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Published in:
The Spine Journal

DOI:
10.1016/j.spinee.2018.03.017

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record with the publisher's layout.

Link to publication

Citation for published version (APA):

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Anxiety and depression in spine surgery—a systematic integrative review

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Received 31 October 2017; revised 15 March 2018; accepted 26 March 2018

Abstract

BACKGROUND: Symptoms of preoperative anxiety and depression occur in approximately one-third of patients with chronic back pain undergoing surgery. In the last 2 decades, several studies have established that preoperative anxiety and depression are important outcome predictors of greater pain and physical impairments, and lower health-related quality of life in patients undergoing spine surgery. To accommodate symptoms of anxiety and depression and thereby better surgical outcomes, we need to identify factors associated with these symptoms.

PURPOSE: We aimed to identify factors associated with symptoms of anxiety and depression in adults both before and after undergoing spinal surgery.

STUDY DESIGN: An integrative literature review was carried out.

METHODS: The independent charity Helsefonden supported this literature review by contributing $45,000 to remunerate a dedicated investigator. A systematic literature search was conducted in PubMed, CINAHL, PsycINFO, Embase, Scopus, Cochrane, and Web of Science. A three-step selection and assessment process was conducted; titles and abstracts of 1,124 articles were skimmed for relevance and of these, 53 articles were found to be of relevance and were read in full. Articles not meeting the inclusion criteria (n=26) were excluded. The 31 articles were critically appraised for methodological validity; 14 of these were synthesized and analyzed using a convergent qualitative design to transform both qualitative and quantitative articles into qualitative findings.

RESULTS: Fourteen studies were included, reporting results based on 4,833 participants, 3,017 men and 1,816 women, whose mean age was approximately 49 years. From these results, we extracted 75 individual findings, which we then divided into five categories of factors associated with anxiety and depression both before and after undergoing spine surgery: pain, information, disability, employment, and mental health.

FDA device/drug status: Not applicable.

Author disclosures: JS: Grant: Independent charity Helsefonden (E, Paid directly to institution), pertaining to the submitted work. MBB: Nothing to disclose. CVN: Nothing to disclose. CNT: Nothing to disclose. TLF: Nothing to disclose.

The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

https://doi.org/10.1016/j.spinee.2018.03.017
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Introduction

This is an integrative review, a method that allows for the inclusion of diverse methodologies. The review aims to identify factors associated with symptoms of anxiety and depression throughout the course of treatment of adults undergoing spine surgery. These factors can be used to develop preoperative and postoperative educational initiatives and aids to reduce anxiety and depression within this patient group. Symptoms of preoperative anxiety and depression occur in approximately one-third of patients with chronic back pain who undergo surgery [1,2] and found to be common in patients with chronic back pain in general [3,4], with an estimated prevalence of depression to be two to three times greater in patients with back pain than in the general population [3]. The last decade, several studies have established that preoperative anxiety and depression are important outcome predictors of greater pain, physical impairments, and lower health-related quality of life in patients undergoing spine surgery [5–9]. Thus, both anxiety and depression can be associated with poor surgical results, leading to poorer rehabilitation.

It has been shown that educating patients about surgical procedures has the potential to decrease the occurrence of anxiety in patients undergoing cervical disc herniation surgery [10]. However, the question is how the identification of the overall factors associated with anxiety and depression in spine surgery is addressed in the literature. The aim of this review is to identify factors associated with anxiety and depression in adult patients, both before and after undergoing spine surgery.

Methods

The International Classification of Functioning, Disability, and Health (ICF) defines the ability to function in a multiaxial model in which interrelated factors influence each other in a dynamic, interactive, and non-linear process [11]. In the present review, this model is used to explain the relationship between anxiety and depression as outcome predictors of greater pain and functional disability, and lower health-related quality of life, and thereby clarify components that are important for the development of educational aids.

An integrative systematic review was undertaken [12]. This specific scientific and validated approach strives to provide a more comprehensive understanding of a challenge or a phenomenon; the method summarizes past empirical or theoretical literature, including qualitative, quantitative, and mixed methods articles. The integrative method supports the ability of grasping the complexity of existing findings and strengthens their ability to inform policy and practice [12]. The integrative review is by Whittemore and Knafl (2005) described in five stages: (1) problem identification, containing a clear identification of the problem, the review purpose and valuables of interest, being the concepts, population and the focus of interest; (2) literature search, with a well-defined search strategy and search being the basis for accurate results; (3) data selection and evaluation, where each research design has different criteria and frame of evaluation; (4) data analysis requiring that the data are unbiased, ordered, coded, and categorized and summarized into conclusions about the identified problem; and finally, (5) presentation, where the results ideally capture the depth and the breadth of the problem being investigated. Explicit details from sources should be presented to demonstrate the chain of evidence [12].

Search strategy

A three-step search was used [13]. First, an initial search was conducted using preliminary subject headings and keywords based on knowledge of the field. Second, subject headings and keywords were revised in accordance with the findings obtained in step one, and a second search was conducted in September 2016 in seven databases: Scopus, Web of Science, PsycINFO, Cochrane, PubMed, CINAHL, and Embase. The search was divided into blocks consisting of main keywords and additional variables (see search string in Table 1).

Third, a final search was conducted in which reference lists were manually consulted to identify additional studies.

Study selection and data evaluation

We aimed initially to include studies in adults undergoing lumbar spine fusion only; however, these studies were scarce, and after a thorough reading of our search results, we found that several of the studies obtained referred to depression and anxiety regardless of spine diagnosis, surgical method, and anatomical locations [14–16]. We therefore decided to include studies dealing with spine surgery caused by degenerative disorders in both the lumbar and cervical spines, and not exclusively spine fusion. The inclusion criteria were the following: articles published after January 1, 1986, as the first studies treating mental health in back patients were published in 1986 [17]; articles reporting, investigating, or
Data synthesis

A convergent qualitative design was used transforming qualitative and quantitative results into qualitative findings [47]. This approach was applied as it allows diverse and heterogeneous research to be incorporated into the same review, thereby striving to overcome the limitations of qualitative reviews (addressing only qualitative questions) and quantitative reviews (addressing only quantitative questions) [47].

The included articles were analyzed using qualitative content analysis [48,49]. The analysis was conducted in four stages by JS and thoroughly discussed with LBJ and MB. First, each sentence meaningful to the aim of the review was extracted from the articles, as a finding. Second, the extracted findings were coded using one of the five components in the ICF: body functions and structures, activities, participation, personal factors, and contextual factors (Fig. 2). Third, the coded data were analyzed, and five meaningful categories were generated. Fourth, an explanatory synthesis was aggregated from categories explaining the aim of the review.

A wide range of terms describing the occurrence of anxiety and depression was applied interchangeably in the included...
studies, and multiple questionnaires were used. Findings were extracted when anxiety and depression were incorporated into the questionnaires or terms used. An overview of data collection tools, terms contained, and terms extracted is given in Table 2. Owing to the use of several questionnaires and terms, the associations were often ambiguous, but became less so when the outcomes were incorporated into categories. In this review, the terms anxiety and depression are used.

Results

The 14 included studies, 3 qualitative and 11 quantitative, reported 75 individual findings based on 4,833 participants.
Table 2
Data collection tools and terms contained in findings

<table>
<thead>
<tr>
<th>Author/year</th>
<th>Data collection tools</th>
<th>Extracted terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott et al. (2010) [39]</td>
<td>SF36, Mental health subscale of SF36, also known as MHI-5 is a summary score of five questions investigating <strong>anxiety</strong>, <strong>depression</strong>, loss of behavioral/ emotional control, and psychological well-being.</td>
<td>Mental health</td>
</tr>
<tr>
<td></td>
<td>TAC, Tampa Scale for Kinesiophobia—the fear of movement model suggests that when pain is seen to be threatening, it will promote <strong>anxiety</strong> and give rise to pain-related fear. This fear can give rise to avoidance behavior which again is associated with depression.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CSQ, Three subscales of Coping Strategy Questionnaire were used to assess patients’ current use of coping strategies and assess the use of negative thinking as a reaction to pain.</td>
<td></td>
</tr>
<tr>
<td>Anderson et al. (2015) [40]</td>
<td>Diagnose code: <strong>Depression</strong> Identified subjects diagnosed with other psychological comorbidity, here <strong>anxiety</strong>.</td>
<td>Depression</td>
</tr>
<tr>
<td></td>
<td>TAC, Tampa Scale for Kinesiophobia—the fear of movement model suggests that when pain is seen to be threatening, it will promote <strong>anxiety</strong> and give rise to pain-related fear. This fear can give rise to avoidance behavior, which again is associated with depression.</td>
<td>Anxiety</td>
</tr>
<tr>
<td></td>
<td>PHQ-9, Nine-item Patient Health Questionnaire is a multipurpose instrument for screening, diagnosing, monitoring, and measuring the severity of depression.</td>
<td>Depression</td>
</tr>
<tr>
<td>Havakesian and Mannion (2013) [41]</td>
<td>MSPQ, Modified Somatic Perception Questionnaire and Modified Zung Self-Rating Depression Scale (SDS) were used together to determine psychological disturbances.</td>
<td>Psychological disturbances</td>
</tr>
<tr>
<td></td>
<td>FABQ, Fear Avoidance Beliefs Questionnaire was used to investigate patients’ beliefs about physical activity, and patients fears of activity when experiencing pain.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCQ, Six items on the catastrophizing subscale of the Coping Strategies Questionnaire. Pain catastrophizing is characterized by patients magnifying their fear of painful situations, misinterpreting, and exaggerating the threat of a situation.</td>
<td></td>
</tr>
<tr>
<td>Mancuso et al. (2014) [15]</td>
<td>GDS, Geriatric Depression Scale—assesses depressive symptoms.</td>
<td>Depression, Anxiety, and together; Psychological comorbidity</td>
</tr>
<tr>
<td></td>
<td>STAI, Spielberg State Trait Anxiety Inventory measures trait and state anxiety. It can be used in clinical settings to diagnose anxiety and to distinguish it from depressive syndromes.</td>
<td></td>
</tr>
<tr>
<td>Maratos et al. (2012) [14]</td>
<td>HADS, Hospital Anxiety and Depression Scale obtains anxiety and depression scores, is a 14-item scale, with 7 items related to anxiety and 7 items to depression, developed to detect symptoms of anxiety and depression in somatically ill patients.</td>
<td>Anxiety</td>
</tr>
<tr>
<td>Monticone et al. (2014) [43]</td>
<td>TAC, Tampa Scale for Kinesiophobia—the fear of movement model suggests that when pain is seen to be threatening, it will promote <strong>anxiety</strong> and give rise to pain-related fear. This fear can give rise to avoidance behavior which again is associated with depression.</td>
<td>Misked fears</td>
</tr>
<tr>
<td></td>
<td>PCS, Pain Catastrophizing Scale—catastrophizing is defined as a method of cognitive coping and is characterized by negative self-statements, overly negative thoughts and ideation, and patients misinterpreting and exaggerating the threat of a situation.</td>
<td>Fear behaviors</td>
</tr>
<tr>
<td>Papaioannou et al. (2009) [20]</td>
<td>HADS, Hospital Anxiety and Depression Scale obtains anxiety and depression scores, is a 14-item scale, with seven items related to anxiety and seven items to depression, developed to detect symptoms of anxiety and depression in somatically ill patients.</td>
<td>Anxiety</td>
</tr>
<tr>
<td></td>
<td>PCS, The original Pain Catastrophizing Scale</td>
<td>Depression</td>
</tr>
<tr>
<td></td>
<td>SDS, Zung Self-Rating Depression Scale, a psychological self-rating test measuring depression severity.</td>
<td></td>
</tr>
</tbody>
</table>
(3,017 men and 1,816 women, mean age approximately 49 years, most of whom were Caucasians). For the study characteristics, see Table 3.

Based on the 75 findings, five categories of factors associated with anxiety and depression both before and after undergoing spine surgery were generated: pain, information, disability, employment, and mental health. In this study, mental health is used to indicate psychological well-being. Examples of findings within the five categories are shown in Table 4.

The experience of pain and the associations with anxiety and depression

Pain is subjective, multidimensional, and associated with anxiety and depression, and can be characterized by chronicity, persistence, or intensity. Quantitative studies report elevated preoperative levels of anxiety and depression in patients with chronic pain [25,41] and show a bidirectional correlation between chronic pain and depression [25]. However, chronic pain can have pain-free periods, creating a sense of relief [45]. Intensity influences anxiety and depression because strategies used to cope with pain fail when pain becomes too intense [45]. The association regarding intensity was strong at 6 weeks and at 3- and 12-month follow-up [16,42].

Furthermore, the association between pain and mental health appeared to reveal temporal variation and was not found to be equally strong throughout the course of treatment. Thus, two quantitative studies indicate that pain is only moderately related to anxiety and depression, as these studies found no relation between use of analgesics and anxiety and depression the first and second day after surgery [20,42]. Depression was found to be relatively independent of pain in the early postoperative phase [42]. Furthermore, a cross-sectional study conducted 1 month before surgery found no correlation between anxiety and depression and pain [39]. However, a prospective cohort study found anxiety and depression to be a natural response to the presence of pain at 1-year follow-up [41], and this is supported by an interview study [45] in which 22 patients with pain for at least 3 years expressed a feeling of change in their personality because pain gave them less joy in life and caused them so much distress that 15 of these 22 patients had considered suicide [45]. However, when pain diminished, there was mental relief, and living was not quite as cumbersome [45]. Two other cohort studies support this relation between pain and anxiety and depression a few days before and 6 and 12 months after surgery [14,25].

Need for information and the associations with anxiety and depression

The need for information was a significant theme that primarily emerged within the qualitative studies. Patients expressed a need for individualized information; both its amount and timing helped them feel less anxious. In two qualitative studies, patients experienced anxiety about not knowing what to expect [44,46]. Discharge was found to cause high levels of anxiety if patients did not know what to expect [44]. Years after surgical treatment, patients still stated that lack or low quality of information engendered high levels of anxiety [45,46]. Patients in both studies agreed that adequate information was important and should be provided individually. Furthermore, information should be presented in a timely and appropriate manner so that patients do not forget it and are able to understand it, which was also perceived individually [44,46]. Findings in a quantitative study indicate that educating patients to adopt appropriate behaviors also enhances a positive attitude [43].

Disability and the associations with anxiety and depression

Both pre- and postoperative associations between depression, anxiety, and degree of self-reported disability were found in most of the quantitative studies. Patients suffering from anxiety or depression experienced significantly worse disability than less depressed and less anxious patients [14–16,40,41]. The prevalence of both anxiety and depression declined in the postoperative period as physical ability and pain improved [14,25]. This bidirectional association is confirmed in another quantitative study using cognitive behavioral therapy to control catastrophizing and modify “mistaken fears.” This behavioral modification results in a more positive attitude toward exercise programs, which also increased patients’ physical performance [43].

Employment and its association with anxiety and depression

Being employed, using one’s education, and maintaining the feeling of being able to contribute to society positively influence the occurrence of depression. Conversely, depression lowers the rate of patients returning to and sustaining employment.

The relationship between return to work and the occurrence of depression is supported by both quantitative and qualitative findings [23,25,40,45,46]. According to quantitative studies, depressed patients were less likely to be working, both within the first weeks after surgery and within 3 years after surgery [25,40]. Furthermore, those patients with depression who were employed 3 years after surgery were absent from work more often than those not depressed [40]. Regardless of professional background, qualitative studies found that non-employed patients had low self-esteem, felt demoted, and had the feeling of not being able to contribute to society, and the presence of these feelings is mentioned as one of several reasons why some patients considered suicide [45,46].

Mental health and its association with anxiety and depression

Several studies found associations between anxiety, depression, and psychological disturbances like posttraumatic
### Table 3
Study characteristics

<table>
<thead>
<tr>
<th>Author/year</th>
<th>Design</th>
<th>Number/surgery/diagnosis</th>
<th>Time of data collection</th>
<th>Data collection/tools</th>
<th>Grading score*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott et al. (2010) [39]</td>
<td>Cross-sectional study</td>
<td>107/Chronic back pain scheduled for lumbar spine fusion.</td>
<td>1 mo before surgery</td>
<td>Demographic and clinical characteristics, VAS, SF 36-MHI-5, TAC, BBQ, SES, three subscales of CSQ, ODI, EQ-5D</td>
<td>100%</td>
</tr>
<tr>
<td>Anderson et al. (2015) [40]</td>
<td>Historical cohort study</td>
<td>2,799/Workers’ compensation patients. Lumbar spine fusion.</td>
<td>Days before surgery, follow-up 2 and 3 y</td>
<td>RTW, medical cost, medical history, all-cause mortality, disability, sociodemographic</td>
<td>100%</td>
</tr>
<tr>
<td>Archer et al. (2011) [16]</td>
<td>Prospective cohort study</td>
<td>141/Degenerative spine conditions. Spinal surgery.</td>
<td>Days before surgery, follow-up 6 wk and 3 mo</td>
<td>Demographic and clinical characteristics, TAC, PHQ-9, BPI, ODI, NDI, SF-12</td>
<td>100%</td>
</tr>
<tr>
<td>Havakeshian and Mannion (2013) [41]</td>
<td>Prospective cohort study</td>
<td>159/Decompression surgery.</td>
<td>Days before surgery, follow-up 1 y</td>
<td>Sociodemographic, medical history, MSPQ, SDS, FABQ, six items on the catastrophizing subscale of CSQ, RMQ, LBP, LP</td>
<td>89%</td>
</tr>
<tr>
<td>Mancuso et al. (2014) [15]</td>
<td>Cross-sectional study</td>
<td>713/Patients presented for preoperative testing.</td>
<td>Days before surgery</td>
<td>Demographic and clinical characteristics, ODI, NDI, CCI, GDS, STAI, SF-12</td>
<td>85%</td>
</tr>
<tr>
<td>Maratos et al. (2012) [14]</td>
<td>Prospective cohort study</td>
<td>302/Degenerative spine conditions. Spinal surgery.</td>
<td>Days before surgery, follow-up 6 and 12 mo</td>
<td>Demographic data, HADS, SF-36</td>
<td>78%</td>
</tr>
<tr>
<td>Monticone et al. (2014) [43]</td>
<td>Randomized superiority-controlled study</td>
<td>130/Degenerative spine condition. Spinal surgery. Assigned to a program consisting of exercises and cognitive-behavioral therapy or exercise alone.</td>
<td>Days before surgery, follow-up 4 wk and 1 y</td>
<td>Demographic and clinical characteristics, ODI, TAC, PCS, NRS, SF-36</td>
<td>100%</td>
</tr>
<tr>
<td>Papaioannou et al. (2009) [20]</td>
<td>Prospective cohort study</td>
<td>61/Degenerative disk disease. Lumbar spine fusion.</td>
<td>1 d before surgery, follow-up 1 or 2 d</td>
<td>Demographic characteristics, analgesic use, PCS, HADS, VRS</td>
<td>78%</td>
</tr>
<tr>
<td>Parlato et al. (2013) [42]</td>
<td>Prospective cohort study</td>
<td>58/Lumbar stenosis. Decompression surgery.</td>
<td>Days before surgery, follow-up 6 and 12 mo</td>
<td>Demographic characteristics, SDS, VAS</td>
<td>89%</td>
</tr>
<tr>
<td>Trief et al. (2000) [23]</td>
<td>Case-control study</td>
<td>102/Degenerative spine condition. Lumbar spine surgery.</td>
<td>Days before surgery, follow-up 6 and 12 mo</td>
<td>Demographic data, follow-up working status or maintenance at home, SDS, STAI-T, MSPQ, Ho, DPQ</td>
<td>89%</td>
</tr>
<tr>
<td>Wahlman et al. (2014) [25]</td>
<td>Retrospective cohort study</td>
<td>232/Lumbar spine fusion.</td>
<td>Days before surgery, follow-up 6 and 12 mo</td>
<td>Register data, demographic data, DEPS, ODI, VAS</td>
<td>78%</td>
</tr>
<tr>
<td>Davis et al. (2013) [44]</td>
<td>Qualitative study</td>
<td>7/Stenosis or disc herniation/decompression surgery</td>
<td>Days before surgery, follow-up 1 or 2 d</td>
<td>Two focus group discussions</td>
<td>90%</td>
</tr>
<tr>
<td>Abyholm and Hjortdahl (1999) [45]</td>
<td>Qualitative study</td>
<td>22/Chronic low back pain. Spinal surgery.</td>
<td>Years after surgical treatment</td>
<td>Individual interviews</td>
<td>80%</td>
</tr>
<tr>
<td>Abyholm and Hjortdahl (1999) [46]</td>
<td>Qualitative study</td>
<td>22/Chronic low back pain. Spinal surgery.</td>
<td>Years after surgical treatment</td>
<td>Individual interviews</td>
<td>80%</td>
</tr>
</tbody>
</table>

* Standardized critical appraisal instruments from the Joanna Briggs Institute [13]: VAS, Visual Analog Scale; SF36-MHI-5, The Mental Health Subscale of the Medical Outcome Study Short Form; TAC, Tampa Scale for Kinesiophobia; SES, The Self-Efficacy Scale; ODI, Oswestry Disability Index; EQ-5D, The European Quality of Life Questionnaire; PHQ-9, Nine-Item Patient Health Questionnaire—Depression; BBQ, Back Beliefs Questionnaire; BPI, Brief Pain Inventory; NDI, Neck Disability Index; SF-12, 12-Item Short Form Health Survey; MSPQ, Modified Somatic Perception Questionnaire; SDS, Modified Zung Self-Rating Depression Scale; FABQ, Fear Avoidance Beliefs Questionnaire; CSQ, Coping Strategies Questionnaire; RMQ, Roland Morris Questionnaire, LBP, Low Back Pain Rating Scale; LP, Leg Pain Rating Scale; GDS, Geriatric Depression Scale; STAI, Spielberg State Trait Anxiety Inventory; CCI, Charlson Comorbidity Index; HADS, Hospital Anxiety and Depression Scale; SF-36, The Medical Outcomes Study 36-Item Short Form Health Survey; PCS, Pain Catastrophizing Scale; NRS, Numerical Rating Scale; VRS, Verbal Rating Scale; STAI-T, Spielberg Trait Anxiety Inventory; MSPQ, Modified Somatic Perception Questionnaire; Ho, The Cook-Medley Hostility Scale; DPQ, Dallas Pain Questionnaire; DEPS, Depression Self-Test; RTW, return to work.
stress disorder, catastrophizing, worsened mental health scores, stress, both before and after surgery. In a cohort study, depressed patients differed from patients without depression; they had a higher degree of anxiety, higher rate of posttraumatic stress, and a higher rate of psychotherapy utilization [40]. Furthermore, in three quantitative studies, findings indicate that patients with depression also had a higher rate of new-onset anxiety and posttraumatic stress disorder [40], had worse overall mental health scores [15], and were more prone to catastrophizing [20]. A smaller cohort study found no new onset of depression at 3 and 12 months after surgery and concluded that depression at long-term evaluation was due to the relapse of pre-existing depression [42]. However, these findings do not correspond to findings from a study including workers’ compensation patients, where 16% of the non-depressed were diagnosed with depression within 3 years after surgery [40].

Discussion
Our finding that pain, information, disability, return to work, and mental health are factors associated with anxiety and depression highlight a complexity that can be captured using the theoretical framework of the ICF, thereby avoiding
reducing the causality of anxiety and depression to a single association.

Maintaining an ICF-based view of the biological, individual, and social explanatory perspectives on the interrelatedness between all identified factors associated with anxiety and depression, we discuss the need for information as a factor that can potentially influence the degree to which the four remaining factors influence anxiety and depression. We find that the cognitive construction of patients’ anticipations or patients’ conceptions, formed by information and thereby knowledge, has a mediating role in the associations between pain, disability, return to work, and mental health, and finally, anxiety and depression. The mediating role of patients’ knowledge and thereby information as a concept in a clinical setting is of potential interest, as spine health-care providers have both the opportunity to influence and facilitate. This will be discussed at greater length later.

A trend in the literature supports the importance of information. Informing patients is known to be a critical component of disease management because the need, mode, and ability to understand are individual, and research indicates that patients who gain knowledge and skills improve their ability to cope and their quality of life [50,51]. A systematic review finds that preoperative information has the potential to reduce preoperative anxiety [52]. Extensive preoperative information has been shown to enhance patients’ knowledge, satisfaction, and quality of life, and to reduce preoperative anxiety and postoperative use of analgesics [10,53,54]. Explaining to patients how to control their fears and modify “mistaken fears” makes them able to adopt more appropriate behaviors and induces a positive attitude [43]. Thus, the mediating role of information on anxiety and depression in patients undergoing surgery is well described [10,52–55]. Patients who adopt a more positive self-image and increased mental health achieve a better quality of life, which may also lower the risk of depression relapse as well as other psychological disturbances [43].

Pain has been seen as a multidimensional construct since 1971, when Melzack [56] defined it as a biomedical component influenced by tissue damage, an evaluative component influenced by coping, and an affective component influenced by anxiety and depression. Based on this model, the association between pain and anxiety or depression is developed in the dynamic interaction between the individual, the individual’s behavior, the information the patients are given, their ability to cope, and environmental factors. Thus, arguing that anxiety and depression are a natural response to the mere presence of pain seems to be a simplification.

Perceived pain the first and second day after surgery might be an expected and accepted result of the operation and would thus not correlate solely with anxiety or depression. Furthermore, correlation between pain and anxiety or depression 1 month before surgery, at the outpatient clinic when the patients were scheduled for surgery, was not evident [39]. Information may be the mediating factor, exemplified in a study that included patients undergoing lumbar spine surgery. When scheduled for surgery, the information they received and thereby the anticipation of pain relief and better physical ability resulted in the patients reporting better quality of life even before surgery [51]. The mediating role of information is substantiated in a second study in which expectations and hopes for future recovery were found to be significant predictors of reduction in depression before hip surgery [57].

During the postoperative period, too, information seems to play a mediating role in the association between pain and anxiety or depression. It was found that patients can start dealing with the consequences of their condition when they know what to expect, and in some cases, even begin a new phase of life [46].

The mediating role of information on anxiety and depression and its association with disability is found to be associated with the cognitive and behavioral aspects of anxiety and depression [14,25,41,42]. The behavior emerging within this group of patients with back pain can be conceptualized as avoidance behavior, and it is one of two responses to pain described by Lethem et al. in 1983 [58]. Avoidance behavior is seen to be derived from fear [59] and, as anxious patients will prioritize thoughts related to their fear, they are predisposed to move with caution. Information that includes elements from cognitive behavioral therapy is known to modify mistaken fears, thereby reducing both anxiety and depression, inducing a positive attitude toward physical performance and self-image and thereby reducing patients’ self-perceived disability in everyday activities [43]. One of the assumptions in cognitive behavioral therapy is that patients act in ways to maintain their thoughts and beliefs, potentially maintaining a maladaptive behavior [60]. When focusing on the cognitive aspect, the goal of information is to make patients adopt more realistic, adaptive perspectives, leading them to feel better emotionally and subsequently move more freely [60]. Functional recovery of patients receiving cognitive behavioral therapy in addition to exercise improves significantly early on in the rehabilitation program, within 3 months [61], and at follow-up 1 year after surgery [43,62].

Expectations concerning return to work are affected by a variety of issues; however, with the use of information, it is possible to help patients create realistic expectations and beliefs concerning their recovery, supporting the patient’s return to work or assisting a new life trajectory [63]. Information provides patients with the possibility of having realistic expectations and beliefs toward treatment and rehabilitation; depression will decrease as quality of life is perceived to be better [51]. In a study that included 168 patients with acute non–life-threatening orthopedic trauma, belief in recovery and perceived pain were identified as predictors for returning to work [64]. Furthermore, a patient’s belief in their own ability predicts recovery independently of physical disability [64].

Clinical implications

Informing patients is not simply a task involving the provision of information or education. As articulated in the
Although this heterogeneity involves clear limitations, it can also be considered an advantage because many spine surgery patients present the same associations between anxiety, depression, and other factors.

The systematic and critical approach is one of the strengths of this review. The systematic work was a collaborative undertaking involving seven researchers, each contributing within their methodological field, and all included studies met at least 75% of the criteria on the JBI checklists to secure the highest possible validity [13]. Sensitivity of findings to the quality appraisal cut point of 75% was found to be high. Further lowering the cut point to 50% would not change the findings of this review as Archer et al. [33], the three excluded studies based on the same study population by de Groot et al. [19,31,32], and the seven studies by Sinikallio et al. and Pakarinen et al. [21,22,26–30], also based on the same study population, found correlations on anxiety and depression as reported in the current review; that is, anxiety and depression were found to be associated with pain and physical impairments (Tables 5 and 6). Thus, these references pinpoint the same associations as presented in this review. If the cut point was raised from 75% to 80%, an additional three quantitative studies would have been excluded: two studies reporting data preoperatively, 3 and 12 months after surgery [14,25], and a third study reporting on data the first and second

**Strengths and limitations**

This review includes patients undergoing spine surgery caused by degenerative disorders and encompasses a range of surgical methods and anatomical locations because we found that both the prevalence of anxiety and depression and the association within factors were present despite variation in the type, duration, and complexity of the operation [14,15]. Although this heterogeneity involves clear limitations, it can included studies, failure to understand information can be attributed to the timing, amount, and quality of the information. It can, however, also be attributed to the level of health literacy [65]. Health literacy is not only about being able to read information; it also relates to patients being able to understand and effectively use it [65]. Approximately half of patients suffer from low health literacy and are thus unable to acquire, understand, and use the information they are given [65]. This reduced ability correlates with decreased learning abilities, higher mortality rates [66], and low levels of self-efficacy related to accomplishing pre-, peri-, and postoperative tasks regarding orthopedic surgical procedure [67]. Informing patients adequately and effectively is hence a comprehensive task in the health-care system.

**Table 5**

<table>
<thead>
<tr>
<th>Appraisal of the included studies with the use of JBI-MAStARI critical appraisal tool for comparable cohort/case-control study</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
<th>Total/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott et al. 2010 [39]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>NA</td>
<td>NA</td>
<td>Y</td>
<td>Y</td>
<td>7/7/100%</td>
</tr>
<tr>
<td>Anderson et al. 2015 [40]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>NA</td>
<td>NA</td>
<td>Y</td>
<td>Y</td>
<td>8/8/100%</td>
</tr>
<tr>
<td>Archer et al. 2013 [33]</td>
<td>U</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>NA</td>
<td>Y</td>
<td>NA</td>
<td>Y</td>
<td>N</td>
<td>3/7/43%</td>
</tr>
<tr>
<td>Archer et al. 2011 [16]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>9/9/100%</td>
</tr>
<tr>
<td>de Groot et al. 1996 [19]</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>3/9/33%</td>
</tr>
<tr>
<td>de Groot et al. 1997 [31]</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>U</td>
<td>3/9/33%</td>
</tr>
<tr>
<td>de Groot et al. 1997 [32]</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>U</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>2/9/22%</td>
</tr>
<tr>
<td>Havakeshian and Mannion 2013 [41]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>8/9/89%</td>
</tr>
<tr>
<td>Malik et al. 2010 [35]</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>U</td>
<td>N</td>
<td>U</td>
<td>U</td>
<td>2/9/22%</td>
</tr>
<tr>
<td>Maratos et al. 2012 [14]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>7/9/78%</td>
</tr>
<tr>
<td>Okoro and Sell 2009 [36]</td>
<td>U</td>
<td>Y</td>
<td>U</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>U</td>
<td>N</td>
<td>Y</td>
<td>4/9/44%</td>
</tr>
<tr>
<td>Pacola et al. 2014 [37]</td>
<td>U</td>
<td>U</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>NA</td>
<td>NA</td>
<td>Y</td>
<td>Y</td>
<td>3/7/43%</td>
</tr>
<tr>
<td>Pakarinen et al. 2014 [26]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>5/9/56%</td>
</tr>
<tr>
<td>Papaioannou et al. 2009 [20]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>7/9/78%</td>
</tr>
<tr>
<td>Parlato et al. 2013 [42]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>8/9/89%</td>
</tr>
<tr>
<td>Sinikallio et al. 2006 [22]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>NA</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>4/8/50%</td>
</tr>
<tr>
<td>Sinikallio et al. 2010 [27]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>5/9/56%</td>
</tr>
<tr>
<td>Sinikallio et al. 2007 [28]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>5/9/56%</td>
</tr>
<tr>
<td>Sinikallio et al. 2007 [29]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>5/9/56%</td>
</tr>
<tr>
<td>Sinikallio et al. 2010 [21]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>6/9/67%</td>
</tr>
<tr>
<td>Skolasky et al. 2012 [38]</td>
<td>U</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>5/9/56%</td>
</tr>
<tr>
<td>Trief et al. 2000 [23]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>8/9/89%</td>
</tr>
<tr>
<td>Urban-Baeza et al. 2015 [24]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>U</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>5/9/56%</td>
</tr>
<tr>
<td>Wahlman et al. 2014 [25]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>7/9/78%</td>
</tr>
</tbody>
</table>

**Note:** JBI-MAStARI, Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument; N, no; NA, not applicable; U, unclear; Y, yes.

day after surgery [20]. Thus, apart from the approximately 600 patients being excluded, only one remaining study in the review would report on associations found the first and second day after surgery. Raising the cut point further and thus above 80%, two of the three qualitative studies would be excluded [45,46], substantially limiting the diversity of studies included, without, however, changing the study findings (Table 7).

A major and quite substantial limitation was the large heterogeneity of the questionnaires used in the studies reviewed and in the terms employed that related to the patients’ anxiety and depression. Furthermore, there is a lack of clarity in the definition of the different terms in several of the studies. Thus, the outcomes of this review are presented as a synthesis between different terms, and a clear definition of the factors anxiety and depression is therefore not possible.

We included a large study among patients receiving workers’ compensation. We are aware that these patients are considered to have more unsatisfactory outcomes than patients not waiting for wage replacement [68]. We found the same factors associated with anxiety and depression. Rather than presenting itself as a limitation, our findings are substantiated by the fact that a diversity of patient categories indicates the same associations.

The influence of anxiety and depression on patients’ evaluation of their own ability is found to be significant, and could lead to bias when using patient-reported outcomes [9,69]. There is a need for a greater awareness of the implications of anxiety and depression mediating the assessed outcome, and there is a need to question the use of self-reported questionnaires as the only proxy for quality and outcome after spine surgery. In addition, if the cognitive and behavioral elements of anxiety and depression mediate patients’ assessed outcome after surgery, they may also do so before surgery. This would cause these patients to be candidates for spine surgery earlier on in their course of illness by presenting a “false” low preoperative physical ability or high degree of pain [15].

With reference to this review there are several scenarios for future research. One of these could be to evaluate the influence of anxiety and depression on patient-reported outcome both before and after surgery.

As to information, spine surgeons and spine care providers have an important impact on communication and the information given. Future research is needed to evaluate the effect of tailored information, taking into account the potential of web-based technologies, health literacy, and the reduced cognitive capacity in a patient group with a high occurrence of symptoms of anxiety and depression. Also, research with focus on optimized pain-treatment algorithms and educational pain and behavior information is needed. Future research evaluating the impact of regulation on workers’ compensation and return-to-work rates on patient-reported outcomes could be interesting. In a New Zealand study, an “early workers compensation” is provided, resulting in a 1-year return-to-work rate of 80% compared with 40% in countries providing

---

**Table 6**

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
<th>Q10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin et al. 2011 [34]</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>NA</td>
<td>U</td>
<td>U</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>3/9/33%</td>
</tr>
<tr>
<td>Monticone et al. 2014 [43]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>10/10/100%</td>
</tr>
</tbody>
</table>

JBI-MAStARI, Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument; N, no; U, unclear; Y, yes.


---

**Table 7**

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
<th>Q10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis et al. 2013 [44]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>9/10/90%</td>
</tr>
<tr>
<td>Abyholm and Hjortdahl 1999 [45]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>8/10/80%</td>
</tr>
<tr>
<td>Abyholm and Hjortdahl 1999 [46]</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>8/10/80%</td>
</tr>
</tbody>
</table>

N, no; U, unclear; Y, yes.

Note: The questions from the Critical Appraisal Checklist for Interpretive & Critical Research (QARI) [13] critical appraisal checklist for interpretive and critical research: Q1. Is there congruity between the stated philosophical perspective and the research methodology? Q2. Is there congruity between the research methodology and the research question or objectives? Q3. Is there congruity between the research methodology and the methods used to collect data? Q4. Is there congruity between the research methodology and the representation and analysis of data? Q5. Is there congruity between the research methodology and the interpretation of results? Q6. Is there a statement locating the researcher culturally or theoretically? Q7. Is the influence of the researcher on the research, and vice versa, addressed? Q8. Are participants and their voices adequately represented? Q9. Is the research ethical according to current criteria, or, for recent studies, is there evidence of ethical approval by an appropriate body? Q10. Do the conclusions drawn in the research report flow from the analysis or interpretation of the data?
a “late compensation” and 74% for “non-compensation patients” [70].

Conclusion

This review is the first to use the integrative review method to identify factors associated with anxiety and depression throughout the course of treatment in patients undergoing spine surgery. Pain, the need for information, disability, return to work, and mental health are found to be factors associated with anxiety and depression in this group of patients. Furthermore, information is found to be a mediating factor in the association between anxiety, depression, and the remaining four factors. With regard to the development of educational aids to reduce anxiety and depression and improve surgical results, the following should be considered: there is a need to address patients’ understanding of pain and their ability to cope; there is a need to inform patients at a time, in a way, and with an informational content suited to the individual; there is a need to address everyday activities, educating patients to be active according to their abilities; there is, in some cases, a need to educate patients in the direction of a new life trajectory; and finally, it seems that addressing these issues will decrease the risk of other psychological disturbances.

Thus, this review emphasizes not only the importance of focusing on biomedical factors to reduce the occurrence of anxiety and depression and to improve the outcome of patients undergoing spine surgery, but also the importance of understanding these patients’ conditions with reference to the biopsychosocial model of the ICF.

Acknowledgment

The authors are grateful to Camilla Meyer, the research librarian at Aarhus University Library, and Hanne Christensen, the medical research librarian, at the Regional Hospital of Viborg, for their valuable contributions to the literature search. Also, sincere thanks are due to the independent charity Viborg, for their valuable contributions to the literature search.

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