New Directions in Pain Management
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Welcome to the August JNLCP issue focusing on pain. The articles herein are a little different from what you might expect, and we hope you’ll find them interesting, provocative, and useful. What I found most intriguing was that in contrast to what we might have published ten years ago, every article here is about treatments and programs not related to opioids. It’s about time. How did we get here?

We all remember learning that “Pain is the fifth vital sign” in nursing school or sometime afterwards, specifically, mandated by the Joint Commission in 2001 in their standards for pain management. Who knew that that well-meant shift in attention from pain as a symptom to pain as something measurable (like a vital sign, right?) presaged what we know today as a deadly opioid epidemic?

We all know how it happened, slowly, inexorably, with good intentions on the part of care providers. We repeated, “Pain is what the patient says it is.” We cited the American Pain Society’s early 1990s guidelines for what they characterized as a national epidemic of untreated pain. We focused on it in every patient interaction, asking before anything else, “How is your pain? Can you rate it on a scale of 1-10?” Inpatient hospital satisfaction surveys asked, “How well was your pain treated?” Once pain scales came into clinical practice, the assumptions easily fell into place: watch the numbers, just as if pain were blood pressure or respiratory rate, then treat the numbers. Physicians began to face legal actions for undertreated pain and pressure from hospitals on the patient satisfaction survey side. The stage was set for profit to be made: Prescriptions for opioids increased from approximately 76 million in 1991 to 220 million in twenty years. Big Pharma told us that there was no limit to the amount of opioids that should be prescribed for pain, all kinds of pain, because the chances of addiction were nil, and we believed them.

The number of drug overdoses grew as prescription opioids, largely synthetics like tramadol and fentanyl and semisynthetic like oxycodone, became gateways for heroin. Now the National Vital Statistics Report shows that average life expectancy in the US has decreased for the first time frame not associated with war casualties, due to the sheer numbers of overdose deaths. The American Pain Society and the Academy of Integrative Pain Management, now the targets of many lawsuits over opioid prescribing, are closing amidst reports that they accepted millions of dollars in donations from opioid manufacturers; members of Congress are similarly facing scrutiny over campaign donations. The World Health Organization’s 2011-12 guidelines on treating pain in adults and children have been found to have been written by Purdue. The CDC now estimates that 140 people per day die in the US from opioid overdose. HHS has links to research, statistics, graphics, and other helpful information can be found at https://www.hhs.gov/opioids/about-the-epidemic/opioid-crisis-statistics/index.html

Wendie A. Howland
Editor, JNLCP
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Information for Authors

AANLCP® invites interested nurses and allied professionals to submit article queries or manuscripts that educate and inform the Nurse Life Care Planner about current clinical practice methods, professional development, and the promotion of Nurse Life Care Planning within the medical-legal community. Submitted material must be original. Manuscripts and queries may be addressed to the Editorial Committee. Authors should use the following guidelines for articles to be considered for publication. Please note capitalization of Nurse Life Care Plan, Planning, etc.

Text
Manuscript length: 1500 – 3000 words
- Use Word© format (.doc, .docx) or Pages (.pages)
- Submit only original manuscript not under consideration by other publications
- Put the title and page number in a header on each page (using the Header feature in Word)
- Use Times New Roman, Arial or Calibri 12 point font
- Place author name, contact information, and article title on a separate title page, so author
- Name can be blinded for editorial review
- Use APA style (Publication Manual of the American Psychological Assoc. 6th Ed)

Art, Figures, Links
All photos, figures, and artwork should be in JPG or PDF format (JPG preferred for photos). Line art should have a minimum resolution of 1000 dpi, halftone art (photos) a minimum of 300 dpi, and combination art (line/tone) a minimum of 500 dpi. Each table, figure, photo, or art should be on a separate page, labeled to match its reference in text, with credits if needed (e.g., Table 1, Common nursing diagnoses in SCI; Figure 3, Time to endpoints by intervention, American Cancer Society, 2003)
Live links are encouraged. Please include the full URL for each.

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Submit your article as an email attachment, with document title: articlename.doc, e.g., wheelchairs.doc
All manuscripts published become the property of the Journal. Manuscripts not published will be returned to the author. Queries may be addressed to the care of the Editor at: journal@aanlcp.org

Manuscript Review Process
Submitted articles are peer reviewed by Nurse Life Care Planners with diverse backgrounds in life care planning, case management, rehabilitation, and the nursing profession. Acceptance is based on manuscript content, originality, suitability for the intended audience, relevance to Nurse Life Care Planning, and quality of the submitted material. If you would like to review articles for this journal, please contact the Editor.
A Message from the President

Recently, I had the opportunity to represent the AANLCP at CMSA’s conference in Las Vegas. I met nurses from all over the United States to spread the word about nurse life care planning and share our mission.

I’m excited to announce that Wendie Howland accepted the position as the editor of the 2nd edition of Core Curriculum for Nurse Life Care Planning. The Executive Board is eager to have this project moving ahead full speed. We know Wendie will do a great job, and we look forward to the updated 2nd edition Core Curriculum. Core authors are already moving forward, dusting off their past chapters and writing new ones. Wendie wants to acknowledge the expert help of her two associate editors, Barbara Bate and Shelly Kinney.

The Executive Board has been updating and upgrading the association’s website platform because the current platform is very labor intensive and restrictive. This will allow our management company more flexibility, and assist with recruitment, renewal, and retention automatically. We have accepted Colin Parker and Lonestar Sales Performance to perform the migration and look forward to providing a cost-effective and user-friendly website.

I want to thank all the new members for their patience while we revamp the Mentor Program. We should have the program up and running in July. We will be looking for mentors! So, if you’re interested in mentoring, please contact Debra Lloyd, AANLCP’s Executive Director, or me. We look forward to providing a strong mentorship program which benefits all of us.

Kelly Campbell, Jenn Craigmyle, and the 2020 Conference Committee are hard at work and are setting up an exciting 2020 conference in beautiful San Diego. Save the date in your calendar: March 6-8, 2020! Becky Czarnik and the Education Committee are hard at work scheduling your monthly educational webinars; send your suggestions or leads to contact Becky, becky@sierranurse.com.

Thank you, Wendie and the JNLCP Committee for all your hard work and dedication to the JNLCP.

We have a few new membership perks that will be hitting the membership benefit section of the website in the next few weeks. Stay tuned!

Erin OConnell

Erin OConnell MSN, MBA, RN, CNL, MSCC, CCM, CNLCP®
AANLCP President August 2018 - December 2019
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Pamela Otto, RN
has been an advocate for resolving delayed recovery and chronic pain cases primarily in the Workers’ Compensation industry for over 25 years. She currently serves as Director of Medical Management at Empatha.

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to this Issue

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Maine’s leading cannabis operator, a model for patient-centric care on the East Coast and beyond. With 80 employees and over $15M in revenue, the Wellness Connection includes four Maine state-licensed dispensaries with state-of-the-art cultivation, processing and manufacturing facilities. She is an active member of the National Cannabis Industry Association (NCIA) Marketing and Advertising Committee as well as the American Trade Association for Cannabis and Hemp (ATACH). She can be contacted at Wellness Connection of Maine, 207-553-9058 https://mainewellness.org/

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Letters to the Editor

Medical Marijuana and the National Council of State Boards of Nursing

The Volume 9, issue 2, July 2018 supplement issue of the Journal of Nursing Regulation is entirely dedicated to articles on medical marijuana. These articles are relevant to anyone interested in medical marijuana or in subscribing and administering recommendations for nurses and nurse practitioners.

Part one is a review of current legislation, scientific literature review and nursing implications. Part Two is the National Council of State Boards of Nursing Guidelines for Medical Marijuana. The article includes Nursing Care of the Patient using Medical Marijuana, Medical Marijuana Education for Pre-licensure nursing programs, Medical Marijuana Education in APRN nursing programs and APRN Certifying Medical Marijuana Qualifying Conditions.

The sixty-page Journal is packed with information about the effects of cannabis, adverse effects, methods of administration, dosing considerations and nursing implications. There are over six pages of references cited.


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LOW DOSE KETAMINE FOR CHRONIC PAIN

Nellie Kreimer, BSN, MSHA, RN, CNLCP

**Introduction**
Chronic pain (CP) affects 20% of US adults, 8% experiencing pain that changes major life activity with limited mobility, anxiety, depression, sleep disturbances, or poor quality of life (Dahlhamer et al., 2016; Geneen et al., 2017). (Dahlhamer et al., 2016). Next to analgesics, antiinflammatories, antidepressants, and antiepileptics, opioids are the most frequently prescribed medications for chronic pain in the United States (Dong et al., 2015; Neisters, et al., 2014). Only 30-40% of people with chronic pain report adequate pain relief (Niesters, et al., 2014). The opioid crisis has amplified public awareness regarding resulting addiction, dependency, and death related to opioid dependence (Dong et al., 2015). Physical, emotional, and psychosocial sequelae of refractory chronic pain call for exploration and utilization of a more effective, non-opioid treatment alternative.

Ketamine was approved for anesthetic use in the 1970s. Now, low-dose ketamine (LDK) is emerging as a viable option for management of refractory chronic pain, now moving to outpatient clinics for treatment-resistant chronic pain. Despite wide use, the lack of standardized protocols for candidate selection, indication, dosing, frequency and effect of long-term use raise legitimate concerns regarding its risks and benefits (Cohen et al., 2018).

**KEY WORDS:** Chronic pain, central sensitization, centrally mediated pain, N-methyl-D-aspartate receptor, NMDAR-Antagonist, ketamine, depression, CRPS

**NURSING DIAGNOSES TO CONSIDER NANDA-I 2017-2019**

1. Chronic pain syndrome (Domain 12, Comfort; Class 1, Comfort)
2. Impaired mood regulation (Domain 9, Coping/stress tolerance; Class 2, Coping responses)
3. Dysfunctional family processes (Domain 7, Role relationship; Class 2, Family relationships)
4. Interrupted family processes (Domain 7, Role relationship; Class 2, Family relationships)
5. Ineffective role performance (Domain 7, Role relationship, Class 3, Role performance)
Chronic pain and central sensitization

Chronic pain is classified as nociceptive, neuropathic, peripheral, central, or mixed; lasting longer than three months; or beyond the time of normal tissue healing (Cohen et al., 2018; CDC, 2016b). Initial tissue damage identifies a primary pain generator, but not how chronic pain evolves from acute pain. Central sensitization (CS) in the central nervous system (CNS) causes chronic pain’s perpetuity and treatment-resistant nature (Harte et al., 2018; Szholz, 2015; Ru-Rong et al., 2018).

Woolf (2011) described central sensitization as: “An amplification of neural signaling within the CNS that elicits pain hypersensitivity (Van den Broeke, 2018).” Injury, inflammation, or lesions in the somatosensory nervous system (in neuropathic diseases) initiate release of cytokines and chemokines that cause hyperexcitability in the sensory neurons of peripheral nervous system (peripheral sensitization). Peripherally sensitized neurons transmit pain signals to the dorsal horn (DH) of the spinal cord, leading to hyperexcitability of the DH neurons and augmentation of pain signaling to the brain. (Ru-Rong et al., 2018). Amplified pain signaling between DH neurons and the brain is facilitated through activation of N-methyl-D aspartate receptors (NMDARs) by an excitatory neurotransmitter glutamate (Ru-Rong et al., 2018).

Normal activity within the NMDARs is essential for cognition and memory. However, hyperactivity of these receptors causes (Cohen, et al., 2018; Ru-Rong, 2018):

- Augmentation of pain signaling between the DH of the spinal cord and the brain leading to central sensitization
- Temporal summation (pain windup);
- Hyperalgesia (an exaggerated pain response to normally painful stimuli);
- Allodynia (pain elicited in response to normally non-painful stimuli, such as light touch);
- Widespread pain;
- Increased pain perception;
- Opioid tolerance

Central sensitization in chronic diseases

Central sensitization is common in most chronic pain syndromes, including fibromyalgia; complex regional pain syndrome (CRPS); chronic migraine headaches; phantom limb syndrome; diabetic neuropathy and other types of neuropathies; sickle cell disease; osteoarthritis of knees; whiplash, and chronic prostatitis (Harte et al., 2018; Bartelely et al., 2016; Nye et al., 2016). Common characteristics of centrally mediated pain include multifocal pain; fatigue; insomnia; memory impairment; and mood disorders (Harte et al., 2018). Significantly, although CRPS and fibromyalgia are considered non-neuropathic pain states, both are centrally mediated pain syndromes. In both, neuroinflammation causes up-regulation of NMDA receptors and sensitization of nociceptive neurons in CNS, or central sensitization (Goh et al., 2017). Ketamine, one of the most potent NMDAR antagonists is efficacious in treatment of refractory pain conditions such as (Niesters et al., 2014; Dong et al. 2017; AANA, 2016; Sheehy et al., 2015):

- Chronic low back pain (CLBP)
- Complex regional pain syndrome (CRPS)
- Fibromyalgia
- Refractory migraine headaches
- Painful limb ischemia
- Traumatic peripheral nerve injury
- Post-herpetic neuralgia
- Trigeminal neuralgia
- Diabetic neuropathy
Ketamine - pharmacology, mechanism of action, side effects and precautions

Pharmacology
Ketamine is a phenylpiperidine derivative structurally related to phencyclidine (PCP, “angel dust”). Ketamine is a Schedule III drug on the United States Controlled Substance Act (Niesters, et al., 2014). Ketamine consists of a racemic mixture of R(-) and S(+) stereoisomers, with the S(+) isomer is 4 times more potent than the R(-) isomer (Gao et al., 2016). In the United States, ketamine is available as Ketalar or ketamine hydrochloride. The national drug code list (NDC) is 67457-001-10 (https://ndclist.com/ndc/67457001/67457-001-10). At higher doses, ketamine is a dissociative anesthetic that produces sedation; unconsciousness; and strong analgesia, while preserving airway reflexes (Sleigh et al., 2014).

At sub-anesthetic doses (0.1 to 0.6 mg/kg), LDK is a potent analgesic, an anti-inflammatory, and an opioid sparing agent, effective for management of acute and chronic pain, including neuropathic pain (Motov et al., 2015). LDK can be administered intravenously (IV), intramuscular (IM), intranasal (IN), sublingually (SL), orally (PO), and rectally (PR). Onset and duration of action depend on route of administration, with the highest absorption through IV (99%), and the lowest by PO (20%). LDK is metabolized in the liver and eliminated through the kidneys and bile (Niesters, et al., 2014).

Mechanism of action
Ketamine, is a non-competitive N-methyl-D-aspartate (NMDA) antagonist that binds to PCP-specific sites on the NMDARs in dorsal horn of the spinal cord, preventing opening of the NMDA channels and exhibits these effects (O’Brian et al., 2014; Dong et al., 2015; Motov et al., 2015):

- Blocks neuronal excitability in the spinal cord,
- Prevents transmission of pain signals to the brain
- Produces strong analgesia
- Reduces perception of pain
- Inhibits central sensitization
- Counteracts spinal sensitization or “wind-up” phenomena (perceived increase in pain over time); allodynia and hyperalgesia
- Binds with the mu-opioid receptors and decreases morphine metabolism, increases the duration of analgesia, decreases morphine requirements in patients with opioid intolerance, opioid allergies, and chronic pain.

Side effects and precautions
Although higher doses and more frequent LDK treatments provide better therapeutic outcomes, the risk of adverse side effects also increases (Maher, et al., 2017; Cohen et al., 2018). The following LDK related side effects have been identified:

- Psychotomimetic - dissociation, hallucinations, paranoia, euphoria, dysphoria, depression, delirium, agitation, nightmares, vivid dreams
- CNS: dizziness, vertigo, blurred vision, double vision, nystagmus
- Memory impairment: working, semantic and episodic memory
- Cognitive impairment, impaired judgement and impaired attention
- Cardiovascular: elevated blood pressure, tachycardia, arrhythmia
- Genitourinary: urinary dysfunction, incontinence, hematuria, cystitis
- GI: nausea, vomiting, gastritis, hepatobiliary dysfunction, hepatotoxicity, abnormal liver function tests

Ketamine should be used with caution in

- Children under 16
- Psychiatric diseases
- Epilepsy
- Glaucoma
- Hypertension, heart failure, ischemic heart disease,

Table 1: CPT codes, services and associated fees for LDK infusions for chronic pain or depression (courtesy Ketamine Clinics of Los Angeles, 2019).
Cerebrovascular accidents

Hyperthyroidism

Low dose ketamine use in hospitals, emergency departments, and ketamine clinics

In hospital care, LDK is used to reduce opioid requirements for post-operative pain and burns for debridement, dressing changes, and skin grafting (Sheehy et al., 2015). In the Emergency Department it is used to manage acute and exacerbation of chronic pain, (0.1-0.6mg/kg), and sedation (1-2mg/kg) for painful procedures. Intranasal LDK is effective in rapid reduction of intractable pain in sickle cell crisis, in procedural sedation, rapid pain reduction in children, and acute pain in the setting of opioid addiction, opioid intolerance or opioid induced hyperalgesia. Ongoing research and diverse use have made transition from institutional to community settings easier.

Representative ketamine clinics

Note: These examples are for informational purposes only. Neither AANLCP nor the JNLCP endorses any facility or program. NLCPs should contact clinics directly and inquire about services, fees for infusions and any additional fees, including evaluations by the clinic director and trial infusions before set of infusions. Costs vary widely.

For breakdown of representative associated services and CPT codes see Table 1 for chronic pain, and Table 2 for depression and other mood disorders.

New York Ketamine Infusions (NYKI) specializes in managing treatment-resistant chronic pain and depression; Dr. Henry Macler, licensed anesthesiologist and medical director, reports an increasing number of potential patients seeking treatment (H. Macler, personal communication April 1, 2019). Diagnoses include:

- CRPS
- diabetic neuropathy
- phantom limb pain
- failed back surgery
- post-herpetic neuralgia
- TM headaches
- fibromyalgia
- musculoskeletal pain

FDA approval of Spravato (esketamine) nasal spray for severe depression in March 2019 signals that approval for LDK in chronic pain is close (H. Macler, personal communication April 1, 2019).

Referral from a pain management physician or clinic is required, including all medical records and results of all previous treatment regimens. There is a fee for initial consultation and first treatment. If the patient tolerates a trial infusion well, dosing is adjusted to maximum response and minimal side effects.

Patients with CRPS begin at 0.5mg/kg and increased to 1-2mg/kg depending on tolerance and side effects. Infusions are given over 4 hours plus one hour of observation; patients may require 10-20 infusions, with average of 4-6 infusions per month. After the initial series, the patient may receive booster infusions every 4-6 months if symptoms recur, depending on the individualized response.

Many of NYKI’s chronic pain patients are dependent on high opioid doses. Perhaps one of the most important benefits of LDK is the ability to bind to opioid receptors and reduce opioid requirements, while relieving refractory pain. Thus, the opioid requirements are decreased and eventually eliminated, improving functionality and quality of life.

Importantly, common co-morbid depression, anxiety and sleep disturbances decrease with pain reduction. The LDK infusion for depression is 1 hour for infusion and 1/2 hour for observation.

Gulf Coast Ketamine Center (GCKC) in Sarasota, Florida provides LDK for treatment resistant chronic pain and severe depression. Dr. Steven Reichbach, anesthesiologist and medical director, notes that although LDK is not a cure, it is effective in 70-80% of patients (personal communication, April 11, 2019). GCKC’s typical treatment for CRPS consists of 6 infusions, lasting 4-6 hours, and may be needed 2-3 times per year. Fibromyalgia treatment usually requires between 2-6 infusions, with booster infusions as indicated. (S. Reichbach, personal communication April 11, 2019).

Ketamine Clinics of Los Angeles is accredited by the American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) and headed by Dr. Steven Mandel, board-certified anesthesiologist. KCLA treats:

- CRPS
- Lyme disease and other neuropathy
- Migraines
- Mood disorders
  - major depressive disorder (MDD)
  - bipolar depression
  - suicidal ideation
• PTSD
• anxiety
• obsessive compulsive disorder
• postpartum depression

Treatment for chronic pain is five infusions over five consecutive days, Monday through Friday, cost including pre-medication and required monitoring post infusion. The frequency of additional infusions is individualized. There is a 70-75% success rate in patients with CRPS (S. Mandel, personal communication, April 10th, 2019).

Individuals suffering from depression and other mood disorders (such as anxiety, suicidal ideation, PTSD) receive six infusions are provided over two weeks. Clients who are out of town may select a modified treatment of five infusions over five consecutive days (S. Mandel, personal communication, April 10, 2019).

LDK and chronic pain: The challenges

Lack of standardized protocols on dosing, frequency, infusion length, and long-term risk create a barrier to widespread acceptance of LDK treatment for chronic pain and depression. Maher et al. (2017) and Bell et al. (2018) found low level evidence for use in non-cancer pain because risk of adverse outcomes was proportional to dose, frequency, and duration. But Bell also reported that it was effective for refractory, neuropathic, or inflammatory pain, with or without depression, and is appropriate if used with extreme caution.

The American Society of Regional Anesthesia and Pain Medicine (ASRA) issued a statement that LDK infusions are effective for treatment-resistant chronic pain and depression; however, they noted outcomes may vary depending on medical condition and dose parameters (ASRA, 2018). They further advise that larger, double-blind, controlled studies would identify potential adverse effects of long-term use, and clarify guidelines for patient selection, dosage, and non-intravenous ketamine use (ASRA, 2018).

Psychedelic reactions are a major concern, especially in individuals with previous psychiatric history. Studies by Pourmand et al., (2017) reported that LDK infusions are less likely to elicit adverse side effects than higher doses. However, reactions can be mitigated with preinfusion clonidine and midazolam. In a study by Schwartzman et al., 19 CRPS patients so premedicated did not experience hallucinations or other psychedelic side effects (Maher et al., 2017).

Ketamine is a drug of abuse and cause low to moderate physical dependence and high psychological dependence. Fear of addiction may discourage wider LDK use, according to the Drug Enforcement Administration (2017). However, clinical studies demonstrate that it is less likely to cause abuse and dependence when used under supervision of qualified providers, and may mitigate the opioid epidemic since it decreases opioid requirements and opioid-induced hyperalgesia (Maher et al., 2017).

Implications for nurse life care planners (NLCPs)

Probability of adverse side effects increases with longer use frequency and duration. A study by Kim et al., (2016) of 30 CRPS patients demonstrated that long-term therapy diminishes executive function; regular assessment and cognitive rehabilitation is required for CRPS patients (Kim et al., 2016) as determined by a treating psychiatrist, with referral to neuropsychology for testing.

Chronic pain patients will require more frequent evaluations than individuals without chronic pain by pain management specialists, cardiologists, urologists, nephrologists and gastroenterologists, due to potential CNS, cardiovascular, hepatic, genitourinary, and gastrointestinal adverse effects. They may require more frequent medical procedures than the general population, including but not limited to cystoscopy, endoscopy, colonoscopy, and blood work for creatinine and liver function tests (Niesters, et al., 2014). Interdisciplinary communication is of utmost importance to project follow-up and treatments, and to coordinate care.

The American Society of Ketamine Physicians at https://www.askp.org/directory serves as clinic locator resource and physician finder. Additional information can be obtained from https://www.ketamineclinicsdirectory.com. This site provides state by state information on active ketamine treatment centers in good standing. Some clinics are affiliated with hospitals, while others are stand-alone private clinics. For example, since approval of esketamine nasal spray for depression by FDA, the Columbia Presbyterian Hospital opened Columbia Ketamine...
Two years ago, Miss Daisy was hit by a car while riding her bicycle to work. She experienced severe pain in her right arm and right leg, dizziness and headache. Radiologic studies revealed fractures in both. She had no other significant injury. Medical diagnoses were:

- Displaced comminuted fracture of shaft of ulna, right arm, sequela; ICD-10: S52.251S
- Displaced comminuted fracture of right tibia; ICD-10: S82.251A
- Mild concussion without loss of consciousness; ICD-10: S06.0X0A

One year after the accident, surgical repair, and therapy, Ms. Daisy experienced sharp, shooting, burning and pounding pain to right arm and right leg, a 9 on a 0-10 pain scale; hyper-sensitivity to light touch and radiation of pain the contralateral extremities. Ms. Daisy reported anxiety, suicidal ideation; feelings of hopelessness; and frequent nightmares about her accident. Antiepileptics were prescribed and then discontinued due to side effects. Multiple antidepressants have been tried with minimal therapeutic effect.

Ms. Daisy was treated by a multidisciplinary team including orthopedics, neurology, pain medicine and rehab, neuropsychology, psychiatry, physical and occupational therapists. Based on multidisciplinary evaluation and diagnostic testing, these medical diagnoses were made:

- Diffuse traumatic brain injury without loss of consciousness, sequela ICD-10 CM S06.2XOS
- Opioid dependence, uncomplicated. ICD-10 CM F11.20

After multiple pharmaceutical and therapeutic treatments failed to mitigate her pain and symptoms of depression, Dr. PMR recommended intravenous LDK infusions to supplement multimodal/multidisciplinary interventions.

### Life Care Plan: LDK for chronic pain
This outlines only the components of the life care plan related to LDK infusions for management of chronic intractable pain and co-morbidities in CRPS-1. According to the National Center for Health Statistics, life expectancy for a 38 years old, Caucasian female is 47.4 years (https://www.cdc.gov/nchs/products/life_tables.htm). Based on the individualized evaluation by the physical medicine and rehab specialist (Dr.PMR) and ketamine specialist (Dr. K) Ms. Daisy will require serial LDK infusions 1 time a year and booster infusions twice a year. She opted to treat with a ketamine clinic accredited by AAAASF.

See table 2 for information on these aspects of Ms. Daisy's LCP.

### Table 2: Selected components of life care plan
#### Low-dose Ketamine Infusions: Lifetime Costs

<table>
<thead>
<tr>
<th>Condition/Treatment</th>
<th>Condition/Treatment</th>
<th>Condition/Treatment</th>
<th>Recommended by</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV LDK infusions for management of chronic pain CRPS-1; anxiety; depression; PTSD</td>
<td>Cost per unit $</td>
<td>Cost per series of 5 infusions</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>Annual cost</td>
<td>Recommended by Dr. K</td>
<td>Lifetime Cost:</td>
</tr>
<tr>
<td>IV LDK booster infusions for recurrent CRPS pain; anxiety; depression; PTSD</td>
<td>Cost per infusion $</td>
<td>Recommended 2 consecutive booster infusions 2x year (every 6 months). Total annual cost: $</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recommended by Dr. K</td>
<td>Lifetime Cost:</td>
</tr>
</tbody>
</table>

### Summary
Chronic pain has considerable adverse physical, psychosocial and economic ramifications. The opioid epidemic...
<table>
<thead>
<tr>
<th>Routine Medical Care</th>
<th>Frequency</th>
<th>Nursing Diagnoses</th>
<th>Cost per visit/Cost per year</th>
<th>Recommended by</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physiatrist:</strong></td>
<td>4x year; prior to each series of LDK infusions, and booster infusions</td>
<td>Chronic pain syndrome, Impaired physical mobility, Risk for injury, Risk for disuse syndrome</td>
<td>CPT code 99215 Established patient fee</td>
<td>Dr. PMR/Dr. K</td>
</tr>
<tr>
<td><strong>Cardiologist: Dr. Heart</strong></td>
<td>1x year</td>
<td>Risk for activity intolerance related to circulatory problem</td>
<td>CPT 93010 Routine EKG, annual CPT 93306 Cardiac ultrasound, annual CPT 93015 Cardiac exercise stress test repeat every 2 years. CPT 93970 Venous ultrasound, arms, legs Repeat every 4 years CPT 99205 Office visit, new patient, once CPT 99215: Office visit, established patient, annual after first visit</td>
<td>Dr. K; Dr. Hart</td>
</tr>
<tr>
<td><strong>GI: Dr. Gut</strong></td>
<td>2x year</td>
<td>Risk for impaired gastrointestinal motility, Risk for impaired liver function</td>
<td>CPT 99205 Office visit, new patient, once CPT 99215: Office visit, established patient, twice annual after first visit</td>
<td>Dr. Gut</td>
</tr>
<tr>
<td><strong>Urologist: Dr. Ureter</strong></td>
<td>2x year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Psychiatrist: Dr. Mood</strong></td>
<td>Every 2 months; 6x year and allow for 2 more visits for emergencies</td>
<td>Ineffective coping, Impaired mood regulation, Post trauma syndrome, Disturbed sleep pattern</td>
<td>CPT 99215 Office visit, established patient.</td>
<td>Dr. Mood</td>
</tr>
<tr>
<td><strong>Neuropsychologist: Dr. Neuron</strong></td>
<td>1x year</td>
<td></td>
<td>CPT 96118 Neuropsychological testing, interpretation and report</td>
<td>1.Dr. Mood/Dr. Neuron</td>
</tr>
<tr>
<td><strong>Neurologist: Dr. Greymatter</strong></td>
<td>2x year</td>
<td>Risk for ineffective thermal regulation</td>
<td>CPT 99215: Office visit, established patient, twice annual CPT: 70553 MRI of the head with and without contrast</td>
<td>Dr. Greymatter</td>
</tr>
</tbody>
</table>
and diminished therapeutic benefits of traditional treatments led to a search for a non-opioid alternative for management of treatment-resistant chronic pain. Low dose ketamine (LDK), has demonstrated efficacy in treatment of multiple chronic pain conditions, especially CRPS. Potential for addiction, emergence of psychedelic side effects, lack of standardized protocols, and limited information on long-term, cumulative effects of LDK may deter its wider adoption. However, LDK use is on the rise for chronic pain and depression. A global drive to reduce opioid consumption and find opioid-free alternatives for management of chronic pain is a driving force for more clinical trials and larger scale research studies on LDK risks and benefits. Clinical research continues and will assist clinicians and patients to make appropriate treatment choices to mitigate chronic pain and associated co-morbidities, minimize disability, and improve quality of life.

The nursing process and standards of practice will guide NLCPs in collaboration with the treating providers for related medical and specialist follow-ups, laboratory services, neuropsychological testing and diagnostic imaging. More ketamine clinics, inter-clinic service variability, variable protocols, and uneven pricing necessitate due diligence to identify optimal care. Keeping abreast of new developments, outcomes of new clinical studies, clinical recommendations, and FDA warnings will enhance NLCP safe practice and professionalism developing LCPs for patients prescribed LDK treatments.

References


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Introduction
As individual states have adopted cannabis legislation over the past ten years, we have seen a significant rise in medicinal marijuana use in all aspects of our pain management practices. The rapid increase in legalization and accessibility and lead to educational gaps. As professionals in the medical marijuana industry, we hope to provide patients with information and improved care planning. This article reviews the basic concepts of medical marijuana and its pharmacotherapy for pain. Significant improvements in dosage and delivery systems have resulted in improved products and safer access to patients. A detailed individualized care plan is critical to guide the cannabis patient towards a positive experience. We will also address the use of medical marijuana specifically for pain management as an adjunct to opioids.

History
Cannabis is one of the oldest cultivated plants throughout the world, flourishing in temperate and tropical climates from coasts to deep mountain valleys. Widely used throughout history for fiber, food, and medicine, cannabis is well-documented in ancient Chinese and Arabic medicine texts and found buried in ancient Egyptian tombs. Cannabis was first recorded in Western texts in 1753 by Carolus Linnaeus’ *Species Plantarum*. Dr. William O’Shaughnessy spent much time in India in the 1830s documenting medicinal uses of marijuana; the Society of Cannabis Clinicians inaugurated their newsletter *O’Shaughnessy*’s in 2003, now a medical marijuana reference.

While cannabis has been deployed medicinally for many medical

**NURSING DIAGNOSES TO CONSIDER NANDA-I 2017-2019**

1. Chronic pain syndrome
   (Domain 12, Comfort; Class 1, Physical comfort)
2. Impaired comfort
   (Domain 12, Comfort; Class 1, Physical comfort)
3. Readiness for enhanced comfort
   (Domain 12, Comfort; Class 1, Physical comfort)
4. Nausea
   (Domain 12, Comfort; Class 1, Physical comfort)
5. Disturbed sleep pattern
   (Domain 4, Activity/rest; Class 1, Sleep/rest)
conditions, scientific rationales for its efficacy are not clear. Much of the research has been hindered by controversy over legality. In 1976, the United States Controlled Substance Act classified cannabis as a Schedule I drug, meaning that it had a high potential for abuse and no accepted medical uses. However, as of June 2019, 33 states and the District of Columbia have enacted laws allowing its medical use. Despite a paucity of standardized and controlled trial research to evaluate short- and long-term health outcomes, all states are consistent in including chronic pain as one of the conditions for which cannabis is approved pharmacotherapy. Indeed, pain relief is the most commonly cited reason for the medical use of cannabis (Bestrashniy, 2015).

Cannabis Basics

The three cannabis species are C.sativa, C.indica and C.ruderalis. All contain phytocannabinoids, terpenoids, and phenolic compounds in varied ratios and concentrations, resulting in a wide variety of medicinal effects. These lipid-based chemical components are excreted from the plant in the form of glandular trichomes and are easily visible under 10x microscopy (Figure 1).

There are more than 200 cannabinoids produced by marijuana, with tetrahydrocannabinol (THC) and cannabidiol (CBD) being the most widely familiar. THC is known for its profound effect for relaxation and pain relief. CBD, if taken on a regular basis, can be very effective for inflammation, anxiety and pain and is non-psychoactive (does not produce intoxication).

Phytocannabinoids vary in ratios and concentrations dependent on the plant strain. While phytocannabinoids are exclusive to marijuana, terpenoids and phenolic compounds are found throughout the plant kingdom and are responsible for many familiar smells and tastes as well as having medicinal qualities. Isolating one component from marijuana does not produce the beneficial synergistic medical effects of using the whole plant. New strains are always being created using the most beneficial aspects of specific plants via natural crossbreeding techniques.

Many of the active compounds in cannabis (cannabinoids, terpenes, flavonoids) work together to enhance the plant’s medicinal potential and mitigate side effects. CBD (cannabidiol) can increase THC’s potential to relieve pain and inflammation while reducing its psychoactive effects; the terpenes myrcene and beta-ocimene augment the plant’s sedative qualities while reducing the respiratory irritation sometimes caused by smoking; the flavonoids quercetin and cannaflavon work together to increase the antioxidant, anti-inflammatory, and antiviral qualities of both THC and CBD. This synergy is known as the “entourage effect” because they must all be present together for a patient to reap the benefits of so many different active compounds — the medicinal value of whole plant cannabis therapy is greater than the sum of its individual parts. (Wellness Connection, nd)

Endocannabinoid System

The human endocannabinoid system is extensive with primary receptors in the central and peripheral nervous systems, CB1 and CB2. CB1 receptors are found in synapses throughout the nervous system, brain, organs, connective tissues, glands and immune cells (Figure 2). CB2 receptors are primarily found in the immune system but can be activated...
in different parts of the body during periods of inflammation or injury.

The body makes its own cannabinoids through the anandamide system. Anandamide (N-arachidonylethanolamine; AEA) and 2-arachidonoylglycerol (2-AG) are the main endogenous agonists of cannabinoid receptors. They mimic several pharmacological effects of delta-9-tetrahydrocannabinol, the active principle of C. sativa preparations like hashish and marijuana (Maccarrone & Finazzi-Agró, 2003). This means we can use exogenous forms of cannabis to trigger positive responses in the CB1 and CB2 receptors while avoiding adverse reactions and complications. Most apparent, especially with THC, is a profound sense of relaxation and pain relief but with the potential for amnesiac experience or feelings of paranoia if taken at too high a dose.

**Delivery Methods**

The industry has developed techniques to extract oils from the plant material to provide more diverse delivery mechanisms. There are four main delivery method categories (Figure 3).

**Inhalation** Patients looking for immediate relief often choose smoking and vaporizing. Traditional flower cannabinoid concentrates are 25-30% and therefore have a higher psychoactive response. During inhalation, there is passive diffusion into the pulmonary capillaries with onset in seconds to minutes, achieving maximal effect after 15 minutes and lasting 2 to 4 hours.

**Ingestion** Ingesting cannabis can provide systemic relief. Patients report that, when they use cannabis regularly and consistently, they can reduce the severity and intensity of their symptoms.
symptoms. Medicated edibles are the most common ingestible and take 45-60 minutes to take effect. Because the time of onset is variable and lengthy, edibles are difficult to dose for those who are new to cannabis. It is important to start with a low, accurate dose.

Sublingual Patients can use sublingual tinctures to provide relief between edible doses or when inhalation is not an option. As with ingestion, a patient will need to wait 30-60 minutes for relief.

Transdermal Topical administration such as a salve or patch that can provide local relief with few side effects. Topical applications are more effective at treating painful joints that are closer to the skin surface and typically do not reach the bloodstream. Patients can realize relief in 15-60 minutes (depending on the administration) and last several hours.

Patient Considerations
We find dosing is very specific or individualized to each patient based on a wide variety of patient needs. For a patient starting a new regimen, it is best to start with a low dose, such as 5-10 mg. Have the patient document the experience by recording the type/strain of cannabis used, dosage, frequency, and duration of effect to help refine a personal treatment plan. Ideally, patients use the absolute smallest amount of cannabis to achieve the desired effect or relief - this can mitigate the tolerance to the effects of cannabis, and the relief it provides, many patients develop over time.

Patients are encouraged to experiment with multiple routes of cannabis administration to find which are most effective for relieving their pain without causing impairment from THC. Topical preparations are often very effective and are the least psychoactive way to use cannabis, but many patients with severe pain and neuropathy find that topical preparations do not relieve their pain as completely as orally ingested or inhaled cannabis, both of which have

Figure 4: Medical Marijuana Patient Breakdown by Qualifying Medical Conditions

Figure 5: Percent of respondents with a reduction in opioid pain medications, agents for anxiety, migraine, drugs to improve sleep, alcohol consumption, and antidepressants. Total N that regularly used each group of drugs is in parentheses. Percent total is listed on each bar at the top and percent with that reduced use “a lot” is at the bottom. ap < .0001 versus antidepressants, bp < .0005 versus alcohol.
much higher psychoactive potential. It is not uncommon for patients to use several different forms in combination or in sequence throughout the day, often using smaller sublingual or topical doses to start, and moving on to larger doses or small doses of inhaled or orally ingested cannabis if/when pain increases and they are in a safe place to consume.

We always recommend to start slow and titrate the dose up based on patient’s individual experience. While CBD does not provide the psychoactive effect it still has a significant anti-inflammatory and anti-pain effects and can be taken throughout the day. There are preparations that have varying ratios of CBD to THC which are very effective.

Pain Management
As more states introduce medical and recreational cannabis policies, we continue to learn more about the relationship between cannabis and opioids. Many patients have had success discontinuing opioids. Mortality from opioids has eclipsed mortality from cardiovascular disease in the US; we seek to utilize all of our tools to address this. While sharing similar receptor mechanisms with opioids, marijuana has a much lower risk profile because it does not suppress respiration or cardiac function. In addition to providing effective pain relief, medical cannabis has been found effective in reducing the symptoms often associated with opioid withdrawal, such as sleeplessness, nausea, lack of appetite, seizures, and anxiety. See Figure 5, results of a survey of 1,510 dispensary patients in Maine, Vermont and Rhode Island (Piper, DeKeuster et al., 2016).

As we see a significant increase in medicinal marijuana use, the medical community needs to be prepared to help educate patients on its benefits and risks.

Conclusion
Marijuana has a wide variety of chemical formulations that we do not yet fully understand. Given increasing debates on medical and policy merits, we need a corresponding increase in cannabis research. We will benefit from limited taxation and clean and consistent products.

Many people have had exposure to recreational marijuana. As we see a significant increase in medicinal marijuana use, the medical community needs to be prepared to help educate patients on its benefits and risks. However, we need to provide good education and planning for patients choosing to participate in a medical marijuana program. Therefore, we advise having a qualified medical marijuana consultant available to work with dispensaries to help assure quality products, help registered caregivers to provide patient education, and participate in developing patient plans of care.

References


Helpful references
https://beyondthc.com/
https://www.projectcbd.org/
LESS INVASIVE OPTIONS FOR CHRONIC LUMBAR PAIN: NOTES FOR THE NLCP

Minda Lee Lockeretz BSN, RN, CRN

Abstract
Anyone who sustains a lower back injury can speak to its debilitating, life altering influence. If conservative medical treatment with rest, ice, physical therapy, non-steroidal anti-inflammatories, and often, opioids fails, surgical options exist. However, patients in 2019 may shy away from open back surgeries if less invasive procedural interventions are possible. Nurse Life Care Planners (NLCP) evaluating cases that include lumbar spine injury can further their understanding of two popular less-invasive pain management options: epidural steroid injections (ESI) and radiofrequency ablation (RFA). These procedures close the gap between medical and surgical treatments for chronic back pain. This article highlights how and where these procedures are performed, and who performs them, medications used, indications, cautions for repeated treatment, and finally, CPT codes for common components.

KEY WORDS:
epidural steroid injection, ESI, lumbar steroid injection, low back pain, chronic back pain, lumbar pain, nerve root injection, rhizotomy, neuroablation, less invasive, fluoroscopy, lumbar facet injection, pain management

NURSING DIAGNOSES TO CONSIDER NANDA-I 2017-2018
1. Chronic pain syndrome (Domain 12, Comfort; Class 1, Comfort)
2. Impaired skin integrity (Domain 11, Safety/Protection; Class 2, Physical Injury)
3. Risk for unstable blood glucose level (Domain 2, Nutrition; Class 4, Metabolism)
4. Risk for bleeding postoperatively (Domain 11, Safety/Protection; Class 2, Physical Injury)
Introduction
Anyone who sustains a lower back injury can speak to its debilitating, life altering influence on life. Simple automatic movements become a painful chore: lying, sitting, standing, walking, driving - countless activities of daily living performed in pain. The lumbar and sacral spine, an area once considered inconsequential to most, may become the focus of daily living. There are many treatment options for acute, chronic, or acute-on-chronic lower back pain (LBP). Conservative medical treatments with rest, ice, physical therapy, non-steroidal anti-inflammatory, and opioids are considered the front-line approach. Many people may choose to shy away from open back surgeries if less-invasive approaches are feasible.

There are two popular options: epidural steroid injections (ESI) and radiofrequency ablation (RFA), also known as rhizotomy and neuroablation.

Epidural steroid injections (ESI) are not new medicine: they've been the gold standard treatment for spinal pain and associated radicular pain from disc herniation or degenerative disc disease, spinal stenosis, spondylosis, post-laminectomy syndrome, or other causes since the 1950s. Typically, these injections of steroids into the epidural space of the spinal canal are considered after three or more conventional medical treatments (such as medication, exercise, and physical therapy) have failed (Patel & Upadhyayula, 2019). Once injected, the steroid (and local anesthesia, if used) bathes and soothes the irritated nerves, reducing or minimizing pain while natural healing occurs.

Orthopedic surgeons, neurosurgeons, anesthesiologists, and pain management interventional radiologists utilize fluoroscopy (live video x-ray) to provide safer, precise, effective treatment to many patients of varied spinal diagnoses. Typically, these physicians provide services in hospitals, orthopedic and pain management clinics, and outpatient surgery centers with ready access to radiological equipment. For epidural injections, a “C-arm” (named for the image projector's shape) is needed for live single-plane fluoroscopic viewing; however, bi-plane (two projection views at once) fluoroscopy is preferred for reduction of procedural time, and thus, less radiation exposure to patients and healthcare workers (Shim, Lee, Lee, & Ahn, 2016).

ESI is performed in a sterile environment while the patient is prone. The patient may choose local anesthesia or be moderately sedated intravenously for their comfort. Some steroid medications used for lumbar epidurals are particulate; a solid mass reconstituted with sterile water for injection, for example, methylprednisolone acetate and betamethasone acetate. A local anesthetic medication (e.g. lidocaine, bupivacaine, ropivacaine, etc.) may be added to the steroid for long-lasting (24-48 hours) anesthetic properties. Particulate medications used in lumbar injection are prohibited for cervical epidurals to avoid the risk of spinal cord or cerebellar infarction (Shim et al., 2016). For cervical epidurals, dexamethasone sodium phosphate (a non-particulate liquid steroid medication) is used. Dexamethasone may also be used in lumbar ESI.

There are three needle approaches commonly used: intra-laminal, trans-foraminal, and caudal (Manchikanti et al., 2012). Intra-laminal (posterior, between the vertebral bodies) and caudal (the sacral spinal cord or “tail”) approaches deliver medications into the general epidural space at the level of injection. These techniques have been performed successfully without image guidance, but exact area of medication delivery is unconfirmed. Using fluoroscopic x-ray guidance (along with knowledge of landmarks and bony prominences), the physician can guide the needle with greater accuracy. Once in the epidural space at the level of desired treatment, a small amount of radio-opaque contrast media is injected. This confirms needle placement and once confirmed, the steroid cocktail is delivered. The needle is removed and an adhesive dressing is applied over the puncture site. The patient...
may recover under nursing care if conscious sedation was used or be discharged home immediately with discharge instructions.

Patients whose pain relief goals are not met following initial intra-laminar injection may seek another route of epidural steroid delivery. The transforaminal (lateral) approach has grown in popularity for its effective pain management over intra-laminal and caudal approaches, especially when targeting a specific laterality (Shim, Lee, Lee, & Ahn, 2016). Using step by step imaging, the physician places the needle through a tiny window in the intervertebral foramen and directly into the targeted nerve where it branches from the spinal cord. This approach provides direct delivery of medication to the primary source of pain; the nerve root itself. Navigating anatomy provides more challenge to the practitioner as there is increased risk of penetrating the radicular artery with this technique and delivering an intra-vascular injection (Manchikanti et al., 2012).

Many patients report symptom improvement within a few days of epidural injection and speak of lasting relief. For patients with moderate but significant improvement, the procedure may be repeated; however, there is limited evidence that can help define what constitutes the appropriate partial response to suggest a repeat injection (Murthy, Geske, Shelerud, Wald, & Diehn, 2014). There are no formal guidelines for repeated dosing, as treatment is largely at the discretion of the physician and based on personal experience and preference (Novak & Nemeth, 2008, p. 543).

Insurance companies’ coverage parameters vary widely. United Healthcare published information stating there is no coverage for more than three injections in a calendar year (“Epidural Steroid and Facet Injections for Spinal Pain,” 2019) and Blue Cross Blue Shield of North Carolina and Massachusetts offer coverage of up to six injections per calendar year if certain criteria are met (“Epidural Steroid Injections for Back Pain,” 2019, and “Epidural Steroid Injections for Neck and Back Pain,” n.d.). The two main arguments for limiting ESI to three times per calendar year are concerns related to systemic effects of the steroid (besides their local effects) and the idea that ‘minimally helpful or not helpful at all’ does not warrant a second attempt. Steroids can cause elevated blood glucose levels (a significant problem for diabetics), suppression of the immune system, and suppression of the hypothalamic-pituitary axis that can lead to decreased bone mineral density (Palmer, 2016). This can be problematic in an already weakened spine.

When epidurals fail to treat significant low back pain, fluoroscopic radiofrequency ablation (RFA) can be considered. RFA uses radiofrequency waves delivered through a needle to effectively “burn” the troublesome nerve to decrease pain signals from being sent to the brain. To perform this procedure, the exact problematic nerve must be identified. To facilitate this and guide treatment, a diagnostic lumbar facet block injection is helpful.

The lumbar facets are small joints on either side of the vertebral bodies. Like other joints (knees, hips, elbows, etc.), these small, cartilage covered structures undergo lifelong breakdown and are often the source of chronic low back pain. Unlike epidurals which often utilize steroid and local anesthetics, the facet joints (either side or both) are injected with local anesthetic by itself for most procedures. A positive outcome of pain relief verifies the level and laterality of irritated nerve and allows for further planning of RFA. Facet injections are primarily diagnostic and rarely used for treatment of chronic pain.

Both facet injections and RFA are performed in a prone position under fluoroscopic guidance with moderate sedation or monitored anesthesia care (MAC) provided by an anesthesiologist. The patient must be awake to confirm symptom similarities when the nerve is stimulated; this can be painful for the patient but a hallmark of accuracy for the physician. Once nerve location is confirmed, sedation may be increased for comfort during the actual treatment. Once completed, an adhesive bandage is applied and the patient recovers in a post-anesthesia care unit before being discharged home. A general review of lumbar RFA success rates indicates an average of 85% success rate with a mean duration of 10.5 months (Son, Kim, Kim, Lim, &
Park, 2010). A successful treatment may be repeated if the problem nerve(s) grow back around the previous ablated (“burned”) area and pain recurs (“Radiofrequency ablation for pain,” 2018). Here, retreatment is individualized to each patient’s specific needs.

Improvements in imaging capability, greater fluoroscopic equipment availability, broader credentialing for specialty physicians, and a public demand for non-surgical “quick fix” treatment options for chronic low back pain may drive the market. Image guided or not, less invasive procedures are not to be taken lightly owing to side effects and procedural risks. Considering chronic low back pain and the secondary debilitating life effects that may occur, both ESI and RFA may be safer, effective treatment options for patients with many painful lumbar diagnoses who wish to avoid surgical management. The importance of commitment to a continued physical therapy program, healthful lifestyle choices, and timely physician follow-ups besides ESI and RFA cannot be understated for the true benefits of these two lumbar pain management solutions.

For convenience, the 2019 CPT codes for lumbar/sacral single treatment areas discussed in this article include: interlaminar epidurals (62321, 62323); transforaminal epidurals (64483, 64484); paravertebral facet joint injections (64493, 64494, 64495); and facet joint ablation (64635, 64636). For bilateral treatment sites, add the modifier 50, besides standardized references for facility fees, anesthesia, and ancillary costs.

Minda Lee (Mindy) Lockeretz RN, BSN, CRN is a long-time critical care and interventional radiology (IR) nurse. She is available as a testifying expert in her specialty field of radiology nursing and welcomes questions from colleagues on the topic. She may be contacted at LockeretzRN@gmail.com.

References


Introduction
Chronic pain is depressing and debilitating. Spinal cord stimulators (SCS), also called dorsal column stimulators, are often considered as an alternative or adjunct treatment when conservative treatments are not an option or have been ineffective. Nurse life care planners (NLCP) should understand how SCS works, its indications and contraindications, procedures and equipment involved, and associated care.

A dorsal root ganglion (DRG) stimulator can be effective in treating pain in areas difficult to treat with traditional SCS. Traditional SCS involves stimulation of the dorsal columns resulting in broad electrical stimulation of multiple dermatomes. DRG stimulation is more precise, directly activating the cell bodies of the very neurons that innervate the painful regions. (Gupta, 2018; Mayo Clinic, 2019)

An SCS uses electrical impulses to interrupt pain sensation as it travels to the brain. The person feels paresthesia, a light tingling, or buzzing. Patients can control its intensity and turn it on and off with a wireless remote controller. The goal of treatment is to improve quality of life and physical function by reducing pain and pain medication.

Decreased medication use varies from person to person: some people can eliminate opioids. (Gupta, 2018) The advantages are obvious.

Indications, contraindications and risks
FDA-approved indications include pain from:
- failed back surgery syndrome (FBSS)
- radiculopathy
- neuropathic pain
- phantom limb pain,
- arachnoiditis,
- complex regional pain syndromes (CRPS)
- postherpetic neuralgia

There are also off-label applications undergoing investigation (Gupta, 2018). This article will focus on SCS used for neck, back and/or extremity pain, but the general principles apply to all.

Contraindications include:
- untreated infection
- implanted cardiac pacemaker or defibrillator
- anticoagulant or antiplatelet therapy
- unstable comorbidities
- psychogenic factors that suggest a somatoform pain disorder
- cognitive impairment that interferes with evaluation or operation

The safety and effectiveness has not been established for pediatric use (under the age of 18) or pregnant women. (Gupta, 2018)

As with any surgery, infection, bleeding and surgical site pain are...
potential risks. As with most spinal surgical procedures, adverse events may include epidural hemorrhage, seroma, CSF leakage, or paralysis. There is also potential for lead migration, hardware malfunction, allergic response to hardware, undesirable change in stimulation and loss of pain relief. (Gupta, 2018) Hardware-related complications are more common than biological complications. “Serious adverse events such as neurological damage are uncommon.” (Eldabe, et al., 2016)

Permanent restrictions
The NLCP should keep these restrictions in mind when assessing the patient’s plan for future activities. Note that SCS technology changes frequently so restrictions are also subject to change.

- Do not use diathermy.
- SCS should not be on while driving or operating heavy machinery.
- The generator / battery should not be charged while sleeping.
- Avoid sources of strong electromagnetic interference (e.g., defibrillation, electrocautery, MRI, radiofrequency ablation, and therapeutic ultrasound).

- However, most neurostimulation devices are now “MR Conditional,” i.e., the person can have an MRI scan within approved parameters (refer to manufacturer for details regarding a specific model).
- Do not scuba dive below 10 meters of water or enter hyperbaric chambers above 2.0 atmosphere absolute (ATA).
- Consult the surgeon before any chiropractic manipulation because it might cause lead migration.
- Avoid excessive twisting or stretching and other activities that may put undue stress on the implanted components. (Mehta, 2016; Orlando, T., et al., 2019; Medtronic, 2019; Boston Scientific, 2019)

Components
SCS systems are manufactured by Medtronic Inc., Abbott (FKA St. Jude Medical Inc.), Boston Scientific Corp., and Nevro Corp. A system consists of implanted components and external components.

There are two implanted components:
- Neurostimulator / Implanted Pulse Generator (IPG) - rechargeable or non-rechargeable implanted power source that generates electrical pulses according to programmable neurostimulation parameters and features
- Lead - a set of thin wires with a protective coating and electrodes near the tip (percutaneous lead) or on a paddle (surgical lead). The electrodes transmit the electrical pulses to the stimulation site. (Medtronic, 2019)

External components allow the therapy to be customized:
- Clinician Programmer - used to program the implanted neurostimulator;
- Patient Programmer - the patient can adjust the settings within preset physician parameters and turn stimulation on and off.
- Charger - for rechargeable devices; the charger also shows IPG battery level
- Wireless External Neurostimulator – used for the trial SCS; mimics the therapy delivered by the implantable neurostimulator. (Medtronic, 2019)

Figure 1: The Intellis™ implantable neurostimulator by Medtronic (Medtronic, 2019)

Figure 2: Boston Scientific surgical leads (paddle leads) and percutaneous leads (cylindrical leads). Paddle leads are available with 16 or 32 contacts in an array of 2 or 4 columns, respectively. Percutaneous leads are available with 8 or 16 contacts. The more contacts, the greater the area of coverage. (Boston Scientific, 2019)

Figure 3: Precision Spectra remote control programmer by Boston Scientific (Boston Scientific, 2019)
Procedures

Trial SCS

A trial assesses neurostimulation effectiveness before permanent SCS placement. The plan should include an office visit for evaluation by the pain management physician (anesthesiologist or physiatrist) who will perform the trial SCS procedure, if not already done. Psychological evaluation is recommended to determine the patient's suitability and evaluate the likelihood of successful outcomes: Somatization, depression, anxiety, and poor coping are important predictors of poor outcome (Blackburn et al., 2014).

The trial is performed in an outpatient surgery setting, e.g., an ambulatory surgical center or hospital outpatient surgery department. Some physicians have the equipment and staff to perform it as an office procedure. Other than those noted above, no preoperative diagnostic tests are needed for a trial.

The physician places two leads in the spinal canal percutaneously under fluoroscopy. These attach to a wireless external stimulator, worn usually on a belt. (Gupta, 2018; Orlando et al., 2019; Medtronic, 2019; Abbott, 2019; Boston Scientific, 2019)

Dorsal root stimulator implantation is similar, but leads are threaded through the epidural space into the intervertebral foramen and directly overlie the dorsal root ganglion.

Inserting trial leads requires awake patient interaction. Local anesthesia and conscious sedation are typically administered by the same physician who performs the procedure or conscious sedation nurse with no other duties than monitoring the patient; some physicians prefer a separate physician/anesthesiologist/nurse anesthetist. A manufacturer's representative is present to help adjust settings and troubleshoot device issues that might arise. There is no additional charge for the manufacturer's representative; this service is included in the cost of the device. The trial procedure can take 30 minutes to 2 hours. (Orlando et al., 2019; Medtronic, 2019; Abbott, 2019; Boston Scientific, 2019)

After 3 to 7 days, the patient returns to the physician's office for removal of the temporary trial leads and to discuss a permanent implant. If the physician prefers percutaneous leads, the trial leads might be used and not removed (Gupta, 2018; Orlando et al., 2019; Medtronic, 2019; Abbott, 2019; Boston Scientific, 2019).

Charges for the postoperative follow up visit and possible removal of the trial leads is included in the physician's surgical fees. A manufacturer's representative may also attend these visits with no additional charge.

The trial is considered successful pain decreases by at least 50%. Results also help determine the optimal permanent lead placement, best IPG model and settings, and the most comfortable IPG placement. (Gupta, 2018; Orlando et al., 2019; Medtronic, 2019; Abbott, 2019; Boston Scientific, 2019)

Permanent SCS Implantation

Remember that until a successful trial has been completed, permanent placement and replacement IPG procedures are possible, but not definite. The NLCP, therefore, should note the permanent placement and replacement IPG procedures as potential.

The primary care provider (PCP) usually opines on preoperative clearance. Preoperative diagnostic studies vary with the patient’s general health status, age and medical history, commonly:

- electrocardiogram (EKG),
- chest x-ray
- complete blood count (CBC)
- comprehensive metabolic panel (CMP)
- coagulation panel: prothrombin time (PT) / partial thromboplastin time (PTT)

Wechter, 2018; Orlando et al., 2019)

Implantation procedure

An incision is made over thoracic spine area. A portion of the bony vertebral arch is removed (laminotomy) to allow room to place the leads.

The leads are placed into the epidural space of the spinal cord and advanced under fluoroscopy to the level where pain relief can best be achieved.

A second incision creates a pocket under the skin large enough to hold the IPG, the size of a stopwatch or smaller, in the lower abdomen, buttocks or upper chest, depending on where the leads are placed and the comfort of the patient.

The leads are connected to the neurostimulator.

(Orlando et al., 2019; Mehta, 2016)
Permanent implantation of percutaneous leads is performed in outpatient surgery by the pain management physician using local anesthesia and conscious sedation.

Permanent paddle leads have more electrodes than percutaneous leads, require a laminotomy or laminectomy, and are placed by a neurosurgeon. Lead placement via a laminotomy takes 1 to 2 hours. This procedure is considered minimally invasive and most patients are discharged home the same day or the following morning, but an inpatient stay might be needed. (Orlando, et al., 2019; Gupta, 2018; Boston Scientific, 2019)

A manufacturer’s representative is routinely present in the operating room to assist with the equipment, settings and any issues that might arise during surgery. There is no additional charge from the manufacturer for the representative’s service.

Charges for leads, IPG, and other equipment are included in the hospital charges. Hospitals typically add a variable handling fee. The NLCP should not use the manufacturer’s list price in the plan, but should confirm with the hospital that the SCS equipment is included in the charge quoted.

Follow-up
Follow-up office visits up to 90 days are generally included in surgical fees. After successful programming, follow up appointments are often every 6 to 12 months and as needed (Medtronic, 2019). A manufacturer’s representative is often present at no charge at physician follow up office visits to determine the need for recalibration or reprogramming for improved pain coverage. The physician will ordinarily include SCS evaluation with overall patient status evaluation. It is uncommon for the physician to charge for more than an office visit, but this varies with the physician. Remember that the patient might need to be seen by the pain management physician more often for other reasons, e.g., medication management.

Postoperative restrictions
Patients are advised to avoid bending, twisting and reaching above the shoulders for the first six to eight weeks after surgery to prevent lead movement while the area around them heals. (Mehta, 2016; Medtronic, 2019)

IPG replacement and battery life
Neurostimulator replacement is usually short. The IPG goes in the original pocket, and the original leads are left in place and connected. Fluoroscopy is not typically necessary. (Abbott, 2019)

A rechargeable neurostimulator battery needs to be recharged regularly to stay effective. A recharge-free (non-rechargeable) neurostimulator need not be recharged, so requires less effort to maintain (Abbott, 2019). The pain management physician should discuss this with the patient and consider the patient’s lifestyle when making this decision.

The NLCP should know the manufacturer and model of the SCS system because this affects the replacement frequency of the IPG / battery, thus the overall cost in the life care plan. Specific individual usage affects IPG battery life. Discuss battery life with the pain management physician, recognizing that physicians can often only estimate a range.

The literature varies, but there is general agreement that the rechargeable IPG will last longer than the non-rechargeable IPG. How long an IPG will last depends on its settings and how often it is used (Abbott, 2019). “Systems with a non-rechargeable battery need to be surgically replaced every 2 to 5 years, depending on the frequency of use. Rechargeable battery systems may last 8 to 10 years or longer (Orlando, et al., 2019).” Boston Scientific rechargeable IPGs have a five-year warranty, but may last much longer (Boston Scientific, 2019). Medtronic has rechargeable IPGs that do not need to be replaced for 9 years independent of the settings or recharge preferences (Medtronic, 2019). “The lifespan of a rechargeable IPGs can vary with manufacturers, but are usually 9 years or more. Theoretically, as the need for battery change is decreased, the number of surgical complications of these procedures should be minimized. To the best of our knowledge however there is no data and we can only speculate (Eldabe, et al., 2016).”

Size matters. Abbott has two different IPGs for the BurstDR™ system. The smaller would need replacement within 5 years; the larger could remain effective for 7 years, but might not fit in a small, thin person (Abbott representative, personal communication, 2018).

The NLCP will therefore have to use a range regarding replacement frequency. If the specific model is unknown, it would help to know if the system has a rechargeable or non-rechargeable IPG. The literature suggests that rechargeable systems are used more often. Review technological advances that could affect the frequency of replacement.

SCS Manufacturers, Models
Manufacturers of spinal cord stimulators are a good source of information. Manufacturers are continuously trying to improve their products with smaller IPGs that require shorter recharging time, have longer battery life and decreased loss of efficacy over time. Newer neurostimulators allow for upgradable technology, when available, with no surgical revision.
To protect the identity of the subject of the life care plan, the names and locations of the providers were not noted. For this case study, only the services related to the spinal cord stimulator were noted below. See the information regarding medical codes in this issue on page 36. Note that dollar amounts are for example purposes only; the NLCP should perform the usual cost research for a given case.

In this case, the initial office visit with the pain management physician had been completed. The preoperative office visit with the pain management physician can be done at one of the planned office visits in the year 2019; see below. The number of office visits was recommended by the treating pain management physician. The charges for permanent SCS implantation were for percutaneous placement, recommended by the pain management physician. Opioid use decreased; further weaning was attempted.

<table>
<thead>
<tr>
<th>Item / Service &amp; Purpose</th>
<th>Age / Year</th>
<th>Frequency of Replacement</th>
<th>Charge Data Source</th>
<th>Charge</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Management Physician, Office Visit</td>
<td>Beginning: Age 58 Year 2018</td>
<td>1-2x/month</td>
<td>Per Unit: $125</td>
<td>Medical Fees 2018 50th%ile; American Hospital Directory (AHD), ahd.com</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ending: Age 59 Year 2019</td>
<td></td>
<td>Per Year: $1,500 - $3,000</td>
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<td></td>
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<tr>
<td></td>
<td>99213: $125</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Item / Service &amp; Purpose</td>
<td>Age / Year</td>
<td>Frequency of Replacement</td>
<td>Charge Data Source</td>
<td>Charge</td>
<td>Data Source</td>
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</tr>
<tr>
<td>Trial Spinal Cord Stimulator (SCS), to assess efficacy of SCS</td>
<td>Beginning: Age 69 Year 2019</td>
<td>One time</td>
<td>Per Unit: $20,515.56</td>
<td>Medical Fees 2018 50th%ile; American Hospital Directory (AHD), ahd.com</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ending: Age 59 Year 2019</td>
<td></td>
<td>Per Year: $20,515.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physician: $8,546.56 (includes conscious sedation)</td>
<td></td>
<td>Facility &amp; SCS equipment: $11,969 (2017 Dollars, latest data)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total: $20,515.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item / Service &amp; Purpose</td>
<td>Age / Year</td>
<td>Frequency of Replacement</td>
<td>Charge Data Source</td>
<td>Charge</td>
<td>Data Source</td>
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</tr>
<tr>
<td>Pain Management Physician, office visit</td>
<td>Beginning: Age 59 Year 2019</td>
<td>1x every 6-12 months</td>
<td>Per Unit: $125</td>
<td>Medical Fees 2018 50th%ile; American Hospital Directory (AHD), ahd.com</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ending: Age 84 Year 2044</td>
<td></td>
<td>Per Year: $125 - $250</td>
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<tr>
<td></td>
<td>99213: $125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physician: $1,918.74 (includes conscious sedation)</td>
<td></td>
<td>Facility &amp; SCS Equipment: $46,926 - $47,937 (2017 Dollars, latest data)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total: $48,844.74 - $49,855.74 (range includes non-rechargeable &amp; rechargeable IPG; manufacturer was not specified)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Physician: $1,918.74 (includes conscious sedation; percutaneous approach)
Facility & SCS Equipment: $46,926 - $47,937 (2017 Dollars, latest data)
Total: $48,844.74 - $49,855.74 (range includes non-rechargeable & rechargeable IPG; manufacturer was not specified)
The latest advances have been related to improved equipment technology, stimulation targets, and how the electrical energy is delivered to the spine and nerves. (Bendel, M., 2018) Remember, however, that they are trying to sell a product.

- Medtronic, Inc., www.medtronic.com
- Abbott (FKA St. Jude Medical, Inc.), www.sjm.com
- Boston Scientific, www.controlyourpain.com
- Nevro Corp. www.nevro.com

The following are examples manufacturers’ information about their systems.

**Medtronic**

- Medtronic SureScanTM systems provide safe access to 1.5 Tesla MRI scans on any part of the body;
- The Medtronic Intellis™ with AdaptiveStim™ automatically adjusts with body movement. AdaptiveStim™ is powered by proprietary Overdrive™ battery technology. With Overdrive™, over 95% battery capacity is retained at 9 years, independent of therapy parameters or recharge preferences. It also recharges faster than traditional lithium ion batteries, taking about 1 hour to recharge from empty to full. Medtronic claims that Intellis, weighing one ounce and measuring 2.2”×1.9,” is the “smallest fully implantable spinal cord neurostimulator (Medtronic, 2019).”

**Abbott**

- Abbott claims that their Prodigy MRI™ IPG with BurstDR™ stimulation has the longest projected battery life, 10 years of practical recharging.
- Several products feature settings that can be charged with Apple™ mobile digital devices and Bluetooth® wireless technology. Approved technologies are easily delivered via software updates.

- With traditional SCS neurostimulation, pain signals are replaced with what some describe as a tingling or buzzing sensation. BurstDR™ stimulation works similarly, but mimics natural patterns found in the brain; modifying pain signals and changing the way the body perceives pain. Most people feel no sensation with BurstDR stimulation. (Abbott, 2019)

**Boston Scientific Corp.**

- The Spectra WaveWriter SCS system combines both paresthesia and paresthesia-free therapy simultaneously in a single device. With multiple therapy options, treatment can adapt to changes in pain over time.
- Boston Scientific has an adapter that will connect compatible Abbott/St. Jude, Medtronic and Nevro leads to a Boston Scientific IPG. (Boston Scientific, 2019)

**Nevro Corp.**

- The Nevro Senza and Senza II have rechargeable IPGs designed to have at least a 10-year battery life. Theses IPGs use HF10 (high-frequency) that does not create a tingling sensation / paresthesia. HF10 does not have driving restrictions. It is MR conditional, approved for MRI scan of the head and extremities with 1.5 Tesla or 3.0 Tesla (Note: Tesla describes the strength of the magnet used in an MRI scanner). (Nevro Corp., 2019; Al-Kaisy, et al., 2014)

Costs vary with the manufacturer and model. Providers, however, rarely specify such variations in their estimated charges ad are rarely aware of them.

**Summary**

Spinal cord stimulation may be an effective alternative or adjunct when conventional treatment provides inadequate pain relief or intolerable side effects. The goals are to improve the quality of life and increase function by reducing pain severity. A 50% decrease in pain is considered successful. The need for pain medication is often decreased. There are numerous models and ongoing technological advances. Charges vary with the manufacturer and model. Charges will also vary depending on the surgical approach, percutaneous or laminectomy. Both variables are determined by the treating physician.

The NLCP should remember that until a successful trial SCS has been completed, the need for permanent placement and replacement IPG procedures is not established, and that permanent and replacement procedures are properly projected as potential needs.

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Springston,
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LNCC, CCM,
CNLCP

entered the world of legal nurse consulting, nurse case management, and life care planning following a clinical nursing career in intensive care, cardiovascular intensive care, and heart transplant care. She serves on the peer review committee for JNLC and on the board of directors of the Phoenix Chapter of AALNC. She is also a member of the International Association of Rehabilitation Professionals (IARP) and the International Academy of Life Care Planners (IALCP). She can be contacted at gerries@vocationaldiagnostics.com
References
SPINAL CORD STIMULATOR CODING

Chris Woolstenhulme, QCC, CMCS, CPC, CMRS
courtesy of Find-a-Code

Electrical Nerve Stimulators
The implanted neurostimulator pulse generator is placed in a subcutaneous pocket and connected to leads to the cervical or lumbar epidural space. There are two general classifications of electrical nerve stimulators: peripheral nerve stimulators and central nervous stimulators.

Peripheral Nerve
An implanted peripheral nerve stimulator involves implanting electrodes around a select peripheral nerve and attaching it to a receiver also implanted under the skin. This procedure is done in an operating room and may be used to treat conditions such as chronic low back pain.

CPT codes for Spinal Cord Stimulator
CPT Codes for neurostimulators are found under Surgical Procedures on the Spine and Spinal Cord (Neurostimulators). Notice there are procedures for the implants and generator that include removal and revisions, 63650-63688. Laminectomy is considered an open procedure.

Lead Implants/Electrodes
63650 - Percutaneous, Electrode
63655 - Laminectomy, plate/paddle

Removal or Revision of Electrodes
63661 - Removal, electrode
63662 - Removal, Plate/Paddle
63663 - Revision, including replacement elect
63664 - Revision including replacement - laminotomy or laminectomy Plate/Paddle

Insertion or Replacement of Generator or Receiver
63685 - Insertion or replacement generator or receiver

Revision or Removal Generator or receiver, with or without reprogramming
63688 - Revision or removal generator or receiver

Electronic Analysis - Once the generator or receiver is revised or removed, it is then evaluated, and adjustments made as needed to ensure proper functioning.

These codes for electronic analysis generator neurostimulator pulse generator or receiver, with or without reprogramming as well as configuration and analysis are generally paid through the APC code, and not billed separately. For example, 95970, 95971, 95972.

HCPCS Codes
Several codes cover DME supplies used for a SCS, e.g., generator, leads, and receivers. You may need to communicate with the treating provider to verify the applicable DME supplies used.

L8679 Implantable neurostimulator, pulse generator, any type
L8680 Implantable neurostimulator electrode, each
L8682 Implantable neurostimulator radiofrequency receiver
L8685 Implantable neurostimulator pulse generator, single array, rechargeable, includes ext.
L8686 Implantable neurostimulator pulse generator, single array, non-rechargeable, includes ext.
L8687 Implantable neurostimulator pulse generator, dual array, rechargeable, includes ext.
L8688 Implantable neurostimulator pulse generator, dual array, non-rechargeable, includes ext.
L8695 External recharging system for battery (external) for use with implantable neurostimulator, replacement only

Trial Stage
The first stage consists of a short trial (e.g., 3-14 days) with temporary percutaneous implantation of neurostimulator electrode(s) (63650) and external generator for assessing the patient’s suitability for ongoing treatment with a permanent surgically implanted nerve stimulator (63685).
During the trial phase, one or two leads are placed via an epidural needle in the appropriate position. If at least 50% pain relief is achieved during the trial phase, the temporary system may be transitioned to a permanent system. Performance and documentation of an effective trial is a prerequisite for permanent nerve stimulation.

**Clinical Example:** Patient "A" - 45-Year-old male was referred to neurologist for a trial screening of an implantable spinal cord stimulator. Patient was referred for chronic pain management a result of an injury 5 years ago. Patient has been experiencing chronic debilitating low back pain for the past 5 years and was diagnosed with radiculopathy in the lumbosacral region. The procedure was performed in the office, the needle was inserted into the epidural space using x-ray guidance, temporary wires were inserted, and leads were connected to a screening cable and the external neurostimulator. The patient tolerated the procedure well and was scheduled for a follow up visit in 12 days.

M54.17 - Radiculopathy, lumbosacral region

**The Permanent Implantation Stage**
The second system involves the implantation of paddle-type leads into the epidural space after laminectomy and subcutaneous connection to a neurostimulator. The patient comes back in for a permanent neurostimulator, the original needs disconnected and you would charge 63641 for removal. Then charge for the new electrode 63650 and generator 63685. Neurostimulators may be either Implantable Pulse Generators (IPGs), which use either a non-rechargeable or a rechargeable internal battery, or radio frequency devices, which receive energy in the form of radio frequency pulses from an external device powered by a rechargeable battery. The appropriate SCS system with up to 16 contacts/electrodes will depend on the underlying condition, the patient's pain patterns, the area of body affected, and the amount and intensity of stimulation required. Permanent neurostimulators must be placed in an Ambulatory Surgical Center (ASC) or hospital".

**Clinical Example:** Patient “A” - Follow up visit with 45-Year-old male, seen 12 days ago in the office for a screening trial for a Spinal Cord Stimulator. The trial was determined to be successful and the decision to do a permanent percutaneous implant was made, an appointment was scheduled in the Ambulatory Surgical Center for the placement of a percutaneous permanent implantation of neurostimulator for the Spinal

**Components Required**
(1) the lead that delivers the electrical stimulation to the spinal cord;
(2) an extension wire that conducts the electrical stimulation from the power source to the lead; and
(3) a power source that generates the electrical stimulation.

Example of pricing a procedure using UCR National Un-adjusted fees used for pricing for Physician Fees. Pricing for physician fees for example only; use appropriate resources for individual cases.

<table>
<thead>
<tr>
<th>Service</th>
<th>Purpose</th>
<th>Frequency</th>
<th>Base Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>63650</td>
<td>TRIAL Spinal cord stim Implant</td>
<td>1 X</td>
<td>6790.33</td>
</tr>
<tr>
<td>63661</td>
<td>Removal of elect - Incl Fluoroscopy</td>
<td>1X</td>
<td>2980.80</td>
</tr>
<tr>
<td>65350</td>
<td>Permanent Elect Implant</td>
<td>1 X</td>
<td>6790.33</td>
</tr>
<tr>
<td>63685</td>
<td>Insertion Pulse generator</td>
<td>1X</td>
<td>1725.64</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>$18287.1</td>
</tr>
</tbody>
</table>

**Additional Resources:**
- Boston Scientific: [https://www.bostonscientific.com/content/dam/bostonscientific/Reimbursement/Neuromodulation/2017/NM-45908-AN%202017%20Outpatient%20Quick%20Reference%20Guide%20%20FINAL.pdf](https://www.bostonscientific.com/content/dam/bostonscientific/Reimbursement/Neuromodulation/2017/NM-45908-AN%202017%20Outpatient%20Quick%20Reference%20Guide%20%20FINAL.pdf)
- American Hospital Directory - Statistics for the Top 20 Medical Diagnoses, based on Medicare OPPS claims data [https://www.ahd.com/outpatient.php?hcfa_id=3575.490ddc15f8e1faaf2998e3d8b9&ek=9c4db81420067e7dd3f65526e46d01](https://www.ahd.com/outpatient.php?hcfa_id=3575.490ddc15f8e1faaf2998e3d8b9&ek=9c4db81420067e7dd3f65526e46d01)
Optimizing Financial and Rehabilitation Outcomes for Chronic Pain Claims Utilizing Biopsychosocial Rehabilitation Programs

Darrell Bruga DC, MDT; Patty Hedrick BSN, RN, BA, CRRN, CCM, CLCP, CNLCP; Pamela Otto RN; Gary Jacob DC, MPH, CHES; Jason Parker BHK; Gideon Letz MD, MPH

Introduction
Musculoskeletal (MSK) disorders are common, disabling, and costly (Global Burden of Disease Study 2017; Johnson, CD, et al., 2018). Gaskin and Richard recently estimated their total costs in 2010 as $560 to $635 billion, greater than the annual costs of heart disease, cancer, and diabetes (Gaskin, D.J., et al., 2012).

Accident and injury disability claims continue to decrease year over year (U.S. Bureau of Labor Statistics, 2017), but work disability, “inability of working-age adults to remain gainfully employed due to health concerns” (Shaw, W., et al., 2017) is increasing at 5% per year (ACC Injury Statistics). Musculoskeletal disorders account for a large portion of needlessly work-disabled individuals, occurring when an injury or illness that should normally result in only a few days of work absence withdraw from work either permanently or for unnecessarily prolonged periods. This persists despite improvements in case management, utilization review, and treatment guidelines such as by American Occupational and Environmental Medicine Guidelines (ACOEM) and the Official Disability Guidelines (ODG).

Larger numbers of Workers’ Compensation (WC) claimants diagnosed with chronic pain and using high doses of opioids account for higher costs; opioid-related deaths increase annually (CDC, National Center for Health Statistics Data Brief No. 329, November 2018). It is not clear that current cost containment efforts have actually resulted in real savings in medical and indemnity costs for employers and insurers.

Needless work disability (also known as delayed recovery or “creeping catastrophic claims”) is defined as “failure to make expected progress 6-12 weeks after an injury” (New York Non-Acute Medical Treatment Guidelines, 2014). These cases represent a small percentage of the total claimants but result in a high percentage of total costs.

KEY WORDS: psychosocial rehabilitation, return to life roles, interdisciplinary pain rehabilitation programs, biopsychosocial, chronic pain, CBT

NURSING DIAGNOSES TO CONSIDER NANDA-I 2017-2019
1. Chronic pain (Domain 12, Comfort; Class 1, Physical Comfort);
2. Interrupted family processes (Domain 7, Role relationship, Class 2, Family relationships)
3. Ineffective role performance (Domain 7, Role relationship, Class 3, Role performance)
Recognizing Delayed Recovery

Research suggests that a significant proportion of the workers we serve will not respond to traditional clinical interventions and will not return to work or recover along expected time frames to the traditional endpoint of reduced or eradicated impairment. Most treatment approaches for injured workers take a “one size fits all” approach with medications, passive and active therapies, injections, surgical intervention, and more. While most workers improve, many do not make progress with common clinical resources. Outcomes for injured workers could be improved by incorporating biopsychosocial (BPS) rehabilitation approaches (Shaw, W., et al., 2017).

Contributions to delayed recovery include (Shaw, W., et al., 2017):

- elapsed time out of work
- uncertainty and distrust due to lack of communication or information
- uncoordinated or inappropriate medical care and advice
- low expectations of recovery
- excessive vigilance
- catastrophic thinking
- false beliefs
- fear of movement
- self-limitation
- perceived injustice
- lack of employer support

One reason for the increase in longer-term work disability associated with pain, mental health, and other conditions is stakeholders’ failure to recognize that work disability is distinct and separate from clinical diagnosis or health condition. Treatment providers have not historically been trained to address work disability or use biopsychosocial methods (Margalit, S., et al., 2007). Policy leaders have suggested that the National Institute for Occupational Safety and Health (NIOSH) and the Centers for Disease Control and Prevention (CDC) recognize and increase research funding for work disability prevention (Letter, Franklin and Muller, February 9, 2015) in addition to their traditional focus on workplace safety.

New York State Non-Acute Pain Medical Treatment Guidelines recommend reexamination in order to confirm the accuracy of the diagnosis and a re-evaluation of the treatment program for patients who have not progressed according to expected norms.

Assessment for potential barriers to recovery (yellow flags/psychological issues) should be ongoing throughout the care of the patient. However, at 6-12 weeks, alternate treatment programs, including formal psychological or psychosocial evaluation, should be considered. Referral to mental health providers for the evaluation and management of delayed recovery does not indicate or require the establishment of a psychiatric or psychological condition: “

Similar definitions are found in the California Medical Treatment Utilization Schedule (MTUS) Guidelines, ODG Guidelines, and ACOEM Guidelines.
Entities usually engage life care planners (LCP) well beyond 6-12 weeks post injury, therefore likely missing the ideal window of opportunity to reduce delayed recovery risk factors. The client is typically in chronic pain, but can still benefit from BPS rehabilitation approaches. These services should be considered in LCPs.

They can also positively affect the lives of individuals without an injury claim but who may need assistance in resuming meaningful life-roles, e.g., being a spouse, friend, parent, worker, or volunteer. BPS care should be a part of any treatment plan regardless of the origin of health complaint or payer source. BPS care is just good evidence-based medicine for everyone.

Despite overwhelming scientific evidence and recommendations from the evidence-based medical treatment guidelines for the last 18 years endorsing the BPS rehabilitation model, treatment providers and payers have been slow to embrace it. In fact, BPS rehabilitation is now considered standard of care to reduce the deleterious effects of delayed recovery.

**Biopsychosocial Behavioral Model**

**Replacements for Biomedical Models**

Modern medicine, also known as biomedicine, has made great advancements employing a method called reductionism, whereby things are reduced to their smallest components to obtain the greatest understanding. Reductionism permits an understanding of humans on a microscopic, molecular level.

While biomedical reductionism has resulted in incredible advancements in the treatment of acute trauma and infectious disease, it has little to offer in the treatment of chronic condition that requires recognition and management of psychosocial factors: the patient’s knowledge, attitudes, beliefs, emotional state, and coping skills.

The biopsychosocial model is an emergent or holistic model, recognizing that different human dimensions need different methods of evaluation and intervention. The biopsychosocial model recognizes our “smallest” biological processes (biomedical). Beyond that, however, are more complex psychosocial processes with profound interactions with biomedical ones. In fact, for some health conditions, psychosocial factors are better predictors of outcomes than physical findings.

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**Figure 1: Biopsychosocial Diagram**

The biopsychosocial model (Figure 1) was first promoted by George L. Engel, M.D., in the late 1970s as a replacement for the biomedical model. Over decades it became clear that the biomedical model was insufficient for chronic conditions. Researchers discovered that the biomedical approach often promotes and exacerbates chronicity if applied too long, suggesting that all biomedical interventions should be applied in a biopsychosocial context. **While the biopsychosocial model is considered a must for managing chronic complaints, using it in the acute phase prevents or mitigates the development of chronicity.**

The biopsychological model also replaced a key component of the biomedical model known as “doctor-centered-care” that did not have to deal with patients’ emotional or educational state. The biopsychosocial response to “doctor-centered care” has been referred to as “patient-centered care” or more appropriately as “relationship-centered care.” The relationship between a provider and patient to the patient’s health condition and engagement with the world is critical to health. **Biopsychosocial evaluation is the best way to determine beneficial lifestyle changes and the best way to implement them.**
Psychosocial Risk Factors Impacting Recovery

Psychosocial risk factors account for as much as 30-40% of the reason that individuals do not return to work (Sullivan). Common risk factors noted as contributing to recovery include expectations, catastrophic thinking, perceived injustice, fear avoidance, and disability beliefs. (Table 2)

<table>
<thead>
<tr>
<th>Catastrophic Thinking (CIEQ-C)</th>
<th>A measure of the client's negative cognitive reactions to their symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Injustice (CIEQ-I)</td>
<td>A measure of the client's perception of unfairness that characterizes their life/health situation</td>
</tr>
<tr>
<td>Fear Avoidance (FFQ-K)</td>
<td>A measure of the client's worries or concerns about how activity might exacerbate symptoms</td>
</tr>
<tr>
<td>Disability Beliefs/Expectancies (GPDI)</td>
<td>A measure of how much symptoms interfere with the client's ability to perform day-to-day activities</td>
</tr>
</tbody>
</table>

Table 2: Common Modifiable Psychosocial Risk Factors

Life Care Planning and Evidence-Based Biopsychosocial Rehabilitation Options

Recent efforts to curb the opioid problem have included utilization review, physician prescribing reforms in some states, and tapering/withdrawal programs. Traditional pain management interventions have little to modest impact for workers late into their chronic recovery cycle. Historically lacking positive results, their reimbursements are increasingly limited. Current trends in evidence-based medicine and real-world clinical implementation are causing a shift away from injections, spinal cord stimulators, opioids, surgery, and other biomedical interventions toward BPS-based treatment.

Cognitive Behavioral Therapy

CBT helps patients understand thoughts and feelings that influence behaviors. CBT is commonly used to treat a wide range of disorders including pain, addictions, depression, phobias, and anxiety. One of the main focuses is changing negative thoughts that contribute to and exacerbate symptoms. CBT is goal-oriented. Client and therapist work together toward mutually established goals using journaling, role-playing, relaxation techniques, and mental distractions. Treatment is solution-focused and often time-limited to 6 to 20 sessions. CBT is most often delivered by a PhD, PsyD, or Master’s level licensed mental health professional.

Claims organizations are no longer concerned about psychological claims with the recent Health and Behavioral Assessment (HBA) codes recently adopted, now used to bill for services for clients without a psychiatric diagnosis but whose behavioral function impacts a health problem. This change in reimbursement has improved the acceptance of CBT in the US, and will influence acceptance in life care planning litigation.

Progressive Goal Attainment Program®

The Progressive Goal Attainment Program (PGAP®) is an evidence-based, standardized psychosocial return-to-work or return-to-life intervention for reducing disability from a wide range of debilitating conditions. The PGAP® is uniquely-focused therapy for helping clients maximize their resumption back to daily living, e.g., as a worker, spouse, parent, friend, and community citizen. The program uses CBT and motivational enhancement techniques, activity planning, graded exposure, problem solving, and targeted techniques to reduce catastrophic thinking, perceived injustice, fear avoidance, and perceived disability (Sullivan, M.J.L., et al., 2013). The PGAP® differs from traditional CBT in that “work disability,” as opposed to the symptoms of the health condition, is the distinct target of intervention. When work resumption is impossible, as it is in many catastrophic cases that need life care planning, the goal of PGAP® shifts toward return to life-roles. The PGAP® serves a broad population and is effective for individuals with conditions such as pain, mental health, whiplash, PTSD-civilian, PTSD-military, concussion, and other chronic conditions.
Research on PGAP® has demonstrated an improved probability for return-to-work and return-to-function with clients having long-term disability from many causes. In one study, adding PGAP® to a functional restoration physical therapy program increased return-to-work rates by over 50%, and with individuals with chronic disability caused by cervical sprain injury, 75% of clients returned to work (Sullivan, M.J.L., et al., 2006; Sullivan, M.J.L., et al., 2010).

Post-program 1-year outcomes showed marked decreased treatment and medication utilization. In one publication, treatment was reduced by 79% with the combined PGAP®/Active physical therapy group compared to only 50% with active therapy alone, due to reduced depression symptoms (Sullivan, M.J.L., et al., 2010). In the same study, 3% were still using medications at 1-year follow-up compared to 62% in the active physical therapy group, related to decreased fear of movement accounted. These results point to post-PGAP® clients having improved function and resumption of meaningful life roles.

PGAP® is delivered one-to-one with a trained provider such as an RN/NCM, rehabilitation counselor, occupational therapist, physical therapist, psychologist, or other type of clinical and rehabilitation provider. The PGAP® is often coupled with active functionally orientated PT over a maximum of 10 weeks. The PGAP® is widely accepted by workers’ compensation and disability carriers and listed in the ODG Guidelines as a recommended intervention where there is access to providers.

Multidisciplinary Pain Rehabilitation Programs
Multidisciplinary pain rehabilitation programs can be less coordinated, with less integration with program goals and communication than interdisciplinary programs; however, they can be very effective for the right person. Typically, the services are delivered by a possibly unallied community of providers, not in a single location. This may include CBT delivered by a psychologist, medical physical, physical therapist, or occupational therapist. However, for the individual who is more challenged by treatment adherence, personality, or behavioral issues, multiple approaches can pose a problem to the treatment team and overall program outcome. In these cases, an interdisciplinary pain rehabilitation program is the treatment of choice.

Interdisciplinary Pain Rehabilitation Programs
Interdisciplinary pain rehabilitation programs (IPRP) have significant evidence dating back 30 years and are recommended by treatment guidelines. True IPRPs are in one facility, with group CBT delivered by a psychologist, medical physician, physical therapist or occupational therapist, vocational counselor, group exercise, and more.

Individuals on high-dose opioids are often referred to an IPRP. Sometimes, the client will require an inpatient program vs. an outpatient IPRP, and sometimes the worker/client may need to be tapered or weaned before starting the program. Some outpatient programs will taper and optimize medications while the client is attending the program. True inpatient pain rehabilitation programs are rare with approximately only 6 to 10 in the U.S. These programs should not be confused with the more common drug and alcohol programs that are often not familiar with chronic pain conditions.

In our personal experience with IPRPs for many years, we have seen significant reductions in high-dose opioids when a highly coordinated care management approach is included, with a reduction of medications at 60% and opioids at 77% (Internal data, Bruga, Otto).

IPRPs run daily M-F for 6 to 8 hours per day to mimic a typical work week, and the programs run 3 to 6 weeks in duration. Team conferences are integrated, with key members of the team: medical physician, psychologist, occupational/physical therapist, and vocational counselor. Some of the top programs in the country include PRIDE (Dallas, TX), Rosomoff (Miami, FL), Brooks Rehabilitation (Jacksonville, FL), and Shirley Ryan (Chicago, IL, formerly the Rehabilitation Institute of Chicago).

There are approximately 50 programs in the US. Quality, outcomes, and content can vary greatly. Nevertheless, IPRPs can very effective for complex cases.
Functional Restoration

Functional Restoration Program (FRP) is a form of IPRP. The PRIDE Program in Dallas, Texas was the first interdisciplinary functional restoration program in the U.S., and won the 1985 Volvo Award for its published work on FRP (Mayer, T.G., et al., 1985). FRE is distinguished by its focus on objective measurements of functional progress. True functional restoration programs use highly specific measurement and treatment approaches such functional capacity evaluation, endurance, and goal-setting along with the key components of IPRP such as CBT, vocational counseling, etc.

Costs Associated with Biopsychosocial Rehabilitation Interventions and Programs

Costs for BPS programs can vary widely across the U.S. For the most part, there are no specific fee schedules or codes except for CBT. However, higher pricing is often associated with value-based and outcome-based oversight networks. Lower pricing is associated with providers with no outcomes oversight.

For cognitive behavioral therapy, some available codes include Health & Behavior Assessment and Intervention codes (CPT codes 96150-96155).

<table>
<thead>
<tr>
<th>Rehabilitation Service</th>
<th>Assessment</th>
<th>Treatment Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT Only</td>
<td>$400 - $1000</td>
<td>$2,400 - $4,200 (12 sessions)</td>
</tr>
<tr>
<td>PGAP Only</td>
<td>$400 - $800</td>
<td>$2,000 - $3,200 (10 Sessions)</td>
</tr>
<tr>
<td>PGAP plus Integrated Restorative Exercise</td>
<td>$400 - $800</td>
<td>$4,800 - $8,600 (30 Sessions)</td>
</tr>
<tr>
<td>Multidisciplinary Functional Restoration</td>
<td>$1,500 - $2,500</td>
<td>$10,000 - $20,000 (4-16 weeks)</td>
</tr>
<tr>
<td>Program format can be highly variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interdisciplinary Functional Restoration Program (aka interdisciplinary pain rehabilitation program)</td>
<td>$1,500 - $3,500</td>
<td>Outpatient $20,000 to $45,000 Inpatient $40,000 to $75,000 Costs range based on estimated length of stay, program specifics, etc.</td>
</tr>
</tbody>
</table>

Table 3: Cost comparison ranges

Some states may mandate specific codes and fee schedules for interdisciplinary functional restoration programs (CPT 97799-CP). In most of the U.S., there are no established codes or fee schedules. Often providers will use unlisted CPT codes e.g., 99499 and others. The fees associated with these programs vary greatly (see Table 1.2 Interdisciplinary Functional Restoration Program). For programs such as PGAP®, there are no specific codes.

Summary

The number of people negatively affected by disability is on the rise. To reduce the effects of health concerns on return to quality of life roles, psychosocial rehabilitation has emerged as an empirically supported intervention with promising results. Psychosocial rehabilitation’s progressive approach to complications related to delayed recovery provides information and resources to assist the life care planner in creating a proactive and realistic life care plan outlining future medical care. This patient-centered approach lends itself directly to the life care planning methodology, as both aspire to obtain a comprehensive assessment of the biological, physical, psychological, social, and past medical treatments to determine a successful roadmap for the future.
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Introduction:
Although pain is a useful signal of danger and the brain makes sense of it so the person can decide how to react to the threat, some pain has no protective value and can seriously degrade quality of life. Graded motor imagery (GMI) is a noninvasive therapy protocol that treats complex, ongoing, dysfunctional pain by activating brain cortices sequentially to retrain brain networks. It comprises laterality training, graded motor imagery, and mirror therapy. This treatment strategy can have positive effects with stroke, CRPS (complex regional pain syndrome), phantom limb pain (PLP), and chronic musculoskeletal pain (CMP). These conditions have varied causes, but they have similar limitations: pain, loss of mobility, and reduced ability to perform activities of daily living.

With chronic pain there is no easy fix. It requires an active, persistent, patient approach with education and coaching. GMI gradually introduces implicit (indirect) stimulation to the brain areas involved in symptom production, progressing to active explicit (direct) stimulation, facilitating recovery (Bowering et al., 2013).

Chronic Musculoskeletal Pain (CMP)
The statistics on chronic pain are startling: 100 million Americans and 1.5 billion people worldwide suffer from chronic pain. According to Vos et al. (2012) chronic low back pain is the most prevalent condition. Chronic neck pain is ranked eighth.

Dr. Moseley, one of the world’s foremost pain researchers, states that in CMP, “the hardware (the biological structures involved in conveying and processing danger messages and in integrating other threatening cues) increases its sensitivity.” In CMP, cortical inhibitory centers become less effective, so pain is felt more acutely. Parts of the brain related to emotion and memory become more involved in pain processing, magnifying the response. Although by 3 to 6 months most injured tissues are healed, pain beyond that point appears to be a consequence abnormal,

GMI treatments are geared towards return to function. The pt is asked to imagine a task. This activates the primary motor cortex.
nonfunctional processing; the brain continues to produce debilitating pain unnecessarily.

**Phantom limb pain**

Phantom limb pain arises from surgery or amputation; patients can have pain for decades, severely limiting mobility. GMI, especially mirror therapy, can treat PLP, positively affecting the sense of motor control and helping reduce phantom pain. V.S Ramachandran (1996), a pioneer in this field, discovered the positive effects of mirror therapy on upper limb amputations. Initially trying to discover the mystery behind synesthesia, a sensory discriminatory aberrancy, while studying amputees he discovered that visual stimuli can trick the brain to perceive the unaffected extremity as the affected extremity. More recent work has demonstrated the efficacy of the mirror therapy with lower limb amputations (Maclachlan, 2004).

**CRPS**

CRPS (complex regional pain syndrome), affects up to 1 to 5% of patients after limb trauma. CRPS can lead to sensory, motor, and autonomic nervous system dysfunction of the affected limb (Veldmen et al., 1993). Patients have altered perception, perceiving the affected limb(s) to be increased in size and extremely painful (Lewis et al., 2007). Functional brain MRI studies demonstrate significant differences between the unaffected and affected extremity. Some researchers characterize this as the brain effectively disowning a hand, and perceiving it as a threat (Lewis et al., 2007, Mosley, G.L, 2005). GMI can combat CRPS by effectively addressing gradual cortical reorganization, thus helping CRPS patients overcome the pain and loss of mobility. (Maihofner C. et al., 2012; Mosley, G.L., 2005; Mosley, 2004; Decety et al., 1994; Decety, 1996).

**Stroke**

Studies have shown that early goal-oriented and task-specific intervention can help patients with ischemic and hemorrhagic stroke regain functional mobility (Langhorne, 2011) through neuroplasticity, using and strengthening available neurological pathways to promote movement and function. However, the challenge early on is for patients whose paresis is more severe and who cannot perform the early motor activation patterns. (IMI) implicit motor imagery can achieve preliminary activation of the primary motor cortex, a region of the brain dedicated to movement control (Parsons et al., 1995). To the brain, imagining movement is the same as doing it. Priming the primary motor cortex with laterality training, using explicit GMI, and then applying mirror visualization therapy in sequence is key in the overall GMI program (Hamzei et al., 2012, Osuagwu BA, 2014; Yavzur, 2009). GMI can also have an analgesic effect, reducing debility and enhancing quality of life.

GMI for stroke, PLP, CMP, CRPS, or CMP

Adapted from Graded Motor Imagery Handbook (Moseley et al., 2012).

GMI promotes gradual exposure of movement to the brain, improving motor and sensory maps, reducing the effects of learned disuse, and helping patients overcome...
Laterality Training: Implicit Motor Imagery accessing movement with reduced pain.

Figures 3 and 4: Laterality training implements implicit motor imagery. The patient activates the pre-motor cortex without activating the primary (motor) cortex, thus gradually introducing the brain to the idea of movement. For a limb, the exercises involve using the unaffected limb while visualizing using the affected limb in the postures and movements shown. For spine exercises, the patient moves in the direction towards which the image is turning (Moseley et al., 2012).

Laterality Training
Pain scientists have shown a link between motor cortex activation and pain; laterality training bypasses that neurologically, and is an integral first step with patients with high level pain such as PLP, CRPS, stroke, and chronic musculoskeletal pain (Mezlak 1990, Moseley 2004; Swart et al., 2009).

Laterality training improves the accuracy and speed with which patients can differentiate left and right, a common problem after neurological injury. For hands and feet, the goal is to reach 80% accuracy at this task in less than two seconds of response time for hands and feet. For back and neck, the goal is up to six seconds with consistent response and less than .05 seconds difference between serial responses (Moseley et al., 2012). Neurologically, this exercise helps prime the brain for movement without activating the primary somatosensory and motor cortices that cause pain, particularly in CRPS (Swart et al., 2009; Cocksworth and Punt 2013). This reduces pain by helping...

Figure 5: The homunculus is an area of the brain that featuring the precentral gyrus featuring the primary motor cortex, and also the post central gyrus or the primary somatosensory cortex. These are areas directly affected by the GMI program, and the gradual approach is designed to gradually stimulate these regions in tandem with other regions of the brain.
the affected brain area to discriminate between left and right without activating the part of the brain that would cause pain sensation.

### Explicit Motor Imagery

This follows the implicit stage to involve motor cortex activation gradually. Activating the motor cortex for the affected limb may be too much stimulation and cause pain in an affected limb, so it is prudent to start with imagining the contralateral limb performing the movement and gradually introduce imagining movements in the affected limb. (Moseley et al., 2012).

Imagining movement is an important step, and neurologically very similar to actual movement because the brain primes itself before initiating actual movement. It is important to practice this skill at different times of the day, with different environmental sounds (music, other) and task contexts in the brain (Moseley et al., 2012). This allows patients to use their imaginations, and also activates the part of the brain involved with movement without triggering pain, acting “under the pain radar (Moseley et al., 2012).”

### Mirror Therapy

People who experience the most pain relief from the gradual motor imagery program are those who are able to imagine the affected limb (Moseley et al., 2012). Mirror therapy directly affects the synapses in the brain, activating the primary motor cortex of the affected hand and simultaneously creating the illusion that the affected limb is moving. The evidence is mounting that mirror therapy is very effective as the final GMI component (Thieme, 2012). Key points in building a mirror box include size to allow plenty of space for movement, a rigid mirror, and portability so the patient can use it in other contexts to help to generalize its applicability.

### Clinical outcomes data associated with mirror therapy

According to the New England Journal of Medicine a medical journal with a high impact factor conducted a randomized controlled trial of mirror therapy with 24 patients with stroke within 14 months, and CRPS 1 of the paretic extremity. The groups were divided into a sham mirror therapy group, a mental imagery group, and a...
mirror therapy group. The mental imagery group had decreased pain, but the mirror therapy group experienced a larger effect. Interestingly, during the study there was a crossover period where patients in the mental imagery group crossed over to the mirror therapy group where they had a 92% success rate with pain. This was measured on a visual analog scale of pain 100 mm to determine the effectiveness of each group. Data from Moseley in the Journal of Neurology (2006) demonstrated success with GMI in neuropathic pain states. A systematic review in the Journal of Pain (Bowering, 2013), further demonstrated success with chronic neuropathic pain states.

A systematic review of 359 studies on chronic neck and low back pain by Heinrich et al. (2019) found positive effects of mirror therapy alone, but benefits were short-lived. More clinical investigation is necessary to investigate this for low back pain (Heinrich 2019) and, specifically, long term effects of GMI on low back pain (Breckenridge 2018). With PLP, landmark studies have demonstrated positive effects for lower limb amputations, and also on upper limb amputations (MacLachlan, 2004 and Ramachandran, 1996).

**How long does GMI take?**

GMI is individualized for the duration of treatment until pain resolves and motor control is regained. Therapy duration depends on individual pathology and severity. Initial research studies suggested treatment for several hours per session for up to 6 weeks, recognizing that some patients will need longer to be able to progress to the second and third stages.

Some individuals will recover more quickly than others; pain response will also vary. Education, timely intervention, and gradual and consistent intervention are key to improved outcomes.

For non-specific low back pain, non-specific cervical spine pain, or radiculopathy without red flags, the patient must achieve at least 80% success in laterality testing with a 6-second response. Mirror therapy should follow as an adjunct to physical therapy for motor control and muscular strengthening for at least 6 weeks before reassessment by the prescribing physician. If there has been no improvement then further imaging may be indicated. Surgery or advanced nonoperative techniques may be needed for significant neurological deficits.

For a CMP diagnosis of hand/wrist or foot/ankle pain, GMI should be implemented for at least 6-8 weeks, before referral to another practitioner for differential diagnostics to rule out tissue damage or red flags. For CRPS and stroke, therapy continues until the patient achieves functional improvement, generally for 3-12 months. Recovery depends on the response of the individual patient. Timing is key: Early intervention reduces the extent of disability.

For both CRPS and stroke, therapy duration and frequency can be expected to progress from a few minutes at a time to 30 minutes multiple times a day until normalization of function, based on patient tolerance. Completing the entire GMI sequence is important.

No conclusive studies have demonstrated a specific time frame for mirror therapy in PLP.

**How much does GMI cost?**

Materials for GMI cost less than sixty dollars. For laterality, the first part of the GMI sequence, the patient can use an app, Recognize, purchased for ten dollars at the Neuro Orthopedic Institutes (NOI) group website. There is also a free app called Orientate available at Google Play online.

The second part of the sequence, graded motor imagery, requires no equipment.

The third, mirror therapy, uses a NOI mirror box triangle which can be purchased online for less than 60 dollars. It can also be constructed from basic materials: cardboard with an attached mirror. The box should allow room for the affected extremity to fit inside the mirror without touching the box.

**GMI and NLCP**

A nurse life care planner can identify patients with high...
pain levels associated with CMP, stroke, PLP, or CRPS as potentially benefiting from GMI. A physical therapist can treat affected upper and lower extremities and spines; an occupational therapist may specialize in treating the upper extremity. Consider suggesting GMI to MDs, OTs, and PTs as a part of neurological rehabilitation programs at inpatient hospitals and chronic pain centers.

Often patients with chronic pain are depressed and avoid activity. The nurse life care planner should also educate patients on GMI’s positive benefits as part of active recovery. Patients may find this noninvasive and approach attractive.

Summary:
GMI is a noninvasive, sequenced neurological program to treat chronic pain, neurological, and musculoskeletal conditions. Considerable literature supports its efficacy, particularly mirror therapy with PLP, CRPS, stroke, and CMP (Bowering et al., 2013; Thieme, 2012). GMI initially engages the part of the brain that deals with laterality and progresses to graded motor imagery to activate the cortex similar to but without actual movement. Mirror therapy follows after the patient has a better understanding of the involved body part(s) and movement. Some patients can experience high levels of pain just thinking about moving the affected part, so therapy progresses from minimal to more normal movement.

Nurse life care planners can play a critical role in the identification of patients that could benefit from GMI, and also provide education to encourage these patients to seek active recovery strategies. GMI is customarily delivered by occupational and physical therapists with a specialty in neuromuscular work. Early intervention is more successful than later, as pain sensitivity and disability increase with time.

Resources and programs that utilize mirror therapy
Mirror Therapy Training with Dr. David Butler: https://www.youtube.com/watch?v=hMBA15Hu35M

How to find practitioners for GMI:
Neuro Orthopedic Institutes (NOI) group has a resource specifically on live courses and inquiry can be made on http://www.noigroup.com/en/Courses. Special requests can be made on the NOI group website to host a live course.

Hospital for Special Surgery in New York City utilizes Graded Motor Imagery to work with an array of conditions. https://www.hss.edu/professional-conditions_using-mirror-therapy-to-reduce-pain-and-improve-movement.asp

Walter Reed Medical Center in Washington, D.C., Brooke Army Medical Center in San Antonio, and Navy Medical Center in San Diego use mirror therapy for PLP. This link interviews Dr. Jack Tsao, one of the first to perform a randomized controlled trial on mirror therapy for phantom limb pain. https://www.dana.org/Briefing_Papers/Mirror_Therapy_for_Phantom_Limb_Pain/

Trust me ed. Graded Motor Imagery Course. https://www.trustme-ed.com/lectures/an-introduction-to-graded-motor-imagery-2. This is an online physical therapy educational course on the basics of Graded Motor Imagery. The course is taught by Tim Beams, principle instructor of the NOI group in the United Kingdom and coauthor of the Graded Motor Imagery Handbook.

Graded Motor Imagery Handbook, www.gradedmotorimagery.com on the Neuro Orthopedic Institutes website. This group is based in Adelaide, Australia, and they are world renowned physical therapists, and educators providing in depth information on Graded Motor Imagery for all medical practitioners, lawyers, PT and OT, and nurses.

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