prospective randomized study. *Qual. Life Res.* **16** (5), 725–729 (2007).
130. Tappen, R. M., Whitehead, D., Folden, S. L. & Hall, R. Effect of a video intervention on functional recovery following hip replacement and hip fracture repair. *Rehabil Nurs.* **28** (5), 148–153 (2003).

Figures

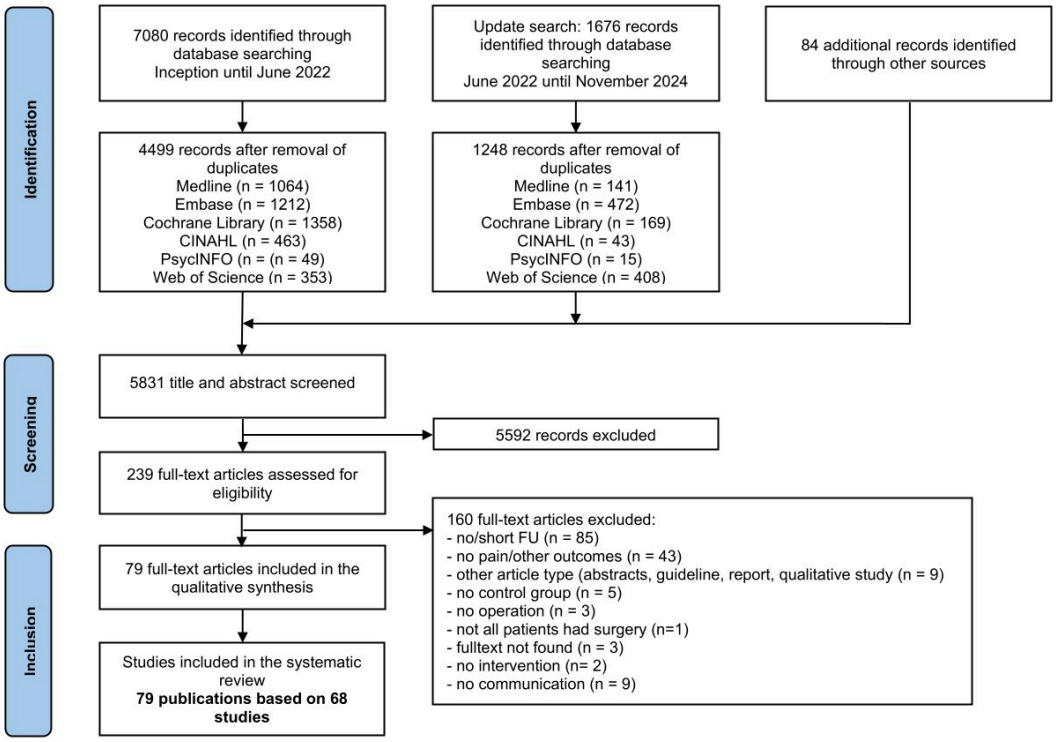


Figure 1

Study flow update search

Legend: Search from the inception to November 24, 2024.

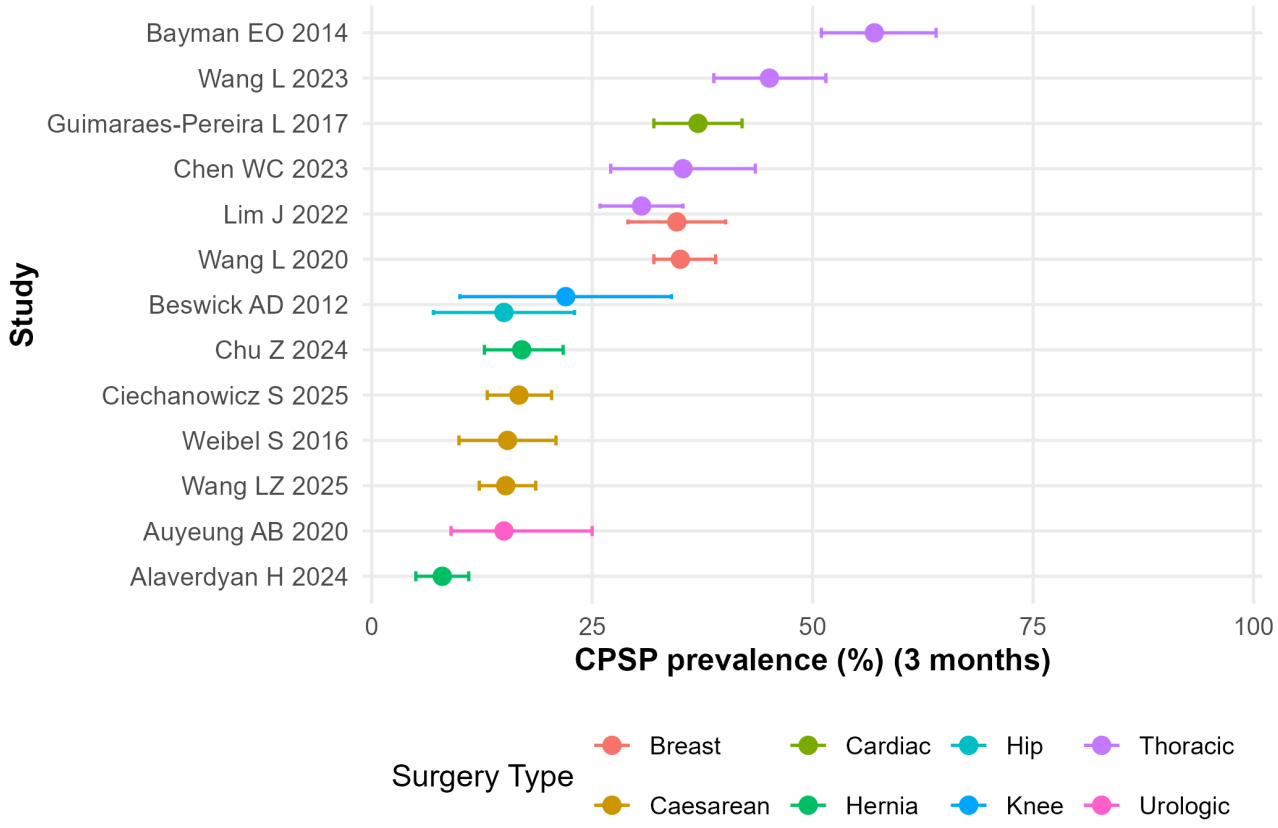
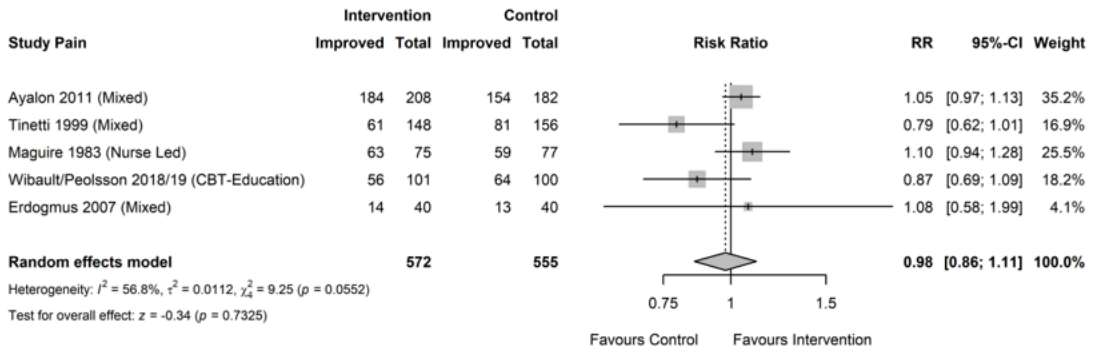


Figure 2

Pooled prevalence of chronic post-surgical pain



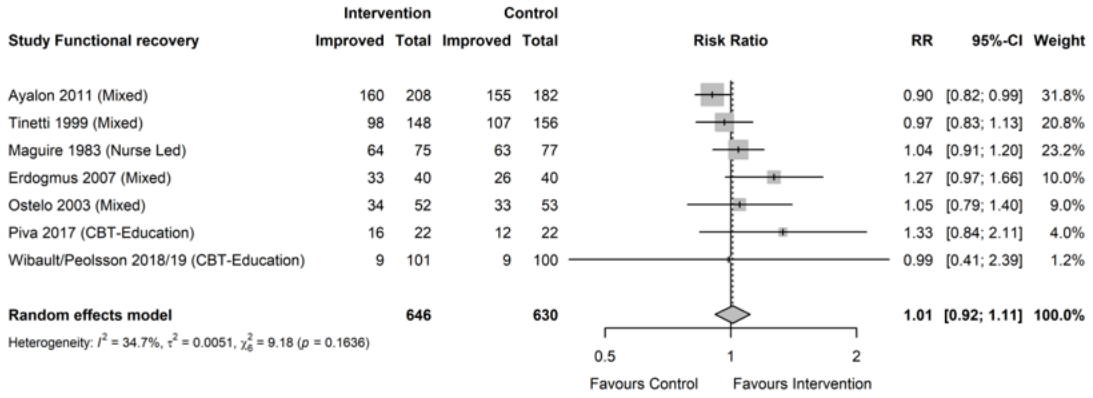


Figure 3

Risk for chronic pain and functional recovery

3A: Forest plot for risk of chronic pain

3B: Forest plot for functional recovery

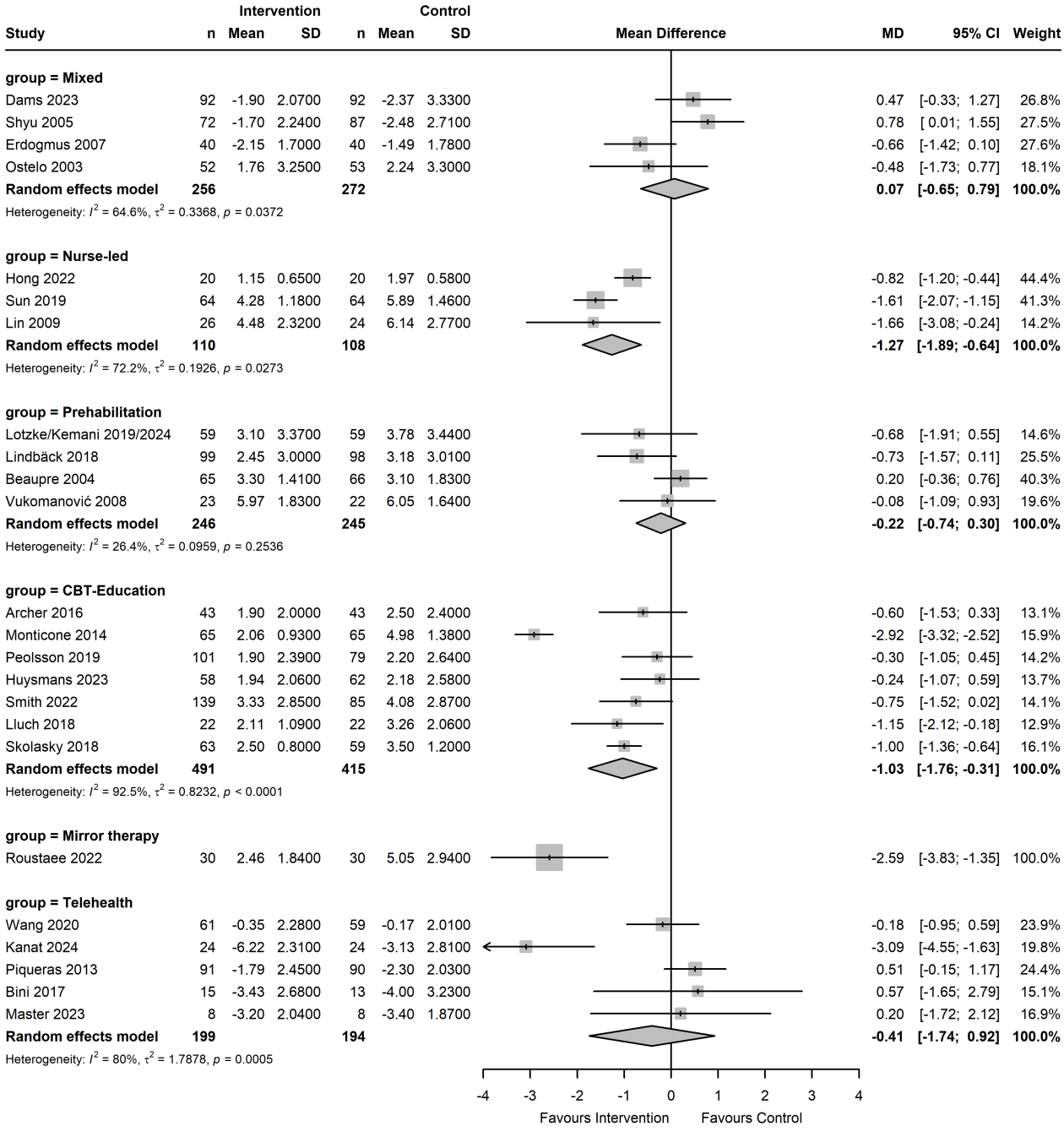


Figure 4

Influence of communication interventions on chronic post-surgical pain

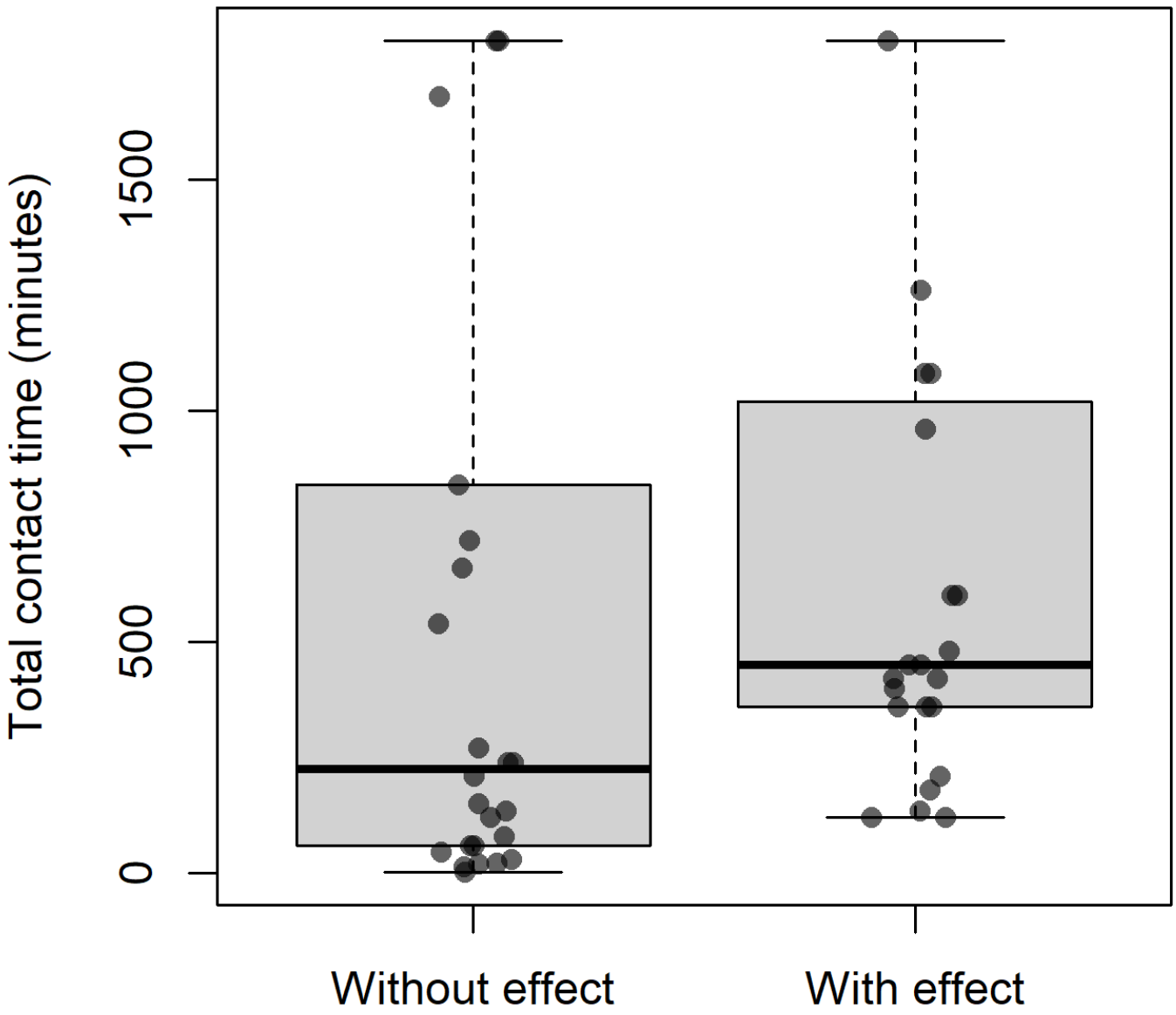


Figure 5

Comparison of overall contact time in studies with impact on pain and/or pain related disability compared to studies without effect

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix.pdf