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Narrative Review

Utilizing Multidisciplinary Medicine in Pain Management: A Narrative Review

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Background: The role of psychological factors influencing chronic pain has been well documented. This review includes a historical perspective and current examination of the literature on psychological and behavioral health characteristics and their influence on chronic pain.

Objectives: To identify psychological and behavioral health factors involved with chronic pain, as well as the challenges and opportunities of integrating multidisciplinary care into a pain management practice.

Study Design: Narrative review of peer-reviewed literature examining psychological and behavioral health factors associated with poor clinical outcomes with an emphasis on orthopedics.

Methods: The Medline database was reviewed to identify peer-reviewed research that discussed psychological and behavioral health factors relevant to pain management or orthopedics.

Results: The evidence provided suggests that these constructs should receive strong consideration when managing chronic pain. The incorporation of such factors may improve patient care and clinical outcomes and reduce total health care costs.

Limitations: This narrative review is not systematic in nature, but rather focused on the impacts on orthopedics and pain management.

Conclusions: Psychological and behavioral health factors should be an integral component of a pain management practice as there is substantial overlap between depression and anxiety with chronic pain. Positive affect, such as resilience, may act as a buffer and confer some protection against the sequelae of chronic pain. There is evidence that psychological screeners offer further insight into the patient condition and would contribute to the treatment plan. The novel role of a behavioral health navigator in a pain management clinic is worthy of further exploration as it has proved beneficial in other chronic health conditions.

Key words: pain management; chronic pain; psychological; multidisciplinary; behavioral health navigator; resiliency; opioids

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Chronic pain is defined as persistent pain which lasts for more than three months and is associated with significant emotional distress and/or functional disability (1). The focus on pain and the well-intentioned introduction of pain as the "fifth vital sign" has done little to reduce the prevalence chronic pain and cost of opioid utilization and management (2). It is estimated that 20% to 41% of American adults are living with chronic pain or a painful health condition (3,4). Epidemiological work has found that the majority of this pain is spine-related and prevalence has been unchanged over the past 18 years despite increased spending and utilization of care (5). Chronic pain in the United States continues to be a nationwide problem with an enormous annual economic burden with an estimated range from $560 to $635 billion dollars (3). Interestingly, the prevalence of chronic pain increased 8% from 2001 to 2014, while strong opioid use for severe pain-related interference doubled during the same time from 12% to 24% (4). Historically, clinicians have relied heavily on medication management and interventional procedures, which may at least partially explain the increase in opioid-related deaths (6). Even with the advances in pharmacotherapies, implantable technologies (7), and minimally invasive surgeries, treatment-resistant patients (i.e., nonresponders) frequently exhaust their benefits, the clinicians, and themselves in the pursuit of fixing the problem (8).

The Department of Health and Human Services Inter-Agency Task Force report on pain management best practices states that there are 5 primary approaches to pain management: medication management, restorative therapies, interventional procedures, behavioral health approaches, and complementary and integrative health (9). It is well-known that the risk of developing persistent postsurgical pain depends on patient characteristics as well as the features of the surgical procedure (10). Therefore, orthopedic and other healthcare settings must improve identification of patients at risk for developing chronic pain and opiate dependence. Further, there are compelling ethical and financial justifications to identify low-risk, efficacious treatments to aid in pain management. Early work on psychological factors in chronic pain suggests that adequate behavioral health evaluation and treatment appears promising in positively impacting pain outcomes (11-14). Therefore, the purpose of this review is to identify psychological and behavioral health factors involved with chronic pain, as well as the challenges and opportunities of integrating multidisciplinary care into a pain management practice.

Methods

The search strategy used included in the following terms: mental health, behavioral health, psychological, psychosocial, resilience, depression, anxiety, chronic pain, and pain management in the Medline database. Additionally, references from reviewed publications were examined and relevant publications were included for review.

Results

The Opioid Crisis and Chronic Pain

The United States (US) saw an unprecedented boom in utilization of opioid analgesics from 1999 to 2015 as prescriptions tripled to nearly 227 million filled by 65 million citizens (15). This phenomena was precipitated by a series of articles highlighting the low addiction potential of long-term opioids (16,17), combined with an aggressive marketing strategy by pharmaceutical companies, which included misreporting the addictive nature of oxycodone HCL (18). A more current review of the literature shows addiction rates as high as 30% (19) and increased mortality with high-dose opioid therapy (20). Unfortunately, increased usage does not reflect efficacy, as a recent meta-analysis and systematic review reported that in non-cancer pain, opioids provided only small improvements in pain and physical functioning (21). Approximately 450,000 deaths were associated with opioids (both prescribed & illicit) from 1999 to 2018 (22), and 1.7 million individuals were suffering from opioid use disorders in 2017 (23). In addition, there is weak evidence of long-term pain relief (24) and possible development of opioid-induced hyperalgesia (25). The economic costs are estimated at $504 billion yearly (26). Additionally, newer research has shed light on the potential carcinogenic effects of high-dose opioids by inhibiting natural killer cell activity in vitro (27). Furthermore, even with a wealth of resources committed to the opioid crisis, suicidality in those with chronic pain remains a poorly addressed problem (28-30). Therefore, it can be argued, based on evidence, that the risks of opioid reliance to manage chronic pain appears to outweigh the benefit.

The Centers for Disease Control and Prevention's 2016 report on guidelines for prescribing opioids discussed the importance of regular reassessment to ensure management efficacy and also suggests seek-

ing out nonpharmacologic and nonopioid treatments to augment care (34). These concerns compelled the authors to explore the contributing factors that may increase the vulnerability of some patients to experience chronic pain and opioid dependency/misuse. While there is no current practical roadmap for comprehensive pain management, the Consortium Pain Task Force white paper outlined several effective non-pharmacological solutions including but not limited to physical rehabilitation, psychological/behavioral therapies, mind-body exercises, and massage/manual therapies (35). These recommendations have also been supported by the 2019 Pain Management Best Practices Inter-Agency Task Force report (9). The authors also noted that these treatments may elicit added benefits such as improved mood or sleep and present a significantly lower risk than opioids (35). Several systematic reviews and meta-analyses have also provided support for these treatments, however, optimal frequency, dosing, timing, and techniques must be elucidated and some services may not be completely covered by insurance or available in rural areas (35). The American Society of Interventional Pain Physicians opioid guidelines and 2 recent reviews provide additional information on the opioid crisis, and offer guidance on opioid risk reduction and abuse prediction (31-33).

Rationale for Multidisciplinary Approaches to Pain

Multidisciplinary approaches to pain management emerged in the 1960s out of necessity and utilized physical medicine, nursing, social work, psychological services, and care coordination (36). Whereas, comprehensive approaches with a multidisciplinary focus were more common, this approach was almost completely abandoned in the US in the mid-1990s. Although the reasons for this are not entirely clear, some evidence suggests that insurance providers changed reimbursement practices, which may have directly impacted clinical practice (37). Nonetheless, there is mounting evidence for the importance of addressing psychological factors influencing clinical outcomes and treatment efficacy (11-13) dating back to Colonel Beecher's work during World War II (38). A multitude of studies have examined psychological variables, including a focus on depression, catastrophizing, and emotional distress (39-42). However, the evaluation of psychological factors has not been widely prioritized in orthopedic and interventional pain settings.

Several physical prognostic indicators for various surgical outcomes have been identified such as smoking status (43), body mass index (44), and glycated hemoglobin (45). These risk factors for poor surgical outcomes are now common criteria in many hospital systems' co-management agreement contracts for determining surgical candidacy (46,47). Similarly, psychological variables need to be incorporated into the determination of surgical candidacy. Concurrently, researchers are shifting the focus back towards protective psychological factors and the initial findings are quite promising (48-51). Resiliency is one important construct that has received recent attention as a modifiable, protective factor for chronic pain, and may be addressed within surgical contexts.

Psychological and Behavioral Health Factors

Psychological risk factors such as fear (52), anxiety (53), depression (54), catastrophizing (55), and low resilience have been linked to poor clinical outcomes and play a role in both the development and the management of chronic pain (39). Across orthopedic subspecialties, patients with poor psychological health have been found to have experienced suboptimal clinical outcomes following surgery (14). Chronic pain is also among the top contributors of poor quality of life (56) with chronic pain patients having higher rates of both anxiety and depression, compared to healthy control groups (57).

Resiliency has been defined as the capacity of an individual to avoid negative social, psychological, and biological consequences of extreme stress that would otherwise compromise their psychological or physical well-being.(58) Resilience can be defined as the ability to restore and sustain living a fulfilling life in the presence of pain (59). Psychological constructs such as resilience have also been found to relate to the experience of pain and pain outcomes. For example, individuals who exhibit characteristics of resiliency, such as optimism and purpose in life, have been found to have better pain acceptance than those lacking (48). Individuals that express a stronger belief that their lives have purpose exhibit a higher tolerance to pain on both cold pressor and heat-based induction procedures (60). Furthermore, patients that have scored higher on a purpose in life scale have demonstrated faster recovery times after total knee arthroplasty (TKA) (61). Pain acceptance is a general willingness to experience pain and its associated cognitive and emotional consequences as a means of fostering a greater sense of personal engagement and well-being by not relying on

avoidant behaviors or control-based coping (62). Pain acceptance levels are directly related to positive affect, which buffers the positive association between pain intensity and negative affect (63).

Depression is defined as a common mental health disorder that presents with a melancholy or irritable mood, loss of pleasure or interest, feelings of low self-worth or guilt, disrupted sleep or appetite, weak concentration, low energy and thoughts of death (64). With approximately 1/5 of the general population affected by chronic pain (65) and depression being the third leading cause of medical disability (66-68), the need for identifying mental health conditions in chronic pain patient populations is paramount. Upwards of 85% of chronic pain patients report being affected by depression (40,69) and the relationship between chronic pain and depression are strongly correlated (70).

Generalized anxiety is defined as excessive uneasiness and worry, occurring more days than not, for at least 6 months, and impacting activities of daily living (71). There is some evidence that a bidirectional relationship exists between anxiety disorders and chronic pain (72,73). The comorbidity of chronic pain and anxiety prevalence may vary between 35% to 60% (74,75). For example, anxiety-related aspects of pain known as pain-catastrophizing and pain-rumination, have been associated with a poorer response to pain treatments, resulting in increased disability due to the pain (76).

Neurobiologically, depression and anxiety share similar regions of the brain that are in control of body pain, supporting the structural foundation for the coexistence of both psychological concerns and chronic pain (77). Further, volumes of the hippocampus and prefrontal cortex were both reduced in patients with depression and appear related to severity of the depression (78,79). With the hippocampus being a therapeutic target for many antidepressants (80,81), the interrelationship could potentially explain the effectiveness of antidepressants in treating both chronic pain and depression. Cognitive behavioral therapy (CBT), an evidence-based psychotherapeutic treatment for depression, anxiety and pain, has been shown to have similar effects on clinical outcomes as antidepressant medications (82). CBT for chronic pain has well-established efficacy as demonstrated by several randomized control trials (83-85) and works to address a variety of problems caused by chronic pain, such as the management of catastrophic thinking and maladaptive behaviors (84,85). Ólason et al (82) found in their randomized control trial with a 3-year follow-up that providing CBT for depression and anxiety, integrated into a rehabilitation pain management treatment, improved the long-term benefits of treatment. This integration of non-pharmacological treatments for psychiatric comorbidities in multidisciplinary pain management may be safer and more effective than pharmacological pain management in isolation.

Barriers and Opportunities to Clinical Implementation

Prevalence rates of chronic pain patients with depression are well known, however, the rate is variable based on the assessment method (86). Due to the correlation of depression and chronic pain, Rapti et al recommended screening for mental disorders for anyone reporting or managing chronic pain (87). Likewise, anxiety disorders and physical diseases have high comorbidity rates, particularly pain syndromes (75,88-90). It appears as though the use of universal screeners for behavioral health disorders would prove beneficial when managing chronic pain to provide personalized medicine and this practice aligns with the patient-centered care model (91).

Unfortunately, the majority of behavioral health disorders remain undetected in medical care settings (92). Based on the rates of comorbidity and improved pain outcomes, comprehensive pain specialists should screen patients for such factors, specifically within the context of invasive neuromodulation strategies (92). Further, Cheatle recommended the use of validated screening tools to be integrated into a comprehensive clinical assessment to identify behavioral health concerns, in addition to strategies to support suicide prevention and interventions, within chronic pain populations (93). For example, the Patient Health Questionnaire-9 (PHQ-9) has shown strong validity and is the most widely used screening tool to detect depression risk in primary care in the US and also includes a suicide screening item (94). A score of 10 or higher on the PHQ-9 has been widely recommended as a first stage screener in primary care, indicating the need for further assessment and/or referral (94). Anxiety disorders are equally common and debilitating as depressive disorders, and have up to 80% comorbidity with depression (95). Brief, validated anxiety screeners such as the General Anxiety Disorder-7 (GAD-7) may be used to detect risk for anxiety disorders. A cut-off score on the GAD-7 of 10 or more has been found to be indicative of a need for further assessment of an anxiety disorders (96). Validated screening tools such as

the PHQ-9 and GAD-7 have been shown to substantially improve accurate and efficient detection of behavioral health disorders risk in medical settings as compared to clinician inquiry without use of a valid tool. It is recommended that clinicians treating patients with chronic pain or opioid abuse risk integrate the use of these tools within their practice. Patient follow-up may include connection with a behavioral health specialist in the setting if available for further assessment and treatment, when warranted. When an on-site or on-call behavioral health specialist is not available, pain clinicians can partner with agencies in the community.

The utility of incorporating such behavioral health screenings into chronic pain practices may facilitate increased access to appropriate behavioral health treatment, resulting in reduced pain, improvement in function, and overall quality of life improvement (87). When looking at patients with chronic lower back pain, depression and anxiety were associated with changes in pain disability at one-year follow-up, further encouraging universal screening for both disorders (97). With multidisciplinary pain management becoming more prominent, the evidence supporting CBT as an effective treatment for chronic pain patients should be considered as a possible supplemental intervention in the treatment plan (98,99). As more evidence becomes available in support of universal screeners, providers must understand that identification is critical in facilitating appropriate treatment and improving clinical outcomes.

Implementing multidisciplinary strategies in pain management may lead to improved patient outcomes, increase practice flow and efficiency, and ultimately demonstrate a cost savings for the practice, patient, and healthcare system (100-102). Interestingly, pain management education and comprehensive care was effective at reducing total care cost by reducing expensive diagnostic imaging and acute inpatient hospital admissions (102). As health integration continues to grow through the expansion of patient-centered medical homes, integrated treatment teams, and interprofessional research programs, the infrastructure needed to execute such integrated models within private practice will become more accessible and mainstream. However, barriers to health integration still exist in a vast majority of settings and will need to be addressed, specifically for successful implementation of multidisciplinary strategies in pain management.

Barriers to care may include billing difficulty, challenges in the adjustment to practice flow, obtaining buy-in by patients, staff, and colleagues, facilitating communication and documentation among multidisciplinary providers (both within and outside of the practice), successful outside referral connections, and financial sustainability (e.g., potential challenges in billing or non-billable services), to name a few. Although many academic medicine programs have overcome such barriers (e.g., Nationwide Children's Sport Medicine Clinic), non-hospital affiliates are being challenged by the barriers mentioned above (103,104).

One possible solution to reducing such challenges to integration may be utilizing strategies such as Behavioral Health Navigation (BHN). BHN, also known more generally as Patient Navigation (PN), is a barrier-reducing, focused intervention used to improve delivery of BH services and access to BH care, typically within an integrated healthcare context (105). The intervention administration is flexible and can be delivered via face-to-face, telehealth, phone, or any combinations.

Such strategies may better facilitate communication amongst providers, referral connection and follow-up for supplemental services, identification of behavioral health conditions (including administration and interpretation of universal screeners), generate a costs savings to the practice, patient, and the healthcare system (102), and provide psychoeducation to increase buy-in by physician colleagues and better inform and empower the patients, as seen in chronic illness and cancer populations (106,107). The BHN process is multifaceted which allows for adaptability in increasing access to care and improvement in quality of life for the patient (108). Although there has been an expansion of nationwide behavioral healthcare services, there are still reports of low rates of accessibility and underutilized behavioral healthcare services for racial and ethnic populations (109). Such information further supports the need for navigation and coordination within a practice to ensure multidisciplinary referrals, specifically those addressing psychosocial concerns, are appropriate and successfully connect patients to providers.

Discussion

Chronic pain is a significant burden to our society and is best understood through a variety of models. Based on this review, a biopsychosocial model, which considers the interplay of physiological, psychological, and social factors interacting to produce the various manifestations of pain and the varying degrees of disability, is the ideal model for understanding the

complexities of chronic pain. In turn, investment in and application of multidisciplinary medicine may provide a superior approach for obtaining desirable outcomes for the management of chronic pain. This is even more critical in the era of the opioid crisis with the known detrimental effects of opioids such as addiction, overdose, and more recently discovered potential carcinogenic effects. While recent in vitro studies have demonstrated the suppression of natural killer cells and thus more growth of the cancer cells (27), there is also some concern about the unmitigated effects of severe pain in the cancer patient (110). Even so, this further provides some compelling reasons to strongly consider non-opioid options in the non-cancer patient.

The International Association for the Study of Pain's definition of pain emphasizes that pain is an unpleasant sensory and emotional experience. This holistic experience is reflected in numerous studies which highlight how treating emotional distress affects the physical pain (39,111). When examining neuroplasticity in chronic pain conditions, numerous regions of the brain exhibit structural and functional changes (112). Kuner suggested that certain molecular target-based interventions as well as targeted neurofeedback and behavioral therapies may be available in the future. This approach is supported by substantial neuroscience literature that demonstrated neurobiological changes following behavioral interventions (113-115). Nonetheless, these data do not detract from the pathophysiological pain model, as many patients with acute injuries have isolated physical ailments. Acute pathophysiological pain is more limited in duration and is more likely to have an isolated physical and psychological sequelae (116). Rather, the biopsychosocial model serves as a template to better understand the transition from an acute pain experience to chronic pain.

When considered collectively, resiliency may be the overarching construct and serves as the linchpin to a positive outcome. In fact, Elliot et al's (117) work in tracking those with high-intensity pain demonstrated that the resilient group were 25% less likely to die within 10 years when compared to the nonresilient group. The benefits of higher resilience are also supported across multiple disciplines (118-120).

Outcome prediction is an integral part of the clinical decision process as the risks and benefits must be weighed for every intervention. The integration of these psychological factors has not been strongly emphasized within interventional pain management, but is gaining traction in orthopedics (121-123). Whether the plan is medication, procedural, or a surgical approach, the patient's biopsychosocial profile must be considered as it will affect the end result. These data do not diminish the practitioner's struggle to offer hope and relief in a chronic pain patient mired down with the sequelae of chronic illness including the aforementioned psychological fatigue, financial strain, and social stressors. Rather, the utilization of brief screening tools can provide a snapshot to facilitate a discussion for addressing the patient's needs. The BHN can then quickly connect the patient to the most appropriate care.

Conclusion

The utilization of a cohesive, multidisciplinary care team for chronic pain likely offers considerable upside when compared to strictly a biomedical approach, and the benefits could reach all aspects of healthcare (i.e., patient, provider, payor). Overall, there appears to be sufficient evidence supporting a multidisciplinary approach for pain management and the benefits may be far-reaching.

References

1. Nicholas M, Vlaeyen JWS, Rief W, et al. The IASP classification of chronic pain for ICD-11. *Pain* 2019; 160:28-37.
2. Manchikanti L, Singh V, Caraway DL, Benyamin RM. Breakthrough pain in chronic non-cancer pain: Fact, fiction, or abuse. *Pain Physician* 2011; 14:E103-E117.
3. Dahlhamer J, Lucas J, Zelaya Carla, et al. Prevalence of Chronic Pain and High-Impact Chronic Pain Among Adults — United States, 2016. *Morb Mortal Wkly Rep* 2018; 67: 1001-1006.
4. Nahin RL, Sayer B, Stussman BJ, Feinberg TM. Eighteen-Year trends in the prevalence of, and health care use for, noncancer pain in the United States: Data from the Medical Expenditure Panel Survey. *J Pain* 2019; 20:796-809.
5. Saxen M, Rosenquist RW. The epidemiology and economic impact of spine pain. In: *Spine Pain Care*. Springer International Publishing; 2020, pp 7-11.
6. Manchikanti L, Boswell M V., Hirsch JA. Lessons learned in the abuse of pain-relief medication: A focus on healthcare costs. *Expert Rev Neurother* 2013; 13:527-544.
7. Wilkes D. Programmable intrathecal pumps for the management of chronic pain: Recommendations for improved efficiency. *J Pain Res* 2014; 7:571-577.
8. Wong AY, Karppinen J, Samartzis D. Low back pain in older adults: Risk factors, management options and future directions. *Scoliosis Spinal Disord* 2017; 12:14.
9. U.S. Department of Health and Human Services. *Pain Management*

Best Practices Inter-Agency Task Force Report: Updates, Gaps, Inconsistencies, and Recommendations.; 2019. www.hhs.gov/sites/default/files/pmtf-final-report-2019-05-23.pdf

10. Chapman CR, Vierck CJ. The transition of acute postoperative pain to chronic pain: An integrative overview of research on mechanisms. *J Pain* 2017; 4:e1-e38.
11. Schatman ME. The American chronic pain crisis and the media: About time to get it right? *J Pain Res* 2015; 8:885-887.
12. Flanigan DC, Everhart JS, Glassman AH. Psychological factors affecting rehabilitation and outcomes following elective orthopaedic surgery. *J Am Acad Orthop Surg* 2015; 23:563-570.
13. MacDowall A, Skeppholm M, Lindhagen L, Robinson Y, Olerud C. Effects of preoperative mental distress versus surgical modality, arthroplasty, or fusion on long-term outcome in patients with cervical radiculopathy. *J Neurosurg Spine* 2018; 29:371-379.
14. Ayers DC, Franklin PD, Ring DC. The role of emotional health in functional outcomes after orthopaedic surgery: Extending the biopsychosocial model to orthopaedics. *J Bone Jt Surgery-American Vol* 2013; 95:e165-1-7.
15. Centers for Disease Control and Prevention. Annual Surveillance Report of Drug-Related Risks and Outcomes — United States, 2017. Surveillance Special Report 1. Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. Published August 31, 2017. www.cdc.gov/drugoverdose/pdf/pubs/2017cdc-drug-surveillance-report.pdf.
16. Porter J, Jick H. Addiction rare in patients treated with narcotics. *N Engl J Med* 1980; 302:123.
17. Portenoy RK, Foley KM. Chronic use of opioid analgesics in non-malignant pain: Report of 38 cases. *Pain* 1986; 25:171-186.
18. Armstrong D. Secret trove reveals Abbott's bold "crusade" to sell OxyContin a blockbuster. STAT website. Published September 22, 2016. www.statnews.com/2016/09/22/abbott-oxycontin-crusade/. Accessed August 2, 2020
19. Juurlink DN, Dhalla IA. Dependence and addiction during chronic opioid therapy. *J Med Toxicol* 2012; 8:393-399.
20. Dunn KM, Saunders KW, Rutter CM, et al. *Opioid Prescriptions for Chronic Pain and Overdose: A Cohort Study*. Ann Intern Med 2010; 152:85-92.
21. Busse JW, Wang L, Kamaleldin M, et al. Opioids for chronic noncancer pain: A systematic review and meta-analysis. *JAMA* 2018; 320:2448-2460.
22. CDC, National Center for Health Statistics. Wide-ranging online data for epidemiologic research (WONDER). Published 2020. http://wonder.cdc.gov. Accessed July 6, 2020
23. Center for Behavioral Health Statistics and Quality. Administration SA and MHS. *2017 National Survey on Drug Use and Health*. 2018. Substance Abuse and Mental Health Services Administration, Rockville, MD. www.samhsa.gov/data/sites/default/files/cbhsq-reports/NSDUHMethodSummDefs2017/NSDUHMethodSummDefs2017.htm
24. Noble M, Treadwell JR, Tregear SJ, et al. Long-term opioid management for chronic noncancer pain. *Cochrane Database Syst Rev* 2007; 2010. Published January 20, 2007
25. Lee M, Silverman S, Hansen H, Patel V, Manchikanti L. A comprehensive review of opioid-induced hyperalgesia. *Pain Physician* 2011; 14:145-161.
26. The Council of Economic Advisers. *The Underestimated Cost of the Opioid Crisis*. Published November 2017. www.hsdl.org/?view&did=806029
27. Maher DP, Walia D, Heller NM. suppression of human natural killer cells by different classes of opioids. *Anesth Analg* 2019; 128:1013-1021.
28. Rose ME. Are prescription opioids driving the opioid crisis? Assumptions vs facts. *Pain Med* 2018; 19:793-807.
29. Aronoff G. How did we get here? A past society president on the opioid crisis. *Pain Med News*. Published online February 28, 2014. www.painmedicinenews.com/Commentary/Article/03-14/How-Did-We-Get-Here-/26043
30. Dasgupta N, Beletsky L, Ciccarone D. Opioid crisis: No easy fix to its social and economic determinants. *Am J Public Health* 2018; 108:182-186.
31. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain-United States, 2016. *JAMA* 2016; 315:1624-1645.
32. Tick H, Nielsen A, Pelletier KR, et al. Evidence-based nonpharmacologic strategies for comprehensive pain care: The Consortium Pain Task Force White Paper. *Explore* 2018; 14:177-211.
33. Manchikanti L, Kaye AM, Knezevic NN, et al. Responsible, safe, and effective prescription of opioids for chronic non-cancer pain: American Society of Interventional Pain Physicians (ASIPP) Guidelines. *Pain Physician* 2017; 20:S3-S92.
34. Kaye AD, Jones MR, Kaye AM, et al. Prescription opioid abuse in chronic pain: An updated review of opioid abuse predictors and strategies to curb opioid abuse (Part 2). *Pain Physician* 2017; 20:S111-S134.
35. Kaye AD, Jones MR, Kaye AD, et al. Prescription opioid abuse in chronic pain: An updated review of opioid abuse predictors and strategies to curb opioid abuse: Part 1. *Pain Physician* 2017; 20:S93-S109.
36. Gerbershagen HU, Frey R, Magin F, Scholl W, Müller-Suur N. The pain clinic: An interdisciplinary team approach to the problem of pain. *Br J Anaesth* 1975; 47:526-529.
37. Schatman M. The demise of multidisciplinary pain management clinics? *Pract Pain Manag* 2006; 6. Available at www.practicalpainmanagement.com/resources/practice-management/demise-multidisciplinary-pain-management-clinics?page=0,1
38. Beecher H. Pain in men wounded in battle. *Ann Surg* 1947; 26:21.
39. Edwards RR, Dworkin RH, Sullivan MD, Turk DC, Wasan AD. The role of psychosocial processes in the development and maintenance of chronic pain. *J Pain* 2016; 17:T70-T92.
40. Bair MJ, Robinson RL, Katon W, Kroenke K. Depression and pain comorbidity: A literature review. *Arch Intern Med* 2003; 163:2433-2445.
41. Edwards RR, Haythornthwaite JA, Smith MT, Klick B, Katz JN. Catastrophizing and depressive symptoms as prospective predictors of outcomes following total knee replacement. *Pain Res Manag* 2009; 14:307-311.
42. Afari N, Ahumada SM, Wright LJ, et al. Psychological trauma and functional somatic syndromes. *Psychosom Med* 2014; 76:2-11.
43. Jackson KL, Devine JG. The effects of smoking and smoking cessation on spine surgery: A systematic review of the literature. *Glob Spine J* 2016; 6:695-701.
44. Giannadakis C, Nerland US, Solheim O, et al. Does obesity affect outcomes after decompressive surgery for lumbar spinal stenosis? A multicenter, observational, registry-based study. *World Neurosurg* 2015; 84:1227-1234.

45. Tarabichi M, Shohat N, Kheir MM, et al. Determining thethreshold for HbA1c as a predictor for adverse outcomes after total joint arthroplasty: A multicenter, retrospective study. *J Arthroplasty* 2017; 32:S263-S267.e1.
46. Rosenberg JG, Ryan ED, Sobolewski EJ, Scharville MJ, Thompson BJ, King GE. Reliability of panoramic ultrasound imaging to simultaneously examine muscle size and quality of the medial gastrocnemius. *Muscle Nerve* 2014; 49:736-740.
47. Dossett HG, Chesser MS. Improving care and reducing length of stay in patients undergoing total knee replacement. *Fed Pract* 2017: 34:38-41.
48. Sturgeon JA, Zautra AJ. Resilience: A new paradigm for adaptation to chronic pain. *Curr Pain Headache Rep* 2010; 14:105-112.
49. Tokish JM, Kissenberth MJ, Tolan SJ, et al. Resilience correlates with outcomes after total shoulder arthroplasty. *J Shoulder Elb Surg* 2017; 26:752-756.
50. Shaha JS, Shaha SH, Bottoni CR, Song DJ, Tokish JM. Preoperative resilience strongest predictor of postoperative outcome following an arthroscopic bankart repair. *Orthop J Sport Med* 2017; 5:2325967117S0011.
51. Ahmed SA, Shantharam G, Eltorai AEM, Hartnett DA, Goodman A, Daniels AH. The effect of psychosocial measures of resilience and self-efficacy in patients with neck and lower back pain. *Spine J* 2019; 19:232-237.
52. Ng Kuet Leong VS, Kästner A, Petzke F, Przemeck M, Erlenwein J. The influence of pain expectation on pain experience after orthopedic surgery: An observational cohort study. *Minerva Anestesiol* 2020; 86:1019-1030.
53. Brox JIJSJI, Skare Ø, Mowinckel P, Brox JIJSJI, Reikerås O, Schrøder CP. Sick leave and return to work after surgery for type II SLAP lesions of the shoulder: A secondary analysis of a randomised sham-controlled study. *BMJ Open* 2020; 10:e035259.
54. Hebert JJ, Abraham E, Wedderkopp N, et al. Preoperative factors predict postoperative trajectories of pain and disability following surgery for degenerative lumbar spinal stenosis. *Spine (Phila Pa 1976)* 2020; 45:E1421-E1430.
55. Fitzsimmons M, Carr E, Woodhouse L, Bostick GP. Development and persistence of suspected neuropathic pain after total knee arthroplasty in individuals with osteoarthritis. *PM R* 2018; 10:903-909.
56. Gaskin DJ, Richard P. The economic costs of pain in the United States. *J Pain* 2012; 13:715-724.
57. Marinus J, Moseley GL, Birklein F, et al. Clinical features and pathophysiology of complex regional pain syndrome. *Lancet Neurol* 2011; 10:637-648.
58. Russo SJ, Murrough JW, Han M-H, Charney DS, Nestler EJ. Neurobiology of resilience. *Nat Neurosci* 2012; 15:1475-1484.
59. Goubert L, Trompetter H. Towards a science and practice of resilience in the face of pain. *Eur J Pain* 2017; 21:1301-1315.
60. Smith BW, Tooley EM, Montague EQ, Robinson AE, Cosper CJ, Mullins PG. The role of resilience and purpose in life in habituation to heat and cold pain. *J Pain* 2009; 10:493-500.
61. Smith BW, Zautra AJ. The role of purpose in life in recovery from knee surgery. *Int J Behav Med* 2004; 11:197-202.
62. Mccracken LM, Eccleston C. A prospective study of acceptance of pain and patient functioning with chronic pain. *Pain* 2005; 118:164-169.
63. Kratz AL, Davis MC, Zautra AJ. Pain acceptance moderates the relation between pain and negative affect in female osteoarthritis and fibromyalgia patients. *Ann Behav Med* 2007; 33:291-301.
64. National Collaborating Centre for Mental Health (UK). *Depression in adults with a chronic physical health problem: Treatment and management*. British Psychological Society; 2010. (NICE Clinical Guidelines, No. 91.) Available from: www.ncbi.nlm.nih.gov/books/NBK82916/
65. Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. *Eur J Pain* 2006; 10:287.
66. Whiteford HA, Harris MG, McKeon G, et al. Estimating remission from untreated major depression: a systematic review and meta-analysis. *Psychol Med* 2013; 43:1569-1585.
67. Collins PY, Patel V, Joestl SS, March D, Insel TR, Daar AS. Grand challenges in global mental health. *Nature* 2011; 475:27-30.
68. World Health Organization. *ATLAS on Substance Use: Resources for the Prevention and Treatment of Substance Use Disorders*. 2010. Available at www.who.int/publications/i/item/9789241500616.
69. Williams LJ, Jacka FN, Pasco JA, Dodd S, Berk M. Depression and pain: An overview. *Acta Neuropsychiatr* 2006; 18:79-87.
70. Fishbain DA, Cutler R, Rosomoff HL, Rosomoff RS. Chronic pain-associated depression: Antecedent or consequence of chronic pain? A review. *Clin J Pain* 1997; 13:116-137.
71. American Psychological Association (APA). *Diagnostic and Statistical Manual of Mental Disorders: Depressive Disorders 5th Edition*. American Psychiatric Publishing, Inc, Washington, D.C., 2013.
72. Gureje O, Simon GE, Von Korff M. A cross-national study of the course of persistent pain in primary care. *Pain* 2001; 92:195-200.
73. Cohen S, Rodriguez MS. Pathways linking affective disturbances and physical disorders. *Heal Psychol* 1995; 14:374-380.
74. Fishbain DA, Goldberg M, Robert Meagher B, Steele R, Rosomoff H. Male and female chronic pain patients categorized by DSM-III psychiatric diagnostic criteria. *Pain* 1986; 26:181-197.
75. McWilliams LA, Cox BJ, Enns MW. Mood and anxiety disorders associated with chronic pain: An examination in a nationally representative sample. *Pain* 2003; 106:127-133.
76. Burns JW, Johnson BJ, Mahoney N, Devine J, Pawl R. Cognitive and physical capacity process variables predict long-term outcome after treatment of chronic pain. *J Consult Clin Psychol* 1998; 66:434-439.
77. Meerwijk EL, Ford JM, Weiss SJ. Brain regions associated with psychological pain: implications for a neural network and its relationship to physical pain. *Brain Imaging Behav* 2013; 7:1-14.
78. MacQueen GM, Yucel K, Taylor VH, Macdonald K, Joffe R. Posterior hippocampal volumes are associated with remission rates in patients with major depressive disorder. *Biol Psychiatry* 2008; 64:880-883.
79. Chan SWY, Harmer CJ, Norbury R, O'Sullivan U, Goodwin GM, Portella MJ. Hippocampal volume in vulnerability and resilience to depression. *J Affect Disord* 2016; 189:199-202.
80. Sairanen M, Lucas G, Ernfors P, Castrén M, Castrén E. Brain-derived neurotrophic factor and antidepressant drugs have different but coordinated effects on neuronal turnover, proliferation, and survival in the adult dentate gyrus. *J Neurosci* 2005;

25:1089-1094.

81. Santarelli L, Saxe M, Gross C, et al. Requirement of hippocampal neurogenesis for the behavioral effects of antidepressants. *Science* 2003; 301:805-809.
82. Ólason M, Andrason RHRRH, Jónsdóttir IH, et al. Cognitive behavioral therapy for depression and anxiety in an interdisciplinary rehabilitation program for chronic pain: A randomized controlled trial with a 3-year follow-up. *Int J Behav Med* 2018; 25:55-66.
83. Linden M, Scherbe S, Cicholas B. Randomized controlled trial on the effectiveness of cognitive behavior group therapy in chronic back pain patients. *J Back Musculoskelet Rehabil* 2014; 27:563-568.
84. Buhrman M, Syk M, Burvall O, Hartig T, Gordh T, Andersson G. Individualized guided internet-delivered cognitive-behavior therapy for chronic pain patients with comorbid depression and anxiety: A randomized controlled trial. *Clin J Pain* 2015; 31:504-516.
85. Wetherell JL, Afari N, Rutledge T, et al. A randomized, controlled trial of acceptance and commitment therapy and cognitive-behavioral therapy for chronic pain. *Pain* 2011; 152:2098-2107.
86. Wörz R, Frank M, Achenbach U. Controlled-release oxycodone--a therapeutic option for severe neuropathic pain. Two multicenter observational studies. *MMW Fortschr Med* 2003; 145 Suppl 3:71-76.
87. Rapti E, Damigos D, Apostolara P, Roka V, Tzavara C, Lionis C. Patients with chronic pain: Evaluating depression and their quality of life in a single center study in Greece. *BMC Psychol* 2019; 7:86.
88. McWilliams LA, Goodwin RD, Cox BJ. Depression and anxiety associated with three pain conditions: Results from a nationally representative sample. *Pain* 2004; 111:77-83.
89. Gili M, Comas A, García-García M, Monzón S, Antoni S-B, Roca M. Comorbidity between common mental disorders and chronic somatic diseases in primary care patients. *Gen Hosp Psychiatry* 2010; 32:240-245.
90. Sareen J, Cox BJ, Clara I, Asmundson GJG. The relationship between anxiety disorders and physical disorders in the U.S. National Comorbidity Survey. *Depress Anxiety* 2005; 21:193-202.
91. Institute of Medicine (US) Committee on Quality of Health Care in America. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington (DC): National Academies Press (US); 2001.
92. Shamji MF, Rodriguez J, Shcharinsky A, Paul D. High rates of undiagnosed psychological distress exist in a referral population for spinal cord stimulation in the management of chronic pain. *Neuromodulation* 2015; 19:414-421.
93. Cheatle MD. Depression, chronic pain, and suicide by overdose: On the edge. *Pain Med* 2011; 12:S43-S48.
94. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9. *J Gen Intern Med* 2001; 16:606-613.
95. Kessler RC, Avenevoli S, McLaughlin KA, et al. Lifetime co-morbidity of DSM-IV disorders in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *Psychol Med* 2012; 42:1997-2010.
96. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. *Arch Intern Med* 2006; 166:1092-1097.
97. de Oliveira RF, Fandim JV, Fioratti I, Fernandes LG, Saragiotto BT, Pena Costa LO. The contemporary management of nonspecific lower back pain. *Pain Manag* 2019; 9:475-482.
98. Dehghani M, Sharpe L, Nicholas MK. Modification of attentional biases in chronic pain patients: A preliminary study. *Eur J Pain* 2004; 8:585-594.
99. McCracken LM, Turk DC. Behavioral and cognitive-behavioral treatment for chronic pain: Outcome, predictors of outcome, and treatment process. *Spine* 2002; 27:2564-2573.
100. Brecht DM, Stephens J, Gatchel RJ. Interdisciplinary pain management programs in the treatment of pain conditions. In: Noe C (eds). *Pain management for clinicians*. Springer International Publishing, Switzerland, 2020 pp 461-489.
101. Noe C, McDermo E. The benefits of interdisciplinary pain management. *J Fam Pract* 2012; 61:S5-S16.
102. Maeng DD, Baylor K, Bulger JB, Han JJ. Impact of a multidisciplinary pain management program on patient care utilization and cost of care. *J Pain Res* 2018; 11:2375-2383.
103. Warren C, Jaisankar P, Saneski E, Tenberg A, Scala E. Understanding barriers and facilitators to nonpharmacological pain management on adult inpatient units. *Pain Manag Nurs* 2020; 21:480-487.
104. Danilov A, Danilov A, Barulin A, Kurushina O, Latysheva N. Interdisciplinary approach to chronic pain management. *Postgrad Med* 2020; 132:5-9.
105. Freeman HP, Rodriguez RL. History and principles of patient navigation. *Cancer* 2011; 117:3537-3540.
106. Crowley RA, Kirschner N. The integration of care for mental health, substance abuse, and other behavioral health conditions into primary care: Executive summary of an American college of physicians position paper. *Ann Intern Med* 2015; 163:298-299.
107. Lanoye A, Stewart KE, Rybarczyk BD, et al. The impact of integrated psychological services in a safety net primary care clinic on medical utilization. *J Clin Psychol* 2017; 73:681-692.
108. Freund KM, Battaglia TA, Calhoun E, et al. Impact of patient navigation on timely cancer care: The patient navigation research program. *J Natl Cancer Inst* 2014; 106:dju115.
109. Alegría M, Alvarez K, Ishikawa RZ, DiMarzio K, McPeck S. Removing obstacles to eliminating racial and ethnic disparities in behavioral health care. *Health Aff* 2016; 35:991-999.
110. Boland JW, Pockley AG. Influence of opioids on immune function in patients with cancer pain: from bench to bedside. *Br J Pharmacol* 2018; 175:2726-2736.
111. Meints SM, Edwards RR, Gilligan C, Schreiber KL. Behavioral, psychological, neurophysiological, and neuroanatomic determinants of pain. *J Bone Jt Surg* 2020; 102:21-27.
112. Kuner R, Flor H. Structural plasticity and reorganisation in chronic pain. *Nat Rev Neurosci* 2016; 18:20-30.
113. Sevinc G, Hölzel B, Greenberg J, et al. Strengthened hippocampal circuits underlie enhanced retrieval of extinguished fear memories following mindfulness training. Biol Psychiatry 2019; 86:693-702
114. Goldfarb E, Sinha R. Fighting the return of fear: Roles of mindfulness-based stress reduction and the hippocampus. *Biol Psychiatry* 2019; 86:652-653.
115. Guan M, Ma L, Li L, et al. Self-regulation of brain activity in patients with postherpetic neuralgia: A double-blind randomized study using real-time FMRI neurofeedback. *PLoS One* 2015; 10:e0123675.
116. Katz W, Rothenberg R. Section 3: The nature of pain: Pathophysiology. *J Clin Rheumatol* 2005; 11(Suppl):S11-15.
117. Elliott AM, Burton CD, Hannaford PC. Resilience does matter: Evidence from

a 10-year cohort record linkage study. *BMJ Open* 2014; 4:e003917.

118. Campo RA, Wu LM, Austin J, Valdimarsdottir H, Rini C. Personal resilience resources predict post-stem cell transplant cancer survivors' psychological outcomes through reductions in depressive symptoms and meaning-making. *J Psychosoc Oncol* 2017; 35:666-687.
119. Johnson AK, Hayes SN, Sawchuk C, et al. Analysis of posttraumatic stress disorder, depression, anxiety, and resiliency within the unique population of spontaneous coronary artery dissection survivors. *Am Hear Assoc* 2020; 9:e014372.
120. Springer BD, Sotile WM. The psychology of total joint arthroplasty. *J Arthroplasty* 2020; 35:S46-S49.
121. Rosenberger PH, Jokl P, Ickovics J. Psychosocial factors and surgical outcomes: An evidence-based literature review. *J Am Acad Orthop Surg* 2006; 14:397-405.
122. Wieser K, Zingg PO, Betz M, Neubauer G, Dora C. Total hip replacement in patients with history of illicit injecting drug use. *Arch Orthop Trauma Surg* 2012; 132:1037-1044.
123. Moseley JB, O'Malley K, Petersen NJ, et al. A Controlled trial of arthroscopic surgery for osteoarthritis of the knee. *N Engl J Med* 2002; 347:81-88.