

Psychological Factors Affecting Rehabilitation and Outcomes Following Elective Orthopaedic Surgery

David C. Flanigan, MD

Joshua S. Everhart, MD, MPH

Andrew H. Glassman, MD

From The Ohio State University, Columbus, OH.

Dr. Flanigan or an immediate family member serves as a paid consultant to Smith & Nephew and Sanofi; has received research or institutional support from Histogenics; and has received nonincome support (such as equipment or services), commercially derived honoraria, or other non-research-related funding (such as paid travel) from Arthrex, Biomet, Smith & Nephew, and Mitek. Dr. Glassman or an immediate family member has received royalties from Exactech and Innomed; is a member of a speakers' bureau or has made paid presentations on behalf of Exactech and Pipeline Orthopaedics; serves as a paid consultant to Exactech and Pipeline Orthopaedics; has received research or institutional support from Stryker; and serves as a board member, owner, officer, or committee member of the American Academy of Orthopaedic Surgeons and the Columbus (Ohio) Orthopaedic Society. Neither Dr. Everhart nor any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article.

J Am Acad Orthop Surg 2015;23:563-570

<http://dx.doi.org/10.5435/JAAOS-D-14-00225>

Copyright 2015 by the American Academy of Orthopaedic Surgeons.

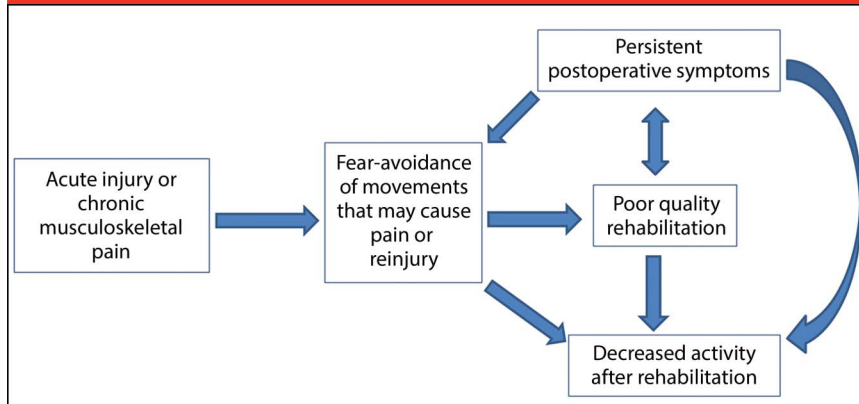
Abstract

Orthopaedic surgery often requires many months of rehabilitation to achieve a successful outcome, regardless of subspecialty. Several important psychological factors strongly influence pain perceptions, rehabilitation compliance, and patient outcomes after common orthopaedic surgeries that require extensive rehabilitation, including total joint arthroplasty, anterior cruciate ligament reconstruction, and spine surgery for degenerative disease. Early recognition of patients exhibiting psychological distress, fear-avoidance behavior, or poor perceived self-efficacy or pessimistic personality traits can be used to improve preoperative risk stratification for poor rehabilitation or surgical outcomes. Several intervention strategies exist to address these psychological factors when they appear to contribute suboptimal postoperative rehabilitation or recovery.

When the primary indication for elective orthopaedic surgeries is symptom relief or a return to a high level of function, the surgeon is frequently required to conduct a careful preoperative assessment to determine whether a given patient is an appropriate surgical candidate. In addition to a basic determination of morbidity and mortality risk, the surgeon must consider how much surgery is likely to benefit the patient compared with nonsurgical management. Many factors, including current symptoms, anticipated lifestyle demands, and identification of a correctable physiologic deficit, are used to synthesize a general impression of whether a given patient will have a satisfactory surgical outcome. A substantial body of evidence shows that patient psychological traits also affect orthopaedic outcomes. In particular, psychological factors that affect compliance, rehabilitation effort,

and pain perception also influence key outcome measures, including complication rates, symptom and function scores, and patient satisfaction.

Increasing evidence shows that postoperative recovery and rehabilitation are substantially influenced by patient choices and psychological traits. It has been consistently reported that psychological factors affect postoperative outcomes following total joint arthroplasty (TJA) and spinal fusion, and in recent years, this topic has also received increased attention with respect to anterior cruciate ligament reconstruction (ACLR). Several evidence-based strategies exist for preoperatively optimizing patients for surgery and for conducting interventions in patients who have problems early on in rehabilitation. Here, we provide a conceptual framework and review of the

Figure 1

Conceptual diagram of fear-avoidance behavior as a contributor to persistent pain and poor-quality rehabilitation. (Adapted with permission from Everhart JS, Best TM, Flanigan DC: Psychological predictors of anterior cruciate ligament reconstruction outcomes: A systematic review. *Knee Surg Sports Traumatol* 2015;23[3]:752-762.)

orthopaedic literature for the psychological traits that are relevant to surgical outcomes as well as an overview of options for psychologically optimizing a patient for surgery and ways to address problems encountered in the postoperative period.

Pain Perception and Its Effect on Postoperative Recovery and Rehabilitation

Differences in psychological and behavioral responses to pain are some of the best-studied factors that may contribute to a lack of return to activity following an injury or surgery.¹ The fear-avoidance model of pain is a cognitive-behavioral theory originally developed by Lethem et al;² this model has persisted for several decades and has been extensively validated.³ In the orthopaedic setting, when patients experience recurrent pain with particular movements or activities, an exaggerated negative psychological response to pain or the anticipation of pain (ie, pain catastrophizing)⁴ may develop that leads

to an active avoidance of movement out of fear of recurrent pain or injury (ie, kinesiophobia).⁵ In the postoperative setting, this persistent fear-avoidance behavior, despite surgical correction of the pain generator, may contribute to poor-quality rehabilitation that, in turn, may lead to insufficient improvement in symptoms (Figure 1).

In the spine literature, van Wilgen et al⁶ found a strong association between levels of kinesiophobia and leg pain or pain disability in a preoperative sample of 128 patients with lumbar stenosis and/or a herniated disk. Archer et al⁷ found that postoperative but not preoperative levels of kinesiophobia were associated with worse postoperative pain and disability in patients treated for degenerative cervical or lumbar conditions. Svensson et al⁸ reported similar results, showing that kinesiophobia was both highly prevalent (45%) and associated with worse quality of life, disability, and pain scores at 10 to 37 months after lumbar discectomy.

In the total joint literature, a greater focus has been placed on the relationship between pain catastrophizing

and surgical outcomes rather than the fear of movement. In a prospective cohort study of 140 total knee arthroplasty (TKA) patients, Riddle et al⁹ reported that patients who exhibited a high degree of preoperative pain catastrophizing were 2.7 times as likely to have an unsatisfactory outcome at 6 months (defined as a <50% improvement in preoperative pain scores) after controlling for other psychological risk factors, including self-efficacy and kinesiophobia. In the immediate postoperative period, Witvrouw et al¹⁰ found that increased preoperative levels of pain catastrophizing but not pain severity were associated with a longer length of hospital stay after TKA.

Kinesiophobia appears to be a strong contributor to high rates of lack of return to sport after ACLR.¹ Flanigan et al¹¹ reported that a large subset of ACLR patients may have difficulty in fully returning to their preinjury activity levels, despite good functional outcomes, because of a persistent fear of reinjury. Conversely, Arden et al¹² demonstrated in a cross-sectional study that patients who do return to sport following ACLR have low levels of kinesiophobia.

Optimism and Self-efficacy: Effect on Postoperative Recovery and Rehabilitation

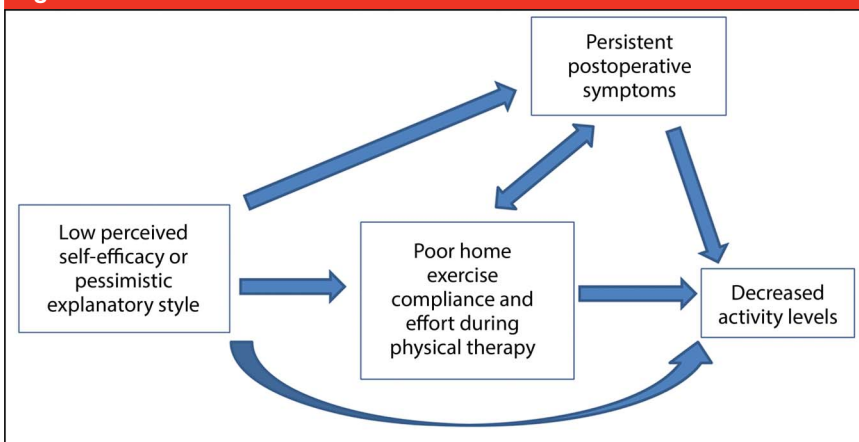
Rehabilitation following major orthopaedic surgery is a daunting, time-intensive task, and satisfactory orthopaedic outcomes are often contingent on good rehabilitation compliance and effort. Perhaps not surprisingly, a consistent relationship has been demonstrated between psychological traits, such as self-confidence, optimism, and motivation to recover from injury, and orthopaedic surgical outcomes.¹³⁻¹⁵

This relationship between personality and task completion was originally described by Bandura¹⁶ as the theory of self-efficacy, and it appears to be particularly relevant for postoperative rehabilitation because confidence, optimism, and motivation are strongly associated with higher rates of task completion in rehabilitation¹⁷ and home exercise adherence¹⁸ (Figure 2).

Among patients who underwent ACLR, self-efficacy and optimism were associated with future knee pain, function, and return to sport.^{13-15,19} Similarly, a consistent association exists between measures of optimism or self-efficacy and successful outcomes following ACLR. Thomeé et al¹³ found that perceived self-efficacy at completing future knee rehabilitation exercises was predictive of higher self-rated knee function and activity scores at 12-month follow-up; comparable results were reported by Brewer et al¹⁴ with respect to self-motivation and higher rates of home exercise completion and greater effort during rehabilitation. Similarly, Swirtun and Renström¹⁵ found high levels of optimism were associated with higher knee function scores at 5-year follow-up.

Among 251 primary TKA patients, Wylde et al²⁰ found that self-efficacy was an important preoperative predictor of Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain and function scores at 1-year follow-up. Similar results were reported by Venkataramanan et al²¹ in 145 revision TKA patients; in this prospective study, perceptions of helplessness were associated with higher pain and disability scores as well as lower satisfaction at 2-year follow-up. Finally, in a large cohort of 702 primary TKA patients, Singh et al²² reported that patients with a pessimistic explanatory style had more moderate or severe pain (odds ratio, 2.21) and less improvement in knee

Figure 2



Conceptual diagram of self-efficacy and optimism as personality traits that positively influence rehabilitation quality and surgical outcomes. (Adapted with permission from Everhart JS, Best TM, Flanigan DC: Psychological predictors of anterior cruciate ligament reconstruction outcomes: A systematic review. *Knee Surg Sports Traumatol* 2015;23[3]:752-762.)

function (odds ratio, 0.53) at 2-year follow-up.

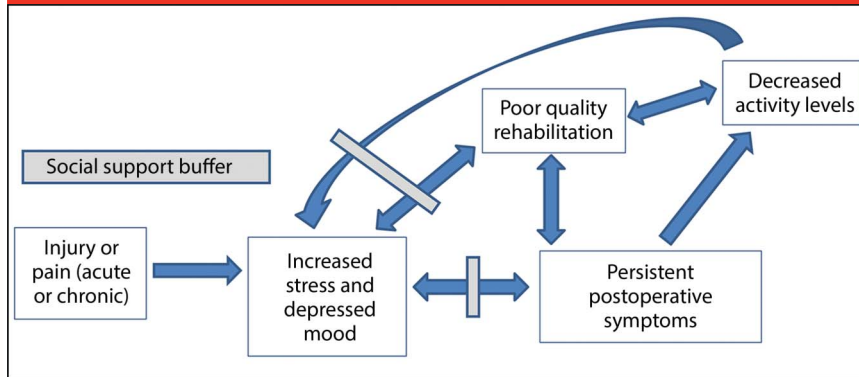
In the spine literature, limited data relate to the role of optimism or self-efficacy in surgical outcomes. In a moderately sized prospective study of 65 patients who underwent lumbar spine surgery, higher preoperative patient activation scores (ie, a measure of a patient's propensity to engage in positive health behaviors, such as rehabilitation) were associated with greater improvements in pain and disability postoperatively.²³ In a cross-sectional study of 201 patients with cervical radiculopathy who were scheduled for surgery, Wibault et al²⁴ reported that low self-efficacy was strongly associated with worse Neck Disability Index scores.

Depression, Stress, and Social Support

A well-studied relationship exists between a patient's level of psychological stress and overall physical and mental health as well as the ability to recover from injury or surgery. Cohen and Wills²⁵ hypothesized that stress

and depression globally affect physical and mental health and that a person's degree of social support is believed to modulate this effect. The relationship between stress, depression, and pain in patients with chronic low back pain has been well-studied;²⁶ this relationship also strongly influences symptom severity and the ability to recover from surgery in patients with chronic or acute musculoskeletal conditions (Figure 3).

Following ACLR, Brewer et al¹⁴ found that higher levels of stress were associated with greater postoperative knee laxity and that higher levels of social support were associated with better rates of home exercise completion. Among younger athletes, Brewer et al²⁷ found that team participation itself was a major source of social support and that a lack of athletic self-identity due to injury-related time away from sport resulted in worse rehabilitation outcomes. In a larger study of 180 patients who underwent arthroscopic knee surgery, Rosenberger et al²⁸ found that preoperative stress was predictive of postoperative pain at 1 year.

Figure 3

Conceptual diagram of stress, depression, and social support as modulators of musculoskeletal symptoms and quality of life following orthopaedic surgery. Stress and depression have a known negative effect on rehabilitation effort and compliance. This indirectly leads to persistent postoperative symptoms, including pain and stiffness; however, there is also a direct association between stress, depression, and higher pain scores regardless of rehabilitation quality. A feedback loop is created in which frustration surrounding poor rehabilitation, persistent symptoms, and decreased activity levels results in yet higher levels of stress and depression. A strong sense of social support can have a buffering effect and attenuate (but not eliminate) the relationship between high stress and depression and somatic symptoms or rehabilitation effort and compliance. (Adapted with permission from Everhart JS, Best TM, Flanigan DC: Psychological predictors of anterior cruciate ligament reconstruction outcomes: A systematic review. *Knee Surg Sports Traumatol* 2015;23[3]:752-762.)

Assessment and Intervention for Psychological Factors That Could Affect Recovery

Several strategies exist for pre-operative and postoperative psychological optimization of patients who appear to exhibit psychological distress, fear-avoidance behavior patterns, or poor self-efficacy or pessimistic explanatory style (Table 1). Based on the current literature, the presence of one or more of these psychological traits or behaviors is not an absolute contraindication to surgery, although there are relative contraindications to surgery in specific populations (Table 2).

Depression or increased stress is not a contraindication to TJA or spinal surgery for degenerative disease because the pain relief offered by surgery often results in an improvement in mental health symptoms. However, patients exhibiting signs of major clinical depression should always receive referral to an appropriate mental health provider if they are not already actively seeking treatment. The Center for Epidemiologic Studies Depression Scale is a self-administered questionnaire that can be used as a screening tool; scores >20 indicate an increased risk for depression⁴² (Table 3). Using the *Diagnostic and Statistical Manual*, 4th edition (DSM-IV)

Although stress and depression appear to result in worse overall outcomes following TKA, the current literature suggests that the magnitude of improvement is similar among distressed and nondistressed patients and that the pain relief afforded by TKA can improve mental health.²⁹⁻³¹ Psychologically distressed patients appear to have worse symptoms at baseline; among 104 TKA patients followed prospectively, Hirschmann et al²⁹ reported that preoperative and postoperative depression and anxiety scores both significantly correlated with worse knee pain scores before surgery and at 1-year follow-up. Lavernia et al³⁰ conducted a prospective study of 640 TJA patients and found that those with greater psychological distress had lower postoperative symptom scores at a minimum 2-year follow-up; however, the magnitude of improvement in symptoms was

similar between distressed and non-distressed patients. Blackburn et al³¹ reported similar results with regard to preoperative anxiety and depression and postoperative knee disability scores; however, the authors also found that patients with postoperative improvements in pain and depression had greater improvements in pain scores, suggesting that pain relief afforded by TKA can improve mental health symptoms.

In a prospective series of 302 patients who underwent elective spine surgery for degenerative disease, Maratos et al³² found that patients with high preoperative stress and depression scores had worse physical function at 1-year follow-up; however, the magnitude of improvement in function was similar among patients with and without psychological distress, and significant improvements in mental health scores were also seen following surgery. Similarly,

criteria for major depression disorder, Zimmerman et al⁴³ proposed and validated a simplified version that includes the presence of at least three (one of which is low mood or loss of interest) of the following five symptoms: low mood, loss of interest, feelings of guilt or worthlessness, impaired concentration or indecisiveness, and death wishes or suicidal thoughts.

Attendance at a preoperative education class for joint arthroplasty surgery is an effective way to reduce self-reported anxiety.³⁵ Use of peer support (ie, volunteers who have recovered from the same surgery) can significantly affect anxiety, self-efficacy expectations, and activity following major procedures, such as cardiac surgery; however, this finding has not been investigated in an orthopaedic setting.³⁶ Other methods to counteract the isolation and loss of social support athletes often experience during injury and recovery include pairing of injured athletes with previously injured athletes who have recovered and providing encouragement to stay involved in team training sessions or events.³⁷

Fear-avoidance behavior patterns may be addressed with a variety of modalities. In patients who exhibit pain catastrophizing, cognitive-behavioral therapy has been effective in mentally “retraining” patients to better cope with pain with movement.³⁸ Patients with chronic low back pain can also benefit from a desensitization protocol with physical therapists in which they are exposed to either graded exercises (ie, slow progression to an exercise quota) or graded exposure (ie, slow introduction of movements feared by the patient to cause pain).³⁹ Additional strategies to reduce kinesiophobia in a sports setting include sports psychology referral and pairing athletes with other athletes who have recovered from injury.³⁷

Patients who appear to display poor rehabilitation effort and

Table 1

Psychological Optimization in the Elective Orthopaedic Patient

Pain Catastrophizing and Kinesiophobia

Cognitive-behavioral pain management³⁸
Desensitization therapy with physical therapy³⁹
Sports psychologist referral³⁷

Stress, Depression, and Social Support

Consider primary care or mental health referral if untreated depression suspected
Peer support network of previous patients³⁶ or athletes who have recovered from injury³⁷
Attendance at a preoperative education class³⁵

Self-efficacy, Self-motivation, and Optimism

Clinical staff-delivered motivational phone calls or in-person interviewing^{40,41}
Goal setting and positive self-talk^{19,40,41}
Sports psychologist referral³⁷

Table 2

Relative Psychological Contraindications to Elective Orthopaedic Surgery

All Elective Surgeries

Clinical suspicion for untreated depression or CES-D score >20⁴²
Recommended action: Delay surgery until depression is addressed by a mental health provider.

Anterior Cruciate Ligament Reconstruction

High risk for poor-quality rehabilitation or high levels of kinesiophobia in the setting of low baseline functional demands and/or lack of symptoms of instability
Recommended action: Delay surgery and initiate physical therapy. Request an attendance record and a progress letter from the physical therapist. Do not offer surgery at follow-up if the patient has relief of symptoms or has poor rehabilitation attendance or effort.

Spine Surgery

High stress and depression in patients being assessed for revision surgery³⁴
Recommended action: Delay surgery until the patient has sought appropriate treatment. Require a letter from the mental health provider indicating that the patient has had a significant treatment response and is now well-controlled.
Stress and treated depression are not contraindications to primary surgery
Recommended action: No delay or cancellation of surgery is required. During the preoperative discussion, counsel patients that although their symptoms will improve, there is an increased likelihood that they will not become symptom free.

Total Joint Arthroplasty

Stress and treated depression are not contraindications to surgery
Recommended action: No delay or cancellation of surgery is required. During the preoperative discussion, counsel patients that although their symptoms will improve, there is an increased likelihood that they will not become symptom free.

CES-D = Center for Epidemiologic Studies Depression Scale

compliance or who voice pessimistic views of their ability to recover may benefit from several behavioral modification strategies focused on

improving task completion. Scherzer et al¹⁹ reported that patients instructed in goal setting and positive self-talk strategies before starting

Table 3
Center for Epidemiologic Studies Depression (CES-D) Scale

Instructions: Below is a list of the ways you might have felt or behaved. Please choose the response that best indicates how often you have felt this way in the past week or so.

0 (not at all or less than 1 day last week)
1 (1–2 days last week)
2 (3–4 days last week)
3 (5–7 days last week)

1. I was bothered by things that don't usually bother me.
2. I did not feel like eating; my appetite was poor.
3. I felt that I could not shake off the blues even with the help of my family or friends.
4. I felt that I was just as good as other people.
5. I had trouble keeping my mind on what I was doing.
6. I felt depressed.
7. I felt everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt fearful.
11. My sleep was restless.
12. I was happy.
13. I talked less than usual.
14. I felt lonely.
15. People were unfriendly.
16. I enjoyed life.
17. I had crying spells.
18. I felt sad.
19. I felt that people disliked me.
20. I could not get "going."

Scoring: Sum the scores for all questions except 4, 8, 12, and 16. For questions 4, 8, 12, and 16, sum the reverse score (3 points for <1 day per week, 2 for 1–2 days per week, 1 for 3–5 days per week, and 0 for >5 days per week). The total score ranges from 0 to 60 with higher scores indicating more depressive symptoms.

Interpretation: Scores <15 are clinically insignificant. Scores 16–20 are suggestive of mild-moderate depression. Scores >20 are suggestive of major depression.

Adapted with permission from Radloff LS: The CES-D scale: A self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;1:385-401.

rehabilitation after ACLR had greater rates of home exercise completion and participated with greater effort during rehabilitation as perceived by the physical therapist. Skolasky et al⁴⁰ reported that structured goal-setting and motivational interviewing by clinical staff are also core components of ongoing clinical trials for recovery from lumbar spine surgery. Mertens et al⁴¹ reported on

a nursing-delivered motivational interviewing protocol that is used to prepare patients for rehabilitation for chronic musculoskeletal pain (the PREPARE trial). An important but challenging aspect of treating a patient with psychological traits that can adversely affect surgical outcomes is determining when the patient is ready for surgery or is benefitting from an

intervention. There are several specific situations in which we recommend delay or cancellation of surgery until certain treatment end points are met (Table 2). Additionally, among patients who do not require delay of surgery but would benefit from an intervention, we recommend use of treatment end points based on correspondence from the treating provider; objective evidence, such as an attendance record; or patient self-report (Table 4). In patients who initially present with suspected, untreated depression, a clearance letter from the treating primary care physician or mental health provider may be used to confirm a positive treatment response. Progress letters after referral for desensitization therapy, cognitive-behavioral therapy, or sports psychology evaluation are helpful to assess response and the need for further treatment. Patients who demonstrate poor rehabilitation compliance or effort in the early postoperative period can be monitored with an attendance record and a progress letter from the physical therapist. Self-report of conversations with previously injured patients is often helpful to assess whether this intervention has decreased anxiety regarding surgery or rehabilitation. If a goal-setting method is being used, the provider can ask the patient to report on his or her initial experiences, thus giving the provider an opportunity to realign expectations if the stated goals are unrealistic or if the patient initially has trouble meeting the goals.

Summary

Several basic psychological processes influence patient outcomes following elective orthopaedic surgeries, including ACLR, TJA, and spine surgery. Early recognition of patients exhibiting psychological distress,

fear-avoidance behavior, or poor perceived self-efficacy or pessimistic personality traits can be used to improve preoperative risk stratification for poor rehabilitation or surgical outcomes. Several intervention strategies exist to address these psychological factors when they appear to be contributing to sub-optimal postoperative rehabilitation or recovery. For patients with depression or high stress who present for TJA or primary elective spine surgery, it is important during the preoperative discussion to emphasize that although surgery should improve their symptoms, there is an increased likelihood that they will not become symptom free.

References

Evidence-based Medicine: Levels of evidence are described in the table of contents. In this article, references 6, 7, 9, 10, 13, 15, 21, 23, 28-30, 32, 33, and 38 are level I studies. References 5, 8, 20, 24, 26, 27, 31, 36, 39, and 41 are level II studies. References 11, 12, 22, 34, and 43 are level III studies. Reference 37 is a level IV study. References 1, 4, 14, 16-19, and 42 are level V expert opinion.

References printed in **bold type** are those published within the past 5 years.

1. Ardern CL, Webster KE, Taylor NF, Feller JA: Return to sport following anterior cruciate ligament reconstruction surgery: A systematic review and meta-analysis of the state of play. *Br J Sports Med* 2011;45(7):596-606.
2. Lethem J, Slade PD, Troup JD, Bentley G: Outline of a fear-avoidance model of exaggerated pain perception: I. *Behav Res Ther* 1983;21(4):401-408.
3. Leeuw M, Goossens ME, Linton SJ, Crombez G, Boersma K, Vlaeyen JW: The fear-avoidance model of musculoskeletal pain: Current state of scientific evidence. *J Behav Med* 2007;30(1):77-94.
4. Sullivan MJ, Bishop SR, Pivik J: The pain catastrophizing scale: Development and validation. *Psychol Assess* 1995;7:524.

Table 4

Recommended Treatment End Points for Psychological Optimization in the Elective Orthopaedic Patient

Correspondence With Treating Provider

A clearance letter from the treating primary care provider or mental health professional is recommended for patients who initially present with suspected, untreated depression or for patients with known depression who request revision spine surgery.

A progress letter from the physical therapist is useful to identify patients with poor rehabilitation compliance and/or to assess improvement after an intervention.

Progress letters following desensitization therapy, cognitive-behavioral therapy, referral for pain catastrophizing, or sports psychology referral can be used to assess response to treatment.

Attendance or Completion Record

An improved attendance record at physical therapy sessions can be used as an end point for discontinuing staff-delivered motivational calls.

A record of completion of a preoperative educational session or video can be required to schedule surgery.

Patient Self-report

Patient-self report of an interaction with a former patient or athlete can be used to assess whether this intervention has decreased stress or apprehension regarding surgery or rehabilitation.

Self-report of goal-setting strategies can be used to assess whether the patient perceived them to be useful and to realign expectations if the stated goals are unrealistic.

5. Swinkels-Meewisse EJ, Swinkels RA, Verbeek AL, Vlaeyen JW, Oostendorp RA: Psychometric properties of the Tampa Scale for kinesiophobia and the fear-avoidance beliefs questionnaire in acute low back pain. *Man Ther* 2003;8(1):29-36.
6. van Wilgen CP, Stewart R, Patrick Stegeman PT, Coppes M, van Wijhe M: Fear of movement in pre-operative patients with a lumbar stenosis and/or herniated disc: Factor structure of the Tampa scale for kinesiophobia. *Man Ther* 2010;15(6):593-598.
7. Archer KR, Phelps KD, Seebach CL, Song Y, Riley LH III, Wegener ST: Comparative study of short forms of the Tampa Scale for Kinesiophobia: Fear of movement in a surgical spine population. *Arch Phys Med Rehabil* 2012;93(8):1460-1462.
8. Svensson GL, Lundberg M, Ostgaard HC, Wendt GK: High degree of kinesiophobia after lumbar disc herniation surgery: A cross-sectional study of 84 patients. *Acta Orthop* 2011;82(6):732-736.
9. Riddle DL, Wade JB, Jiranek WA, Kong X: Preoperative pain catastrophizing predicts pain outcome after knee arthroplasty. *Clin Orthop Relat Res* 2010;468(3):798-806.
10. Witvrouw E, Pattyn E, Almqvist KF, et al: Catastrophic thinking about pain as a predictor of length of hospital stay after total knee arthroplasty: A prospective study. *Knee Surg Sports Traumatol Arthrosc* 2009;17(10):1189-1194.
11. Flanigan DC, Everhart JS, Pedroza A, Smith T, Kaeding CC: Fear of reinjury (kinesiophobia) and persistent knee symptoms are common factors for lack of return to sport after anterior cruciate ligament reconstruction. *Arthroscopy* 2013;29(8):1322-1329.
12. Ardern CL, Taylor NF, Feller JA, Webster KE: Fear of re-injury in people who have returned to sport following anterior cruciate ligament reconstruction surgery. *J Sci Med Sport* 2012;15(6):488-495.
13. Thomeé P, Währborg P, Börjesson M, Thomeé R, Eriksson BI, Karlsson J: Self-efficacy of knee function as a pre-operative predictor of outcome 1 year after anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2008;16(2):118-127.
14. Brewer BW, Van Raalte JL, Cornelius AE, et al: Psychological factors, rehabilitation adherence, and rehabilitation outcome after anterior cruciate ligament reconstruction. *Rehabil Psychol* 2000;45:20.
15. Swirtun LR, Renström P: Factors affecting outcome after anterior cruciate ligament injury: A prospective study with a six-year follow-up. *Scand J Med Sci Sports* 2008;18(3):318-324.

16. Bandura A: Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev* 1977;84(2):191-215.
17. Altmaier EM, Russell DW, Kao CF, Lehmann TR, Weinstein JN: Role of self-efficacy in rehabilitation outcome among chronic low back pain patients. *J Couns Psychol* 1993;40:335.
18. Desharnais R, Bouillon J, Godin G, et al: Self-efficacy and outcome expectations as determinants of exercise adherence. *Psychol Rep* 1986.
19. Scherzer CB, Brewer BW, Cornelius AE, et al: Psychological skills and adherence to rehabilitation after reconstruction of the anterior cruciate ligament. *J Sport Rehabil* 2001;10(3):165-173.
20. Wylde V, Dixon S, Blom AW: The role of preoperative self-efficacy in predicting outcome after total knee replacement. *Musculoskeletal Care* 2012;10(2):110-118.
21. Venkataramanan V, Gignac MA, Dunbar M, et al: The importance of perceived helplessness and emotional health in understanding the relationship among pain, function, and satisfaction following revision knee replacement surgery. *Osteoarthritis Cartilage* 2013;21(7):911-917.
22. Singh JA, O'Byrne MM, Colligan RC, Lewallen DG: Pessimistic explanatory style: A psychological risk factor for poor pain and functional outcomes two years after knee replacement. *J Bone Joint Surg Br* 2010;92(6):799-806.
23. Skolasky RL, Mackenzie EJ, Wegener ST, Riley LH III: Patient activation and functional recovery in persons undergoing spine surgery. *J Bone Joint Surg Am* 2011;93(18):1665-1671.
24. Wibault J, Öberg B, Dederich Å, et al: Individual factors associated with neck disability in patients with cervical radiculopathy scheduled for surgery: A study on physical impairments, psychosocial factors, and life style habits. *Eur Spine J* 2014;23(3):599-605.
25. Cohen S, Wills TA: Stress, social support, and the buffering hypothesis. *Psychol Bull* 1985;98(2):310-357.
26. Häuser W, Schmutzer G, Brähler E, Schiltenswolf M, Hilbert A: The impact of body weight and depression on low back pain in a representative population sample. *Pain Med* 2014;15(8):1316-1327.
27. Brewer BW, Cornelius AE, Van Raalte JL, et al: Age-related differences in predictors of adherence to rehabilitation after anterior cruciate ligament reconstruction. *J Athl Train* 2003;38(2):158-162.
28. Rosenberger PH, Kerns R, Jokl P, Ickovics JR: Mood and attitude predict pain outcomes following arthroscopic knee surgery. *Ann Behav Med* 2009;37(1):70-76.
29. Hirschmann MT, Testa E, Amsler F, Friederich NF: The unhappy total knee arthroplasty (TKA) patient: Higher WOMAC and lower KSS in depressed patients prior and after TKA. *Knee Surg Sports Traumatol Arthrosc* 2013;21(10):2405-2411.
30. Lavernia CJ, Alcerro JC, Brooks LG, Rossi MD: Mental health and outcomes in primary total joint arthroplasty. *J Arthroplasty* 2012;27(7):1276-1282.
31. Blackburn J, Qureshi A, Amirfeyz R, Bannister G: Does preoperative anxiety and depression predict satisfaction after total knee replacement? *Knee* 2012;19(5):522-524.
32. Maratos EC, Trivedi R, Richards H, Seeley H, Laing RJ: Psychological distress does not compromise outcome in spinal surgery. *Br J Neurosurg* 2012;26(4):466-471.
33. Skolasky RL, Riley LH III, Maggard AM, Wegener ST: The relationship between pain and depressive symptoms after lumbar spine surgery. *Pain* 2012;153(10):2092-2096.
34. Adogwa O, Parker SL, Shau DN, et al: Preoperative Zung depression scale predicts patient satisfaction independent of the extent of improvement after revision lumbar surgery. *Spine J* 2013;13(5):501-506.
35. Prouty A, Cooper M, Thomas P, et al: Multidisciplinary patient education for total joint replacement surgery patients. *Orthop Nurs* 2006;25(4):257-261.
36. Parent N, Fortin F: A randomized, controlled trial of vicarious experience through peer support for male first-time cardiac surgery patients: Impact on anxiety, self-efficacy expectation, and self-reported activity. *Heart Lung* 2000;29(6):389-400.
37. Podlog L, Dimmock J, Miller J: A review of return to sport concerns following injury rehabilitation: Practitioner strategies for enhancing recovery outcomes. *Phys Ther Sport* 2011;12(1):36-42.
38. Nicholas MK, Asghari A, Corbett M, et al: Is adherence to pain self-management strategies associated with improved pain, depression and disability in those with disabling chronic pain? *Eur J Pain* 2012;16(1):93-104.
39. George SZ, Wittmer VT, Fillingim RB, Robinson ME: Comparison of graded exercise and graded exposure clinical outcomes for patients with chronic low back pain. *J Orthop Sports Phys Ther* 2010;40(11):694-704.
40. Skolasky RL, Riley LH III, Maggard AM, Bedi S, Wegener ST: Functional recovery in lumbar spine surgery: A controlled trial of health behavior change counseling to improve outcomes. *Contemp Clin Trials* 2013;36(1):207-217.
41. Mertens VC, Goossens ME, Verbunt JA, Köke AJ, Smeets RJ: Effects of nurse-led motivational interviewing of patients with chronic musculoskeletal pain in preparation of rehabilitation treatment (PREPARE) on societal participation, attendance level, and cost-effectiveness: Study protocol for a randomized controlled trial. *Trials* 2013;14:90.
42. Radloff LS: The CES-D Scale: A self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;1:385-401.
43. Zimmerman M, Galione JN, Chelminski I, et al: A simpler definition of major depressive disorder. *Psychol Med* 2010;40(3):451-457.