



REVIEW

Lessons for Better Pain Management in the Future: Learning from the Past

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Received: March 6, 2020 / Published online: May 14, 2020
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ABSTRACT

The treatment of noncancer pain in the United States and globally is met with significant challenges, resulting in profound physical, emotional, and societal costs. Based on this need, numerous modalities have been proposed to manage chronic pain, including opioid and nonopioid interventions as well as surgical approaches. Thus, the future of pain management continues to be mired in evolving concepts and constant debates. Consequently, it is crucial to understand the past as we move towards the future. The evolution of lessons for better pain management at present and for the future starting from the 1990s to the present date are reviewed and emphasized with a focus

on learning from the past for the future. This review summarizes the evolution of multiple modalities of treatments, including multidisciplinary programs, multimodal therapy, interventional techniques, opioid therapy, other conservative modalities, and surgical interventions. This review emphasizes the individual, patient-centered development of an effective pain treatment plan after proper evaluation to establish a diagnosis. It includes measurable outcomes that focus on improvements in the quality of life and activities of daily living, as well as improvement in pain and function and, most importantly, return to productive citizenship. It is crucial that the knowledge of best practices be advanced, along with emphasis on lessons learned in the past to provide best practices for better pain management.

Digital Features To view digital features for this article go to <https://doi.org/10.6084/m9.figshare.12155850>.

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Keywords: Better pain management; Best practices; Evidence-based medicine; Interventional techniques; Opioid epidemic

Key Summary Points

Why carry out this study?

Treatment of non-cancer pain in the United States and globally continues to face significant challenges, resulting in emotional and societal costs.

The future of pain management continues to be debated on a daily basis. Those involved in pain management, including patients, officials, and physicians, are focusing on advances. However, these advances, and the future evolution of interventional pain management, may be based on lessons learned in the past and present.

What was learned from this study?

This review illustrates substantial variations in the management of chronic non-cancer pain.

The review also illustrates the evolution and numerous issues related to the opioid epidemic, and growing utilization and costs of numerous available modalities, and the demise of multidisciplinary clinics in conjunction with increasing disability.

Future research and advocacy efforts will be necessary to demonstrate the benefit of multidisciplinary clinics and multimodal approaches to the management of chronic pain in order to improve the quality of life and provide appropriate access to effective modalities of treatments focusing on non-opioid therapy.

INTRODUCTION

Chronic pain has been recognized as a national public health problem with profound physical, emotional, and societal costs [1, 2]. Even though estimates vary depending on the methodology used to assess chronic pain, it has been shown that it affects almost 50 million United States (US) adults, of which 19.6 million of these adults experience high-impact chronic pain that interferes with daily life or work activities [3]. The worldwide cost of pain is enormous [4, 5]. The annual US expenditures alone related to pain, including direct medical costs and lost wages, have been estimated to be higher than those for cancer, heart disease, and diabetes combined. However, the treatment covered by these expenditures does not fully alleviate pain in the United States or other countries. The Institute of Medicine (IOM) report of 2011 concluded that the epidemic of chronic pain demands public health approaches with public education to counter myths, stereotypes, and stigma that hinder better care [2]. Cost estimates of chronic pain have been shown by IOM of United States dollars (USD) 560 billion to USD 635 billion annually, which also included a multitude of other conditions, whereas others have estimated approximately USD 100 billion per year in managing spinal pain, which also included surgical interventions [6, 7]. Dieleman et al. [8] provided more accurate estimates of health care spending for spinal pain of USD 87.6 billion in managing low back and neck pain and USD 95.9 billion for musculoskeletal pain with a total of USD 183.5 billion, with escalating disability [9–11]. In a comprehensive review of chronic noncancer pain in Europe, Reid et al. [12] showed that chronic pain was associated with depressive symptoms, significantly impacted patient-perceived health status, affected everyday activities including economic pursuits and personal relationships. They reported 1-month prevalence of moderate-to-severe noncancer pain as 19%. In another review, Bekkering et al. [13] showed that the prevalence of moderate-to-severe general chronic pain among Dutch adults was around 18%. The purpose of this manuscript is

to evaluate the evolution of multiple modalities of treatments including multimodal therapy, interventional techniques, opioid therapy, other conservative modalities, and surgical interventions. Following appropriate review, our objectives are to identify the gaps and provide appropriate strategies for future years.

This article is based on previously conducted studies and does not contain any studies with human participants or animals performed by any of the authors.

IMPACT OF CHRONIC PAIN

With the suggestion that the prevalence of pain remains the same despite the increases of treatment modalities and disability, Freburger et al. [14] showed a rapid overall increase for low back pain of 162% from 3.9% in 1992 to 10.2% in 2006 in a survey conducted in North Carolina (US). In addition, Hoy et al. [10] showed a variable prevalence of spinal pain with a significant recurrence of 24–80%. Further, multiple studies of prevalence of low back and neck pain and its impact in the general population have shown 23% of patients reporting grade II–IV low back pain [15] with a high pain intensity and disability compared to 15% with neck pain [16]. The literature also shows that persistent pain is highly prevalent in the elderly and closely associated with functional limitations [17, 18].

Numerous modalities have been increasingly utilized since the 1990s in managing chronic pain. Exploding health care costs became a major issue for the United States and the world [5], leading to various measures of health care reform, regulations, and the imposition of guidelines often based on quasi evidence-based medicine (EBM) and comparative effectiveness research (CER). The Affordable Care Act (ACA) was enacted in 2010 to increase access, bend the cost curve, and improve quality. It is debatable to what extent these goals have been achieved thus far in the United States [19, 20]. Martin et al. [7] in assessing the treatment costs of back and neck pain problems showed USD 86 billion in health care expenditures in the United States in 2005, an increase of 65% in

expenditures and a 49% increase in the number of patients seeking spine-related care from 1997 through 2006. Overall costs have been described earlier for spinal pain, musculoskeletal pain, and overall chronic pain with costs ranging from USD 100 billion to USD 635 billion. During these years, rates of imaging, interventional techniques, drug use, including opioid use, and surgery for chronic pain problems have increased substantially [5]. Consequently, all modalities have been considered to be escalating with controls being applied.

OPIOID EPIDEMIC

Until recently, efforts to improve pain care led to an increased use of opioids starting in the late 1990s. The evolution of the opioid epidemic dates back 5000 years starting with the use of extracts of the poppy plant, also called “joy plant”, for medical purposes [21, 22]. Opioids, including heroin, were freely available as over-the-counter medical products since 1849 [21]. However, it was identified that there were many who were addicted to cocaine and there were an estimated 200,000 heroin addicts in the United States by 1972 [22]. This occurred despite federal legislation starting with the Heroin Act (1906–1924), which outlawed the production and possession of heroin, in an effort to control the escalating toll of drug abuse [22]. Consequently, the Controlled Substance Act (CSA) was established in 1970 in the United States [23]. The CSA regulated narcotic manufacturing and distribution and classified controlled substances into five narcotic schedules. Consequently, methadone clinics emerged in 1972 [24], and methadone itself soon became a drug of abuse. The emergence of a new pain movement focusing on the undertreatment of pain, influenced by pharmaceutical industry, led to liberalization of multiple existing narcotics regulations and contributed to the escalation in prescription opioid use, abuse, and overdose-related deaths near the end of the century [4, 21, 25].

The opioid epidemic is not a US issue alone, it has essentially become a universal phenomenon with involvement of almost all

countries [26–38]. The US drug overdose data of drug-related deaths from 2017 shows over 70,000 drug overdoses, of which 47,600 were related to opioid overdoses [38]. As shown in Fig. 1, national drug overdose deaths have been escalating. However, it has been shown that the majority of the increases are related to synthetic opioids, as well as heroin. The recent data shows a 14.5% drop in prescription drug opioid deaths to less than 12,000. However, heroin deaths continue to increase, and in 2017, there were over 15,000 deaths due to heroin and, as shown in Fig. 2, fentanyl deaths is the category largely responsible for the escalating opioid epidemic.

In addition, 63% of the deaths involve various other drugs in addition to prescription opioids with 34% cocaine, 33% benzodiazepines, and 12% methamphetamine [37]. Even though deaths due to prescription opioids are declining, the overall opioid deaths continue to increase. Further, age old comparison of increasing prescriptions correlating with increasing deaths has been nullified now that prescriptions are declining, but overall opioid deaths are increasing. The results from the 2018 US National Survey on Drug Use and Health

(NSDUH) [39] showed that nearly one in five people aged 12 or older, or 19.4%, used an illicit drug in the past year, which is a higher percentage than in 2015 and 2016. Further, in 2018, almost 16% of the US population used marijuana, which was higher than percentages in 2002–2017. Prescription pain reliever misuse was also the second most common form of illicit drug use in the United States in 2018, with 3.6% of the population misusing pain relievers.

Even though there is overwhelming evidence that the epidemic of opioid use involves not only the use of prescription opioids, but fentanyl and heroin, policy experts appear to have focused on prescription opioids as the main target in the United States [21]. Manchikanti et al. [21] described various issues related to the opioid epidemic and pointing out the tragic failure of systems in place to control opioid misuse, which propagated the epidemic starting with the pain movement together with a confluence of interest and failure of oversight with industry being responsible to a great extent. Multiple issues related to confluence of interest included promotion of opioids based on inadequate evidence with advocacy from Portenoy

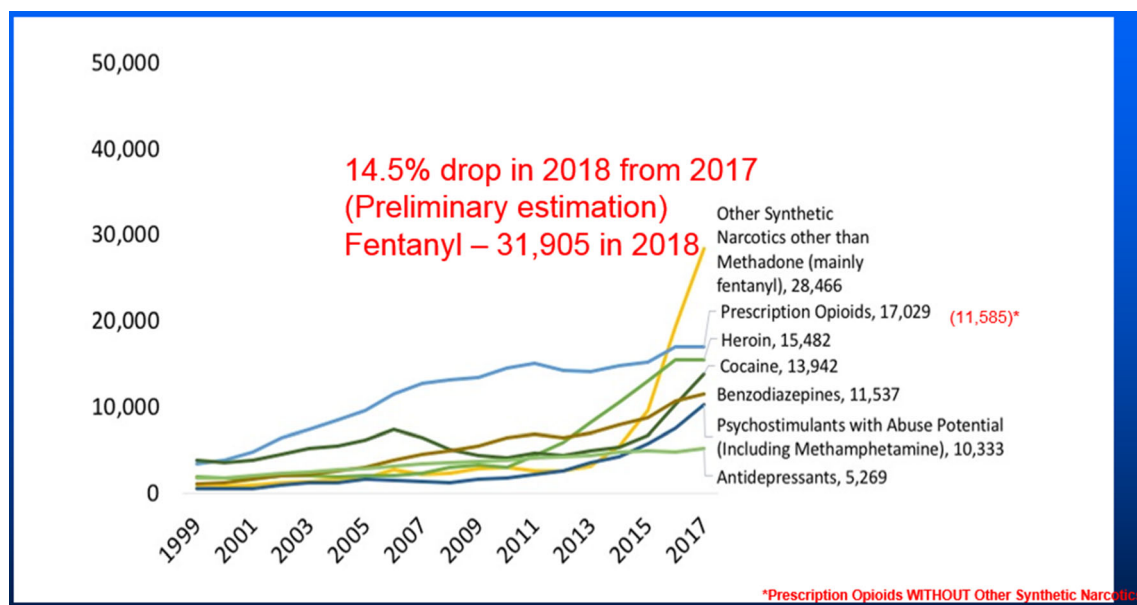


Fig. 1 National drug overdose deaths (number among all ages, 1999–2017). Reproduced from NIDA. (2020, March 10). Overdose Death Rates. Retrieved from [https://www.](https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates)

[drugabuse.gov/related-topics/trends-statistics/overdose-death-rates](https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates) on 2020, April 20

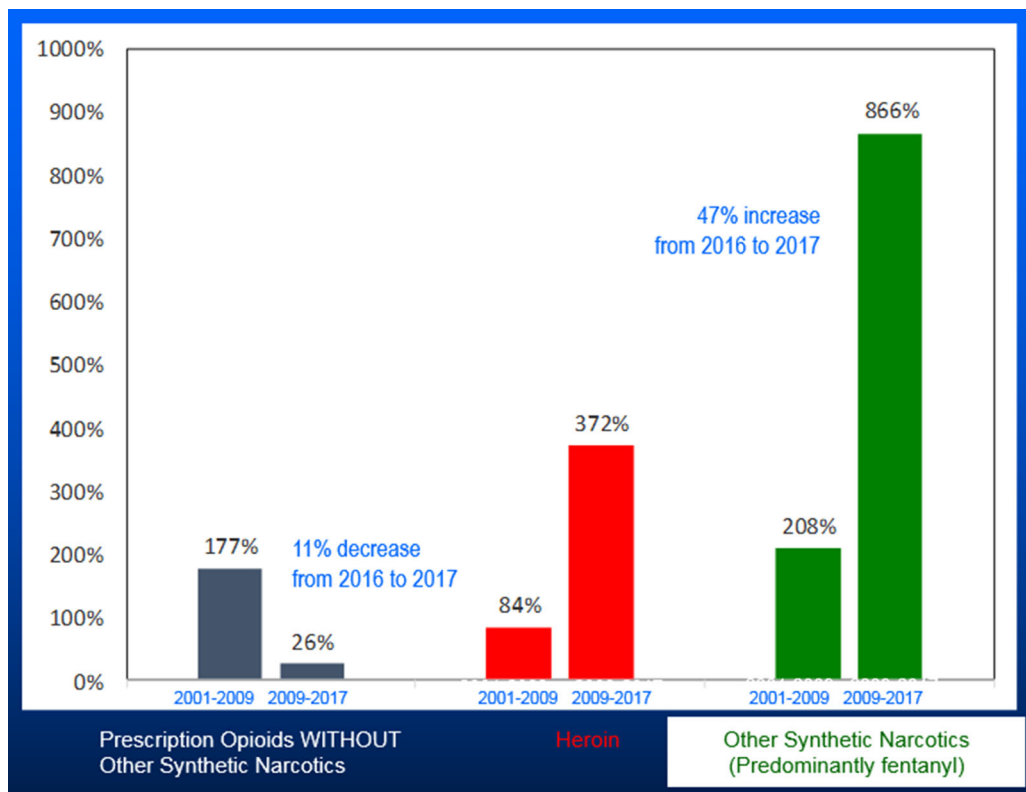


Fig. 2 Quantification of opioid deaths. Reproduced from NIDA. (2020, March 10). Overdose Death Rates. Retrieved from <https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates> on 2020, April 20

and Foley [40]. Subsequently, the Fifth Vital Sign was established in 1995, which became a universal phenomenon [21]. Further, fuel was added with the guidelines implemented by medical boards theoretically for appropriate opioid usage. There were also failures in the oversight of not only opioid manufacturing, distribution, diversion, and import, but also medical necessity and appropriate monitoring of opioid prescriptions.

The significant movement to control the opioid epidemic in the United States was initiated with prescription drug monitoring programs, state regulations, curbing opioid productions, with increased focus on education, with overall federal spending increasing by 128% from 2017 to 2018 with major increases of federal spending in treatment and recovery categories from approximately USD 599 million to USD 2.1 billion [41–52]. Total opioid spending increased from USD 3.3 billion in 2017 to USD 7.4 billion in 2018 in the United States

[41]. In addition, numerous regulations and enhanced prescription drug monitoring programs have also contributed to decreases in opioid prescriptions from a high of 255 million in 2012 to 191 million in 2017, a decrease of 25% [53].

Overall prescription patterns have also changed with reduced dosages. However, this has not gone without criticism. A multitude of criticism has been advanced against the Centers for Disease Control and Prevention (CDC) guidelines and other measures [50–55]. Consequently, the Department of Health and Human Services (HHS), as well as the CDC, have clarified and are encouraging to provide opioids for patients with appropriate medical necessity even though they continue to focus on reducing utilization [54, 55].

INTERVENTIONAL TECHNIQUES

The second most commonly utilized technique in managing chronic pain is with interventional techniques. Interventional techniques are one of the commonly utilized modalities of treatments in managing chronic pain, with increasing use and debate in reference to effectiveness and medical necessity [56]. While there has been increasing utilization over the years, since 2009 there has been a decline in utilization of overall interventional techniques, specifically epidural injections. Manchikanti et al. [56] in a manuscript updating the utilization patterns showed an increase of interventional techniques from 2000 to 2009 of 173.6%, whereas there was a decline of 6.7% in utilization of interventional techniques from 2009 to 2018. Similarly, based on this manuscript [56], epidural injections were shown to have decreased 21% from 2009 to 2018 with an annual decline of 2.6%. Overall, interventional pain management techniques have been shown to be declining, as shown in Fig. 3.

Authors of various manuscripts [19, 20, 56] have attributed declines to some extent to the policies related to the ACA. Various multiple other modalities apart from opioids and interventional techniques include over-the-counter medications, physical therapy and occupational therapy modalities, alternative therapies, and finally surgical interventions including complex surgical fusions, which have been utilized extensively [4, 57–64]. The clinical effectiveness and cost utility have been demonstrated for interventional techniques in multiple assessments [65–79].

MULTIDISCIPLINARY PAIN MANAGEMENT PROGRAMS

Multidisciplinary programs have been defined differently by different groups over the years [80]. These programs may include intensive interdisciplinary therapy versus special interventional pain management programs or special neurosurgical or orthopedic pain

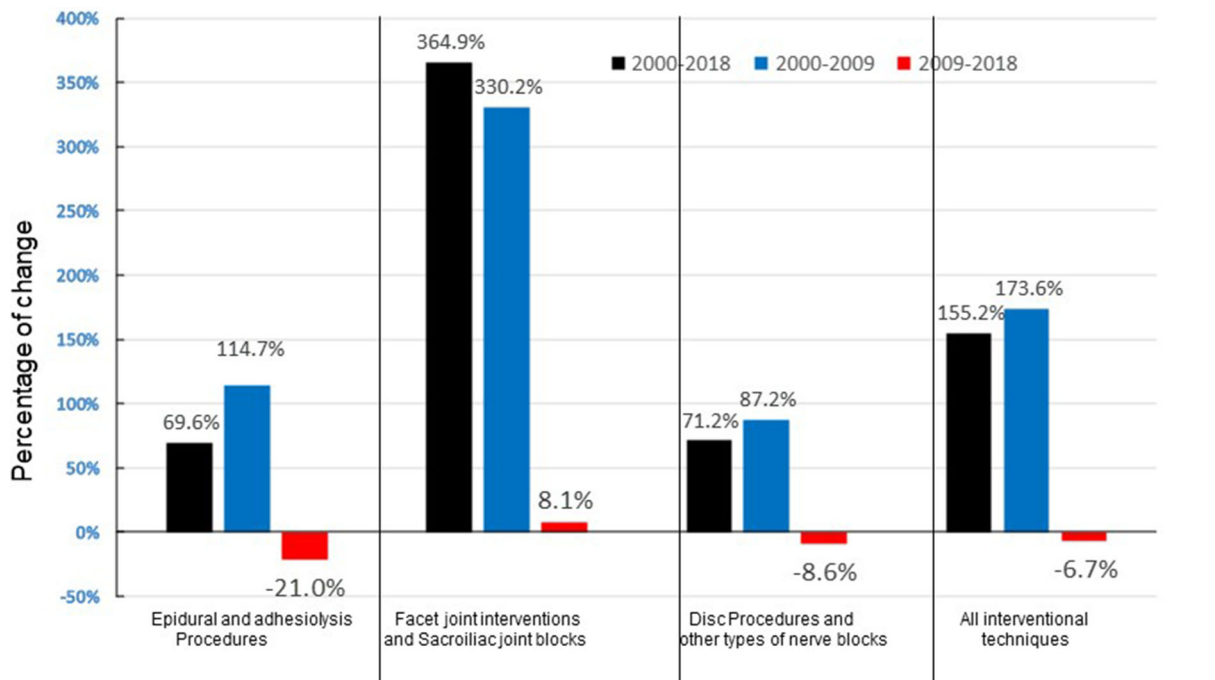


Fig. 3 Comparative analysis of epidural and adhesiolysis procedures, facet joint interventions, and sacroiliac joint blocks, disc procedures, and other types of nerve blocks, all

of which are interventional techniques. Reproduced from Manchikanti Let al. [56]

management programs versus conservative treatment without interventions. Conceptually, multidisciplinary pain management programs are based on the biopsychosocial model in the treatment algorithm of chronic non-cancer pain [81, 82]. Further, multidisciplinary programs are based on the concept that there is no purely nociceptive pain and lack of pure nociceptive pain does not exclude the treatment paradigms [83]. However, many of the patients with non-nociceptive pain as well as with psychological issues, either comorbid or predominant with significant dysfunction and chronic pain syndrome, may be successfully treated in a multidisciplinary setting [83]. Multiple systematic reviews and meta-analyses [84–88] of integrated multidisciplinary chronic pain management programs offered evidence that such programs provide these chronic pain patients an opportunity for relief of their suffering and return to functional lifestyles. It has always been believed that the prior lack of effective treatment of such patients was the result of insufficient diagnosis or insufficient comprehensive therapeutic approaches. It is claimed that multidisciplinary chronic pain management programs provide such diagnostic and therapeutic effectiveness in addition to cost utility effectiveness. Multidisciplinary programs best address not only clinical issues but also behavioral issues with continuing disability, fear, and reliance upon medications [89–92]. In fact, in terms of longevity of benefits of integrated multidisciplinary programs, a follow-up study of patients 13 years following treatment was supportive of maintenance of gains [93, 94]. In addition, it has also been shown that the patients undergoing multidisciplinary treatment of chronic pain utilized fewer medical services compared to chronic pain patients treated through other approaches, even in countries with national health insurance. These programs have been proven to be effective for the treatment of chronic back pain in nationalized health care countries, along with recommendations by German Guidelines for the Treatment of Low Back Pain [95–99]. Despite the body of literature support, the clinical effectiveness, and cost-effectiveness of integrated multidisciplinary chronic pain

management programs, the number of such programs in the United States has steadily decreased in the United States [83]. At present, there are very few programs in the United States offering multidisciplinary pain management programs on a conceptual basis and approved by the Commission for the Accreditation of Rehabilitation Facilities (CARF), in an interdisciplinary fashion with incorporation of various disciplines.

LESSONS LEARNED: PAST TO PRESENT

Based on the review of the literature as shown above, we have learned the lessons of extensive use of almost all modalities of treatments, specifically opioids, which led to an unprecedented epidemic. There has been significant concern among policy makers to not only control the opioid epidemic but also control the overall costs. Previous evidence has also shown that numerous gaps exist in the EBM and assessment of medical necessity of various techniques utilized in treating chronic pain. The Pain Management Best Practices Inter-Agency Task Force identified numerous deficiencies in present care [1]. These lessons included various issues faced by chronic pain patients and lack of access to appropriate modalities of treatments. According to a CDC report using data from National Violent Death Reporting System (NVDRS), the percentage of people who died by suicide and had evidence of chronic pain increased from 7.4% in 2003 to 10.2% in 2014 [100]. The report indicated that these findings are more concerning when one considers the rising trend of health care professionals opting out of treating pain, thus exacerbating an existing shortage of pain management specialists [2], leaving a vulnerable population without adequate access to care. Further, comprehensive pain management can be a challenge. Significant concern was also expressed in reference to opioid management with stigma, comorbidities with anxiety and depression, substance abuse disorders and multiple other issues relating to abuse patterns, and exacerbation of the pain. In fact, multiple

measures employed to educate the patients, prescribers, and to curb prescription opioid misuse with appropriate monitoring led to a gradual decrease of prescriptions, opioid deaths, and opioid misuse [28, 41–52]. Multiple gaps were also identified in managing chronic pain with current inconsistencies and fragmentation of pain care limiting the best practices and patient outcome, recommending a coherent policy for pain management. The specific identified gaps include the following [1]:

1. Multimodal, non-opioid therapies are underutilized in the perioperative, inflammatory, musculoskeletal, and neuropathic injury settings.
2. Clinical policies tend to treat the large population of patients with multiple conditions that cause chronic pain with simple medication rules. Guidelines for medication use for specific populations of patients of different ages, gender, medical conditions, and with comorbidities with chronic pain need to be developed for each specialty group and setting.
3. Opioids are often used early in pain treatment due to minimal pain education in medical school and residency programs, and little guidance for primary care physicians in appropriate pain treatment approaches.
4. There is often a lack of understanding and education regarding clinical indication and effective use of non-opioid medications for acute and chronic pain management. Thus, chronic pain is often ineffectively managed for a variety of reasons, including clinician training, patient access, and other barriers of care.
5. There is a lack of clarity on which rehabilitation therapy or treatments with therapeutic exercises, massage therapy traction, physical therapy modalities, and occupational therapy are indicated in the various pain syndromes.
6. Pain specialists are often not involved in the multidisciplinary approach of diagnosing and treating a pain patient early enough in the treatment phase, which can lead to suboptimal patient outcomes.
7. Access to evidence-based psychological and behavioral health approaches for treating chronic pain and mental and comorbidities (e.g., post-traumatic stress disorder, depression, anxiety, mood disorders, substance use disorders) is limited by geography, reimbursement, and education in family care and specialty care settings. A large variety of complementary and indicative health approaches are often overlooked in the management of pain, with a lack of understanding of these modalities.
8. There is a need for opioid prescribing guidelines for the aging population that provide a potential for increased risk of falls, cognitive impairment, respiratory depression, or metabolism impairment, and age-related and non-age-related pain issues. Several issues related to managing chronic high-impact pain in women are not addressed.
9. Socioeconomic and cultural barriers may impede patient access to effective multidisciplinary care.
10. Specific conditions developed by military active duty, reserve service members, and veterans are often not addressed in chronic pain management.
11. The importance of multidisciplinary pain management programs is underscored, leading to the demise of multidisciplinary pain management clinics [82, 83]. Despite significant evidence in the past of their clinical and cost-effectiveness and them being approved in multiple nationalized health care systems.

PAIN MANAGEMENT BEST PRACTICES

HHS developed the Pain Management Best Practices Based on an Inter-Agency Task Force [1]. This report included updates, gaps, inconsistencies, and recommendations for pain management best practices. The final report was released in May of 2019. However, despite the extensive review in the Best Practices Task

Force, actual practices moved away from multidisciplinary pain management programs to nominal interdisciplinary pain management programs. Thus, despite multiple issues related to chronic pain management as described above, advances continue with the development of medical therapy, rehabilitation therapies, opioid therapy, interventional techniques, and surgical approaches. Clinical best practices based on lessons learned include the application of evidence-based principles, with the provision of cost-effective care to improve outcomes with quality of life and ability to improve activities of daily living. Several clinical practice guidelines of chronic pain, specifically related to interventional techniques and opioid therapy have been based on principles of EBM with adherence to trustworthy standards with appropriate evidence review, which includes the grading or rating the quality and strength of evidence [4, 5]. The guidelines developed for responsible, safe, and effective prescription of opioids for chronic non-cancer pain by the American Society of Interventional Pain Physicians (ASIPP) provided recommendations of four steps with initial steps of opioid therapy, assessment of effectiveness of long-term opioid therapy, monitoring for adherence and side effects, and a final phase. These guidelines have described a ten-step process in opioid therapy (Table 1). They also showed risk stratification and monitoring process [4].

Guidelines for interventional techniques developed by ASIPP [5] identified the evidence for multiple diagnostic and therapeutic modalities with an algorithmic approach as shown in Fig. 4. Further, the more recent evidence available with multiple randomized controlled trials (RCTs), real-world evidence, and systematic reviews shows clinical and cost-effectiveness [65–79]. In addition to the interventional techniques, guidelines have been developed for regenerative medicine, antithrombotic usage, and sedation based on evidence-based principles [101–106].

The CDC provided guidance in managing opioid therapy in primary care settings, which has been applied in all settings [49]. The recommendations are shown in Table 2.

HHS also provided guidance for best practices in managing opioid therapy, which are shown in Table 3.

BEST PRACTICES FOR THE FUTURE

Based on extensive literature and best practice guidance from HHS [1], clinical best practices are recommended with five treatment approaches, as shown in Fig. 5.

Medical Therapy

Effective pain management for chronic pain is achieved through a patient-centered, multidisciplinary approach that may include pharmacotherapy including opioid and non-opioid options [1]. However, due to the opioid epidemic and the public care crisis, there is a surge of interest in non-opioid pharmacotherapies for chronic pain, while continuing with the research to best opioid therapy [105, 107, 108]. Non-opioid medications that are commonly used include acetaminophen, non-steroidal anti-inflammatory (NSAIDs), antidepressants, anticonvulsants, musculoskeletal agents, biologics, topical analgesics, and anxiolytics [1]. Non-opioid medications may be effective in reducing opioid dosages and minimizing opioid toxicity. However, all medications are associated with their own risks and benefits along with different mechanisms of action. These medications can be often synergistic when used in combination. However, a risk–benefit analysis must be performed prior to engaging in combination therapy.

Opioid therapy has been well described in multiple guidelines with necessity to appropriate risk assessment, close follow-up, and reassessment of pain relief, functional improvement, and adverse effects with continuation of management.

At present, some clinical policies tend to treat a large population of patients with multiple conditions that cause chronic pain with simple medication rules. These must be addressed with development of specific treatment guidelines. Further, non-opioids should be used as first-line therapy whenever clinically

Table 1 Ten-step process for opioid prescribing for chronic cancer pain based on ASIPP guidelines of chronic opioid therapy for chronic non-cancer pain

1. Initial steps of opioid therapy
Comprehensive assessment
Risk stratification
2. Establish diagnosis
X-rays, MRI, CT, neurophysiologic studies
Psychological evaluation (basic)
Precision diagnostic interventions (optional)
Consultation(s) as needed
3. Establishing medical necessity
Physical diagnosis
Non-opioid therapy
Physical modalities
Behavioral interventions (optional)
Interventional pain management (optional)
Other alternatives
Consultation(s) as needed
4. Establishing treatment goals
Decrease pain by 30% and/or increase function by 30%
Minimal adverse effects
5. Assessment of effectiveness of opioid therapy
6. Informed decision-making
Controlled substance agreement
Random evaluations including pill counts and urine drug testing
7. Initial treatment (8–12 weeks)
Stratification of risk
Understanding opioids
Initiation with low-dose short-acting opioid therapy
Titrate
8. Adherence monitoring
Prescription drug monitoring programs

Table 1 continued

Urine drug testing (follow urine drug testing algorithm)
Pill counts
Behavioral assessment during each visit
9. Monitoring and managing side effects
Driving
Sedation
Constipation
Breathing
10. The final phase
Chronic opioid therapy may be continued, with continuous adherence monitoring
Methadone and buprenorphine are recommended for use in late stages after failure of other opioid therapy and only by clinicians with specific training in the risks and uses
A trial of opioid rotation may be considered for patients requiring escalating doses
Chronic opioid therapy should be monitored for adverse effects and to manage them appropriately

appropriate prior to embarking on opioids. There is a need to improve the knowledge of clinicians and patients of medical therapy. In addition, it is imperative that overdose prevention education is provided to patients along with management of abuse, dependency, and addiction.

Rehabilitation Therapies

Rehabilitation therapies include various modalities provided by physical therapy and occupational therapy professionals along with therapeutic exercises, and other movement modalities that may be provided as a component of interdisciplinary, and multimodal pain

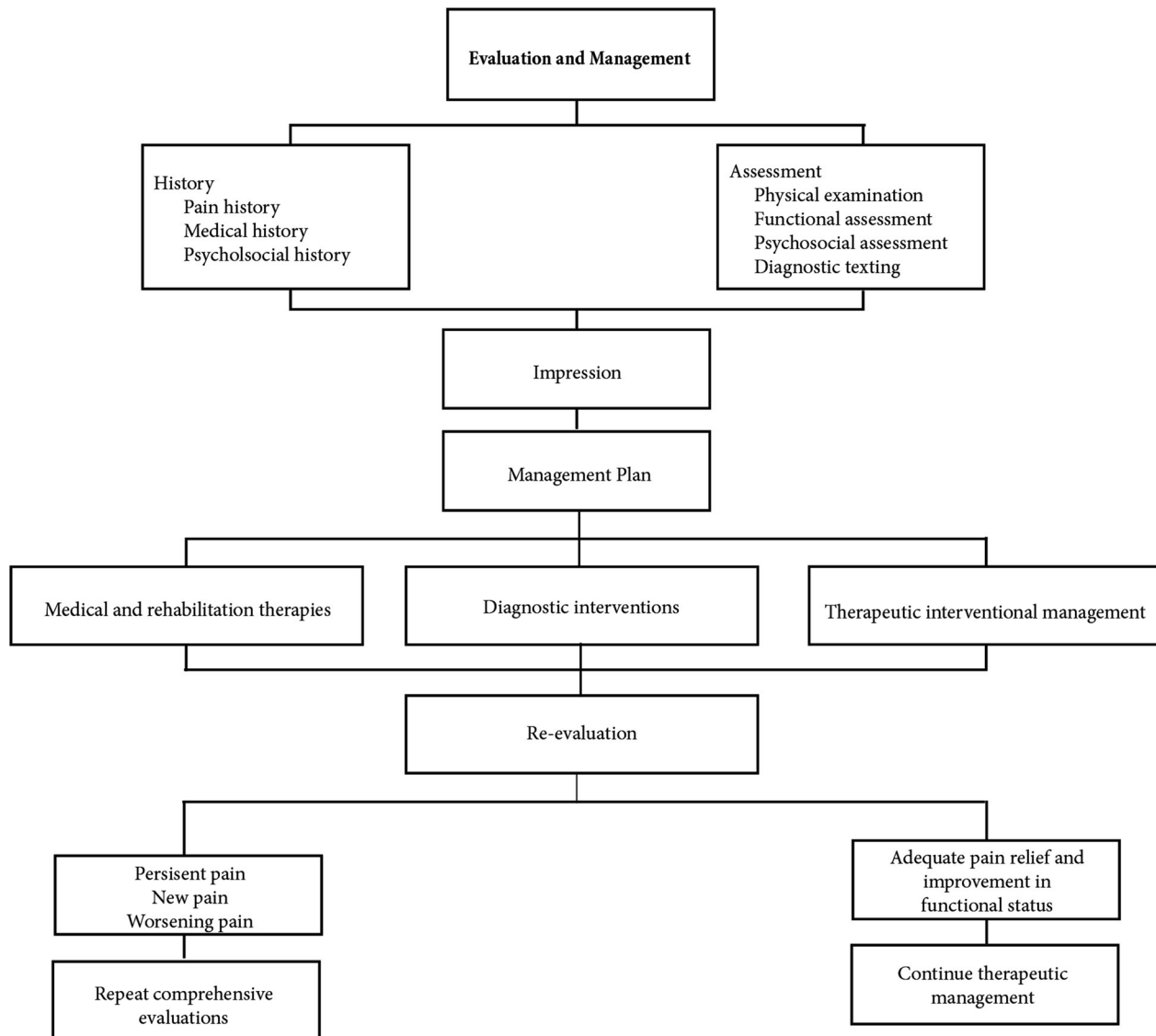


Fig. 4 A comprehensive algorithm for the evaluation and management of chronic spinal pain. Reproduced from Manchikanti et al. [5]

management. Even though there is no significant evidence of individually providing substantial improvement with pain and function, these modalities are essential to manage to continue to improve functional status often with other modalities. Thus, further research is essential to provide data on which rehabilitation therapy is indicated as part of the multidisciplinary approach to specific pain symptoms.

Interventional Procedures

Interventional pain management is a medical subspecialty defined as the discipline of medicine devoted to the diagnosis and treatment of pain-related disorders principally with the application of interventional techniques in managing subacute, chronic, persistent, and intractable pain, independently or in conjunction with other modalities of treatment [109].

Table 2 CDC recommendations for opioid therapy for chronic noncancer pain

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1. Opioids are not a first-line therapy
 2. Establish goals for pain and function
 3. Discuss risks and benefits
 4. Opioid selection, dosage, duration, follow-up, and discontinuation
 - 4.1 Use immediate-release opioids when starting
 - 4.2 Use the lowest effective dose
 - 4.3 Prescribe short durations for acute pain
 - 4.4 Evaluate benefits and harms frequently
 5. Assessing risk and addressing harms
 - 5.1 Use strategies to mitigate risk
 - 5.2 Review PDMP data
 6. Use urine drug testing
 7. Avoid concurrent opioid and benzodiazepine prescribing
 8. Offer treatment for opioid use disorder
-

Interventional pain management techniques are minimally invasive procedures including percutaneous precision needle placement with placement of drugs in targeted areas or ablation of targeted nerves; and some surgical techniques such as laser or endoscopic discectomy, intrathecal infusion pumps and spinal cord stimulators, for the diagnosis and management of chronic, persistent, or intractable pain [110].

Many interventional procedures have been available since 1901; however, there have been substantial developments in diagnostic and therapeutic interventional techniques [4, 65–79]. Multiple interventional techniques are evidence-based as well as cost-effective. These range from epidural injections, facet joint nerve blocks and innervation, peripheral nerve blocks and innervation, sympathetic nerve blocks, percutaneous adhesiolysis, vertebral augmentation procedures, multiple neuromodulation techniques, intrathecal infusion

Table 3 Five-point strategy to combat the opioid crisis. Reproduced from U.S. Department of Health and Human Services. Available from <https://www.hhs.gov/opioids/about-the-epidemic/hhs-response/index.html>

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1. Access: better prevention, treatment, and recovery services
 HHS issued over \$800 million in grants in 2017 to support treatment, prevention, and recovery, while making it easier for states to receive waivers to cover treatment through their Medicaid programs. (Issued five such SUD waivers since PHE declaration.)
 2. Data: better data on the epidemic
 HHS is improving our understanding of the crisis by supporting more timely, specific public health data and reporting, including through accelerating CDC's reporting of drug overdose data
 3. Pain: better pain management
 HHS wants to ensure everything we do—payments, prescribing guidelines, and more—promotes healthy, evidence-based methods of pain management
 4. Overdoses: better targeting of overdose-reversing drugs
 HHS works to better target the availability of lifesaving overdose-reversing drugs. The president's 2019 budget includes \$74 million in new investments to support this goal
 5. Research: better research on pain and addiction
 HHS supports cutting edge research on pain and addiction, including through a new NIH public-private partnership
-

systems, and finally regenerative therapies with interspinous prosthesis spacer devices and joint injections. Consequently, multiple interventional techniques may be applied in conjunction with other modalities or simply home exercise programs and medical therapy.

Behavioral Health Approaches

As chronic pain continues to be understood as a complex disorder with psychological distress and related disability, apart from various



Fig. 5 Chronic pain management consists of five treatment approaches informed by four critical topics. Reproduced from U.S. Department of Health and Human Services. Pain Management Best Practices Inter-Agency Task Force. Final Report on Pain Management Best Practices: Updates, Gaps, Inconsistencies, and Recommendations. May 9, 2019. Available from: <https://www.hhs.gov/ash/advisory-committees/pain/reports/index.html>

physical modalities, behavioral health approaches are essential in addressing multiple issues related to chronic pain and management. It has been well-recognized that psychological factors play an important role in an individual's experience and response to pain and can affect treatment adherence, pain chronicity, and disability status [1]. The evidence shows that access to evidence-based psychological and behavioral health approaches for chronic pain and mental health comorbidities is lacking. Consequently, it is essential to include these therapies and apply evidence-based psychological interventions, including a full range of treatment deliveries with a focus on educating physicians and improving reimbursement for these modalities.

Multidisciplinary Pain Management Programs

Multidisciplinary pain management programs as described above [80, 83] will be crucial in the coming years to provide comprehensive diagnosis and treatment to reduce dependency on drugs, dependency on medical therapies, dependency on self and family, and reducing the overall costs and reducing disability with comprehensive rehabilitation. These approaches are important to be reassessed and reintroduced, specifically in loosely associated so-called comprehensive modality of treatments

directed by either an orthopedic surgeon, neurosurgeon, or interventional pain physician, but, to include multidisciplinary management from initiation to discharge and continued maintenance of these patients. In addition, the public and policy-makers along with providers must focus on multidisciplinary pain management programs approach immediately in their existing programs and slowly convert into a comprehensive rehabilitation program, either accredited or meeting the criteria established for multidisciplinary programs.

Complementary and Integrative Health

Multiple complementary and integrative health approaches have been applied in managing chronic pain including acupuncture, manipulative therapies, and more recently some consider regenerative medicine, as part of this broad category. However, literature is lacking regarding many aspects of these modalities. Thus, it is essential to exercise caution and diligence and apply these modalities cautiously.

Special Populations

Unique issues related to children, adolescents, the elderly, and women must be understood and addressed with evidence-based principles of managing multiple modalities of treatments described above, with appropriate guidance and focus on these populations and conditions, so these populations can be provided appropriate care.

COMMENTARY

As illustrated by multiple reports worldwide, the number of people experiencing chronic pain is substantial, with an enormous impact on various aspects of life [1–13]. The annual US expenditures alone related to pain, including direct medical costs and lost wages by some accounts may be higher than those for cancer, heart disease, and diabetes combined [1–13]. Even then, as seen in this report, the treatment covered by these expenditures does not fully

alleviate pain in the United States or other countries and disability rates continue to increase with a high impact on pain and on the economy [10–18]. To combat chronic pain with improvement in disability status, numerous treatments, regulations, and extensive expenditures have been utilized. Chronic pain has been defined by the International Association for the Study of Pain (IASP) as the pain that exists beyond an expected timeframe for healing [111]. However, a more inclusive definition was developed by ASIPP defining chronic pain as pain that persists 6 months after an injury and beyond the usual course of an acute disease or a reasonable time for a comparable injury to heal that is associated with chronic pathologic processes that cause continuous or intermittent pain for months or years, which may continue in the presence or absence of demonstrable pathologies, may not be amenable to routine pain control methods, and healing may never occur [4].

This manuscript describes various gaps existent in managing chronic pain, along with best practices for the future, including multidisciplinary pain management programs and clinics. It is imperative that we identify the reasons for chronic pain with an increasing prevalence, treatment modalities that are clinically and cost-effective, deleterious effects related to managing chronic pain including complications such as the unintended consequences of the opioid epidemic, or any other treatment. Further, gaps must be assessed on an ongoing basis with the incorporation of multidisciplinary approaches.

Appropriate policies must be developed to treat large proportions of patients with multiple conditions that cause chronic pain with medical therapy, rehabilitation therapies, interventional techniques, behavioral therapies, and surgical interventions. These include appropriate clinical and coverage policies for cost-effective treatments including all modalities. The movement against complete elimination of opioids may not be successful in the near or distant future. However, it is appropriate to control the opioid epidemic, curb unnecessary use, but maintain opioids when they are medically indicated for appropriate use with clinical

and adherence monitoring. An additional aspect of future expectations is that pain specialists must be more involved in the multidisciplinary approach of diagnosing and treating patient's pain early enough in the treatment phase, to avoid suboptimal patient outcomes.

CONCLUSIONS

This commentary, with a review of the literature on available practices of pain management, shows existing gaps and improvements necessary to improve access, along with clinically and cost-effective care. In this manuscript, we have described multiple techniques utilized in managing chronic pain, the present practice patterns, and future practice patterns.

ACKNOWLEDGEMENTS

Funding. No funding or sponsorship was received for the preparation or publication of this article.

Authorship. All named authors meet the International Committee of Medical Journal Editors (ICMJE) criteria for authorship for this article, take responsibility for the integrity of the work as a whole, and have given their approval for this version to be published.

Disclosures. Laxmaiah Manchikanti and Vanila Singh have nothing to disclose. Joshua Hirsch is a consultant for Medtronic. Alan David Kaye is a member of the journal's Editorial Board and a speaker for Merck.

Compliance with Ethics Guidelines. This article is based on previously conducted studies and does not contain any studies with human participants or animals performed by any of the authors.

Data Availability. All data generated or analyzed during this study is included in the published article.

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