Measuring surgical patient engagement: A scoping review

Supplement 1: Example search history

EBSCO host

Search conducted on 25 August 2020

Search	Query	Limiters/expanders	Last run via	Results
S1	AB (measure or questionnaire or survey or scale) AND AB (surgery or surgical patients or perioperative care) AND AB (patient engagement or patient activation or patient participation or patient experience or client engagement or consumer engagement) AND AB (outcomes or treatment outcomes or patient reported outcomes)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	688
S2	AB (patient engagement or patient activation or patient participation or patient experience or patient involvement) AND AB (surgery or surgical patients or perioperative care or operative or operation) AND AB (measure or questionnaire or survey or scale)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	1769
S3	AB (patient engagement or patient participation or patient experience) AND AB (surgery or surgical patients) AND AB (outcomes or treatment outcomes or patient- reported outcomes) AND (survey or questionnaire or measure)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	647
S4	AB (measure or scale or questionnaire or survey) AND AB (surgery or surgical patients) AND AB (patient engagement or patient activation or patient participation or patient experience or patient involvement)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	1559
S5	AB (patient engagement or patient activation or patient participation or patient experience or patient involvement) AND AB (surgery or surgical patients or perioperative care) AND AB (measure or scale or questionnaire or survey) AND (levels of engagement or types of engagement)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	3

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Supplement 2: Data extraction of study characteristics

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Andrawis (2015)[12] USA	Higher pre-operative patient activation associated with better patient-reported outcomes after total joint arthroplasty	Longitudinal study	Inclusion criteria: • all patients scheduled to undergo a primary THA/TKA at UCSF Medical Centre from January 2013 to July 2013 and Harbor-UCLA Medical Centre from March 2013 to January 2014 • 18+ • advanced arthritis refractory to conservative management. Language: N/A Informed consent: N/A Exclusion criteria: N/A	N = 125 Mean age 64 ± 10 60% female 30.4% postgraduate degree 64% unemployed/retired 56% TKA 96% active smoker Ethnicity: N/A Marital status: N/A Income: NA	PAM-13 (0-100 PAM score)	N/A	Pre-op: • PAM • HOOS or KOOS (hip disability and osteoarthritis outcome score or knee injury and osteoarthritis outcome score) • UCLA activity scores • physical and mental health (SF12v2). 6 or 12 months post-op: • HOOS or KOOS • UCLA activity scores • physical and mental health (SF12v2) • HKSS (hip and knee satisfaction scale).
Block (2019)[26] USA	Patient activation mediates the association between psychosocial risk factors and spine surgery results	Longitudinal study	Inclusion criteria: • 1574 consecutive patients who presented for spine surgery or a spinal cord stimulator • capable of providing informed consent. Age: N/A Language: N/A Exclusion criteria: N/A	Pre-operative sample: • N = 1254 • mean age 50.41 ± 13.11 • 56.3% female • mean years of education 13.45 ± 2.88 • 61.7% underwent various conventional spine surgeries • 66.5% obtained fusion Ethnicity: N/A Marital status: N/A Income: N/A Employment: N/A Smoking: N/A Post-operative sample: • mean age 50.2 ± 13.03 • 59.4% female • mean years of education 13.53 ± 2.82 • 70.7% underwent various conventional spine surgeries • 29.3% obtained SCS Ethnicity: N/A Marital status: N/A Income: N/A Employment: N/A Smoking: N/A	PAM-13 (2 levels: low and high)	N/A	Pre-op: • PAM • MMPI-2-RF (Minnesota multiphasic personality inventory-2-restructured form). 3 months, 1 and 2 years post-op: • ODI (Oswestry disability index) • pain and spine surgery evaluation survey.

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Graffigna (2018)[10] Italy	Patient health engagement (PHE) model in enhanced recovery after surgery (ERAS): monitoring patients' engagement and psychological resilience in minimally invasive thoracic surgery	Review	Inclusion criteria: N/A Exclusion criteria: NA	N/A	PHE-s (4 stages: 1. blackout 2. arousal 3. adhesion 4. eudaimonic)	N/A	N/A
Gruber (2014)[28] USA	Patient activation and disability in upper extremity illness	Observational study	Inclusion criteria: • patient visiting the office of one of three orthopaedic hand and upper extremity surgeons • 18+ • English speaking. Informed consent: N/A Exclusion criteria: N/A	N= 112 mean age 46 ± 17 (18-88) 51% male 50% married 58% working full time 52% acute injuries 12% smoking Ethnicity: N/A Household income: N/A Education: N/A	PAM-13 (0-100 PAM score)	N/A	Pre-meeting with surgeon: • PAM • demographic questionnaire • quick disabilities of arm, shoulder and hand • patient health questionnaire-2 • pain self- efficacy questionnaire • pain intensity. Second evaluation: (1 or 2 months) • PAM • quick disabilities of arm, shoulder and hand • pain intensity • satisfaction.
Harris (2019)[24] USA	Engaged patients are more likely to be satisfied at one year following adult spinal deformity (ASD) surgery	Conference abstract	Inclusion criteria: • ASD patients (> 5 levels fused) at a multi-provider, single academic institution. Age: N/A Language: N/A Informed consent: N/A Exclusion criteria: N/A	N= 90 mean age 61 ± 11 71% female Median of nine levels fused Ethnicity: N/A Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	PAM-13 (4 levels: Stages I–IV*)	N/A	Pre-op: • PAM 1 year post-op: • North American Spine Society patient satisfaction index
Harris (2020)[32] USA	The engaged patient: Patient activation can predict satisfaction with surgical treatment of lumbar and cervical spine disorders	Longitudinal study	Inclusion criteria: • patients presenting to a multi-provider, academic spine centre between 2014 and 2017 who received elective surgical treatment of lumbar/ cervical spinal disorders. Age: N/A Language: N/A Informed consent: N/A Exclusion criteria: N/A	N= 257 mean age 60 ± 12.2. 59 % female 82% white 5.5% active smokers Marital status: N/A Income: N/A Education: N/A Employment: N/A	PAM-13 (4 levels: Stages I–IV*)	N/A	Pre-op: • PAM • PROMIS (patient reported outcomes measurement information system) health domains 6 weeks and 3, 6, and 12 months post-op: • PAM • PROMIS • patient satisfaction index

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Patel (2019)[29] USA	Patient activation is not associated with post-operative outcomes following anterior cervical discectomy and fusion	Retrospective study	Inclusion criteria: • patients who had undergone a primary, 1–3 anterior cervical discectomy and fusion (ACDF) for degenerative pathology Age: N/A Language: N/A Informed consent: N/A Exclusion criteria: N/A	N=64 mean age: 52.3 59.4% male 11% smokers Ethnicity: N/A Marital status: N/A Income: N/A Education: N/A Employment: N/A	PAM-10 (3 levels: 1. low PAM (bottom quartile) 2. moderate PAM (2nd and 3rd quartile) 3. high (top quartile)).	N/A	Pre-op: • PAM • demographic questionnaire • Charlson comorbidity Index 6 weeks, 3 and 6 months and 1 year post-op: • NDI (neck disability index) • SF-12 PCS (12-item short-form physical component score) • visual analogue scale neck and arm pain.
Skolasky (2008)[13] USA	Patient activation and adherence to physical therapy in persons undergoing spine surgery	Prospective longitudinal study	Inclusion criteria: • academic spine centre patients for degenerative lumbar spinal stenosis surgery between August 2005 and May 2006 • 18+ • English speaking • capable of providing informed consent (determined by a mini-mental status examination score of >18 of 30 points). Exclusion criteria: • previous spine surgery.	N=65 mean age: 58 ± 15 58% female 89% non-Hispanic white 80% married 43.1% $30–50k household income 44.6% < college education Employment status: N/A Smoking: N/A	PAM-13 (2 levels: low and high)	N/A	Pre-op: • PAM • demographic, health and social characteristics • Charlson comorbidity Index Post-op: • attendance: collected weekly through week 6 • engagement during PT (HRERS): collected at week 6
Skolasky (2011)[30] USA	Patient activation and functional recovery in persons undergoing spine surgery	Prospective cohort study	Inclusion criteria: • patients presenting to their academic spine centre from August 2005 to May 2006 undergoing surgical treatment of degenerative lumbar spinal stenosis • 18+ • English speaking • capable of providing informed consent (determined by a mini-mental status examination score of >18 of 30 points). Exclusion criteria: • previous spine surgery.	N=65 mean age: 58 ± 15 59% female 89% non-Hispanic 80% married 43.1% $30-50k household income 44.6% < college education 80% diagnosed with lumbar spine stenosis 20% diagnosed with lumbar spine stenosis associated with spondylolisthesis Employment status: N/A Smoking: N/A	PAM-13 (4 levels: Stages I–IV*)	N/A	Pre-op: • PAM • demographic, health and social characteristics • Charlson comorbidity Index • pain intensity • ODI (Oswestry disability index) • SF-12v2 for physical and mental health. 12 and 24 months post-op: • pain intensity • ODI (Oswestry disability index) • SF-12v2 for physical and mental health.

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Skolasky (2015, Pt 1)[14] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part I: Improvement in rehabilitation engagement and functional outcomes	Prospective clinical trial	Inclusion criteria: • presented at an academic medical centre from December 2009 to August 2012 for surgical treatment of degenerative lumbar spinal stenosis (i.e. instability or deformity) • 18+ • English speaking • capable of providing informed consent. Exclusion criteria: • previous spine surgery	N= 122 mean age: 59 ± 13.3 63% female 77% non-Hispanic white 47.5% LS (lumbar stenosis) 59 control 63 HBCC intervention group Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	HRERS (N/A)	Brief motivational interview-based HBCC versus control	6 weeks post-op: • rehabilitation participation (HRERS) 3 or 6 months post-op: • ODI (Oswestry disability index) • SF-12v2. Therapists assessed engagement in and patients reported attendance at post-operative rehabilitation (physical therapy and/or home exercise program).
Skolasky (2015, Pt 2)[27] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part II: Patient activation mediates the effects of health behaviour change counselling on rehabilitation engagement	Prospective clinical trial	Inclusion criteria: Presented at an academic medical centre from December 2009 to August 2012 for surgical treatment of degenerative lumbar spinal stenosis (i.e., instability or deformity) 18+ English speaking Capable of providing informed consent Exclusion criteria: Previous spine surgery	N= 122 mean age: 59 ± 13.3 63% female 77% non-Hispanic white 47.5% LS (lumbar stenosis) 59 control 63 HBCC intervention group Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	PAM-13 (2 levels: low and high)	Brief motivational interview-based HBCC versus control	Pre-intervention: • PAM. Post-intervention: • PAM. After 6 weeks of PT: • rehabilitation engagement (HRERS) • self-reported attendance in physical therapy and home exercise program.
Yun (2020)[31] USA	A novel surgical patient engagement model: A qualitative study of patients	Qualitative study	Inclusion criteria: • patients from either a safety net or private hospital in the Houston area for surgery for thyroid, parathyroid, colon or rectal cancer, Crohn's disease, ulcerative colitis and diverticulitis • between 18 and 70 years old • English or Spanish as primary language Informed consent: N/A Exclusion criteria: • pregnant • incarcerated • having post-operative complications; secondary active malignancy, a pre-existing vocal cord paralysis, chronic neurological condition affecting voice or swallow, or a need for multivisceral resection • interview time frames greater than four weeks post-operatively..	N= 38 post-operative patients Age: N/A Gender: N/A Ethnicity: N/A Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	PAM-10 (4 levels: Stages I–IV*)	N/A	4 weeks post-op: • open ended qualitative interview • PAM-10.

UCSF = University of California San Francisco, UCLA = University of California Los Angeles, SF-12v2 = medical outcomes study short form-12, version two, HBCC = health behaviour change counselling

* Stage I = persons not taking an active role in their health, Stage II = persons lacking confidence for self-management, Stage III = persons beginning to take action, Stage IV = persons adopting behaviours of health support.

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Supplement 3: Data extraction of study aims and results

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Andrawis (2015)[12] USA	Higher pre-operative patient activation associated with better patient-reported outcomes after total joint arthroplasty	To determine whether patients with higher activation scores would experience: 1. greater resolution of pain and improved activity 2. greater improvements in post-operative physical and mental health 3. greater satisfaction after primary total hip arthroplasty (THA) or total knee arthroplasty (TKA).	• Higher baseline PAM score experienced better pain relief using the HOOS/KOOS (hip/knee injury and osteoarthritis outcome score) pain scores (R2 = 0.311, p = 0.048) and symptoms using the HOOS/KOOS symptom scores (R^2 = 0.272, p = 0.021). • Higher PAM scores were associated with better post-operative mental health using the SF12v21 (R^2 = 0.057, p<0.001). • Higher PAM scores were associated with having greater post-operative satisfaction after surgery using the HKSS questionnaire (R2 = 0.048, p = 0.023).	N/A	N/A	• Higher pre-operative patient activation was associated with better pain relief, decreased symptoms, improved mental health, and greater satisfaction after total joint arthroplasty.
Block (2019)[26] USA	Patient activation mediates the association between psychosocial risk factors and spine surgery results	To determine whether patient activation mediates some of the psychosocial factors previously found to be associated with reduced outcome of spine surgery (SS) and spinal cord stimulation (SCS).	• Higher pre-surgical levels of patient activation assessed by the PAM are associated with improved surgery results. • PAM scores measured prior to surgery negatively correlated with the MMPI-2-RF scales, implying that patients who tend to be more active in their health care also evidence lower psychosocial risk factors. • Patient activation mediates the association between psychosocial risk factors and surgery results, such that more activated patients did not show the same detriment in outcome associated with the psychological risk factors as did those patients who were not as positively activated. • PAM scores did not mediate the relationship between higher pre-surgical MLS scores and patients reporting that surgical results were not meeting their expectations. • Pre-surgical PAM scores were not associated with pre-operative pain levels when assessed at the same time prior to surgery. • All pre-surgical MMPI-2-RF scores were modestly to substantially negatively associated pre-surgical PAM scores. • Pre-surgical PAM scores were modestly associated with lower post-operative ODI scores and higher expectation and satisfaction scores.	N/A	N/A	• Patient activation mediates numerous associations between psychosocial risk factors and suboptimal outcomes --> patients' involvement in obtaining information, decision-making, and their resilience can explain why some patients do not experience adverse surgical results when pre-surgical psychosocial risk factors are present. • Patient activation –patient's involvement in obtaining information, decision-making and resilience during times of stress – mediates such adverse effects.

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Graffigna (2018)[10] Italy	Patient health engagement (PHE) model in enhanced recovery after surgery (ERAS): monitoring patients' engagement and psychological resilience in minimally invasive thoracic surgery	To discuss the implication of the adoption of these scientific tools in the enhanced recovery after surgery (ERAS) experience and their potentialities for health care professionals working in thoracic surgery settings.	N/A	N/A	N/A	• PHE allows clinicians to easily assess patients' level of engagement, and thus their needs and expectations in terms of doctor–patient communication, health literacy and therapeutic education. • The introduction of the PHE-s along the patient journey, thus, would allow tracking of the evolution of patient engagement, to identify critical cases and even to verify the effectiveness of patient support programs in sustaining patients' psychological resilience and participation in health care.
Gruber (2014)[28] USA	Patient activation and disability in upper extremity illness	To determine if higher patient activation correlates with fewer symptoms and less disability in patients with hand and upper extremity illness.	• Patient activation at enrolment correlated with disability (QuickDASH r = -0.31, P < 0.01), pain intensity and satisfaction with treatment but was only retained in the multivariable model for pain intensity. • Decreased disability between enrolment and re-evaluation correlated with > symptoms of depression, higher PAM at follow up and lower self-efficacy. • Significant predictors of pain at follow up included PAM at enrolment (r = -0.055, P < 0.1). • Satisfaction with treatment was weakly, but significantly, correlated with PAM at enrolment, and PAM at follow up.	N/A	• PAM at enrolment was positively correlated with education and negatively correlated with patient health questionnaire-2, QuickDASH at enrolment and pain intensity.	• Given the consistent relationship between effective coping strategies (e.g. pain self-efficacy) and symptoms and disability and the independent influence of patient activation on pain intensity in this study, future research should address the ability of interventions. • Patients who were more engaged in their health care had better health outcomes (correlation between PAM and DASH). • PAM correlated with self-efficacy and self-efficacy is the strongest correlate of disability, even stronger than symptoms of depression.
Harris (2019)[34] USA	Engaged patients are more likely to be satisfied at one year following adult spinal deformity (ASD) surgery	To identify the association between levels of pre-operative patient engagement and post-operative satisfaction among ASD patients.	• Pre-surgery PAM level: 1 = 8.9%, 2 = 14%, 3 = 22%, 4 = 54%. • 86% were satisfied at 1 year. • Greater odds of satisfaction with PAM stage 3 (OR 16.2, 95% CI: 1.02 – 258.8) or 4 (OR 11.7, 95% CI: 1.4 – 97.1). • No significant odds of being satisfied with higher levels of pre-operative activation at 3 or 6 months post-surgery (p < 0.05).	N/A	N/A	• Patients with higher PAM scores have significantly greater odds of satisfaction at 1 year, while the PAM does not predict satisfaction at 6 months, suggesting that engagement becomes important in longer-term post-operative recovery. Clinicians may consider implementing previously proven techniques to increase patient activation in ASD patients for whom surgery is being considered.
Harris (2020)[32] USA	The engaged patient: Patient activation can predict satisfaction with surgical treatment of lumbar and cervical spine disorders	1. To determine whether activated patients are more likely to be satisfied with the results of their surgical treatment following elective spine surgery. 2. To examine the relationship between patient activation and other validated outcome measures in patients undergoing spine surgery in order to better understand how this construct is related to known health-related quality of life domains in this patient population.	• Pre-operative patient activation was weakly correlated (r ≤ 0.2) with PROMIS health domains. • The most activated patients were three times more likely to be satisfied with their treatment at one year (OR 3.23, 95% CI 1.8–5.8). • Similarly, patients in the second-highest stage of activation also demonstrated significantly greater odds of being satisfied (OR 2.8, 95% CI 1.5–5.3).	N/A	N/A	• Patients who are more engaged in their health care prior to elective spine surgery are significantly more likely to be satisfied with their post-operative outcome. Clinicians may want to implement previously proven techniques to increase patient activation in order to improve patient satisfaction following elective spine surgery. • While a majority of patients endorsed the highest level of activation (56%), 51 (20%) endorsed the lower two stages (neither believing that taking an active role was important nor having the knowledge and skills to manage their condition).

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Patel (2019)[29] USA	Patient activation is not associated with post-operative outcomes following anterior cervical discectomy and fusion	To determine whether an association exists between pre-operative patient activation, as measured by the 10-Item Patient Activation Measure (PAM-10), and post-operative outcomes following anterior cervical discectomy and fusion (ACDF).	• Patients were stratified by their PAM scores as follows: – 25 had a low PAM score – 19 had a moderate PAM score – 20 had a high PAM score. • There was no difference in inpatient visual analogue scale (VAS) pain scores or narcotic consumption. • No difference in improvement in VAS neck pain, VAS arm pain, neck disability index, and SF-12 PCS among subgroups at all post-operative follow-ups. • No difference in immediate post-operative pain and narcotic consumption among PAM subgroups.	N/A	N/A	• Although PAM has been associated with better post-operative recovery in lumbar spine patients and other orthopaedic surgeries, our investigation suggests that pre-operative PAM assessments are not an effective method to predict post-operative outcomes following an ACDF.
Skolasky (2008)[13] USA	Patient activation and adherence to physical therapy in persons undergoing spine surgery	To determine: • the association between baseline patient activation and participation in post-operative physical therapy (PT) in a cohort of individuals after lumbar spine surgery • the influence of baseline PAM to predict PT attendance and engagement.	• Low activated patients were more likely to report low hope, and external locus of control compared to high activated individuals. • Increased activation significantly associated with increased hopefulness (P=0.032) and decreased externalised control (powerful others, P<0.001; physicians, P=0.003; other people, P=0.002).	• Scores on PAM were positively correlated with participation (r = 0.53, P<0.001) and engagement (r = 0.75) in PT. • PAM a significant predictor of PT adherence. • PAM accounted for ~25% of variation of attendance. • PAM accounted for ~56% of variation of engagement score. • PAM significantly increased amount of variance explained in these models indicating that PAM provided additional information in the predication of adherence to PT.	• Low activated patients were more likely to report low PT self-efficacy, low hope and external locus of control compared high activated individuals. • Low activation endorsed lower confidence to participate in PT than those with high activation (53% vs 79%). • Non-white individuals were more likely to score < PAM scores (P=0.042). • High household income more likely to have > PAM score (P=0.048). • Increased activation significantly associated with increasing self-efficacy (P<0.001), increased hopefulness (P=0.032) and decreased externalised control (powerful others, P<0.001; physicians, P=0.003; other people, P=0.002).	• Increased patient activation is associated with improved adherence to physical therapy as reflected in attendance and engagement. • A health care provider may be able to quickly assess an individual's propensity to engage in adaptive health behaviour using PAM.

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Skolasky (2011)[30] USA	Patient activation and functional recovery in persons undergoing spine surgery	To determine whether there was an association between pre-operative patient activation and functional recovery after lumbar spine surgery.	• Stage IV had significantly better decrease in pain (P=0.049) and disability (P=0.035) than Stage I.* • Pain intensity decreased by an average of 3.15 ± 1.91 points for Stage IV individuals, which was significantly greater than the average decrease of 2.01 ± 2.24 points for Stage I individuals (p = 0.029). • Highest stage of patient activation experienced a significantly greater reduction in disability than did those in the lowest stage (mean difference, 27.40 ± 3.20 points; p = 0.035). • Significantly lower pain at baseline for Stage III and IV patients than Stage I. • No association between PAM and change in mental health (P=0.081). • Highest stage of patient activation experienced a significantly greater improvement in physical health than those in the lowest stage (mean difference, 4.6 ± 2.28 points; p = 0.044).	N/A	N/A	• High patient activation was associated with better recovery after surgery. • Increased patient activation may lead to improved functional recovery through increased physical therapy adherence after spine surgery in adults.
Skolasky (2015, Pt 1)[14] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part I: Improvement in rehabilitation engagement and functional outcomes	To examine whether a brief motivational interview-based health behaviour change counselling (HBCC) intervention increased patient participation in physical therapy (PT) and/or home exercise programs (HEPs), reduced disability and improved health status after surgery for degenerative lumbar spinal stenosis.	• Effect of the HBCC intervention on disability was mediated through rehabilitation engagement HRERS (indirect effect calculated as a1*b1, 7.35). Rehabilitation engagement measured by HRERS accounted for 41.5% of the effect of the HBCC intervention on disability. • The effect of the HBCC intervention on physical health status was mediated through rehabilitation engagement HRERS (indirect effect: 4.39, 44.6%).	• HBCC patients had significantly higher rehabilitation engagement (21.204.56 vs 23.572.71, respectively). • HBCC intervention on disability was mediated through rehabilitation engagement HRERS (indirect effect: 4.50, 23.1%), attendance in PT (indirect effect: 2.16, 11.1%), and attendance in HEP (indirect effect: 1.04, 5.3%). The effect of the HBCC intervention on physical health status was mediated through rehabilitation engagement HRERS (indirect effect: 2.12, 18.3%), attendance in PT (indirect effect: 1.12, 9.7%), and attendance in HEP (indirect effect: .37, 3.2%).	N/A	• HBCC can improve outcomes after spine surgery through improved rehabilitation participation.

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Skolasky (2015, Pt 2)[27] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part II: Patient activation mediates the effects of health behaviour change counselling on rehabilitation engagement	To determine the effect of health behaviour change counselling (HBCC) on patient activation and the influence of patient activation on rehabilitation engagement, and to identify common barriers to engagement among individuals undergoing surgery for degenerative lumbar spinal stenosis.	• The effect of HBCC on rehabilitation engagement was mediated by patient activation (standardised regression weight, .079; PZ.395).	• Patient activation predicted engagement (standardised regression weight, .682; P<.001). Post-intervention patient activation was predicted by baseline patient activation (standardised regression weight, .808; P<.001) and receipt of HBCC (standardised regression weight, .444; P<.001).	N/A	• The influence of HBCC on rehabilitation engagement was mediated by patient activation. Despite improvements in patient activation, one-third of patients reported low rehabilitation engagement. Addressing these barriers should lead to greater improvements in rehabilitation engagement. • Thematic analysis identified three common barriers to engagement: 1. low self-efficacy because of lack of knowledge and support (62%) 2. anxiety related to fear of movement (57%) 3. concern about pain management (48%).
Yun (2020)[31] USA	A novel surgical patient engagement model: A qualitative study of patients	To define a new model specifically for surgical patient engagement to guide future work to improve patient outcomes.	• Only 2%, or 1 patient, scored a patient activation level of 2, indicating that this patient is disengaged and easily overwhelmed.	N/A	• Of patients completing PAM, 98% obtained a score of 3 or 4, indicating optimal levels of activation despite differences in socio-economic status. • Patients with high self-efficacy also show significant patient engagement, actively participating in their own post-operative care, leading to better outcomes. • Patients displaying a higher level of self-efficacy; patient 2 without the self-efficacy driver displayed a higher level of anxiety regarding his ability to accomplish required self-care tasks such as assessing his health post-operatively at home and properly receiving standardised discharge precautions. Consequently, this patient returned to the emergency department after discharge despite having a normal exam.	• A novel model of patient engagement specific to surgical patients is necessary because of the unique recovery track they endure. Our new model can be used to develop interventions for these patients to improve their engagement and thereby their outcomes.

SF-12v2 = medical outcomes study short form-12, version two, HKSS = hip and knee satisfaction scale, MMPI-2-RF = Minnesota multiphasic personality inventory-2-restructured form, ODI = Oswestry disability index), QuickDASH = shortened version of the disabilities of arm, shoulder and hand (DASH) outcome measure, SF-12 PCS = 12-item short-form physical component score

* Stage I = persons not taking an active role in their health, Stage II = persons lacking confidence for self-management, Stage III = persons beginning to take action, Stage IV = persons adopting behaviours of health support.