Oregon: Pain, Healthcare's Persistent Challenge, 6 units (191)

Author: Lauren Robertson, BA, MPT

Contact hours: 6

Course price: $35

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This course meets the requirement for a 6-unit course in pain and pain management mandated by Oregon's Senate Bill 885.

Course Summary

Outlines efforts to improve pain management policies, procedures, and healthcare professional education in Oregon. Covers both pharmacologic and non-pharmacologic treatment of pain and discusses the reasons for the startling increase in use, misuse, and abuse of prescription opioids. Describes pain management in special populations and offers effective tools for assessing and documenting pain. Describes common rehabilitation therapy treatments for pain, including manual therapy, therapeutic exercise, and ultrasound, among others. Describes common integrative and alternative pain management techniques, including mediation, acupuncture, and yoga, among others. Describes barriers to effective pain management policies and procedures in healthcare organizations.

COI Support

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Criteria for Successful Completions

80% or higher on the post test, a completed evaluation form, and payment where required. No partial credit will be awarded.

Course Objectives

When you finish this course you will be able to:

1. Explain the original medical use of heroin.
2. Describe three patient populations that experience undertreatment of pain.
3. Define government’s two major responsibilities under the Central Principle of
4. Balance. Discuss the purpose of Oregon’s prescription drug monitoring program.
5. Explain three physiologic effects of unrelieved pain.
6. Define acute pain, chronic pain, and complex regional pain syndrome.
7. Compare and contrast two overall approaches to pain management.
8. List five common pain conditions.
9. Explain one over-reaching issue encountered in the treatment of pain in special populations.
10. State three practices that all healthcare professionals are encouraged to use in the assessment of pain.

11. Explain how depression and anxiety are related to chronic pain.
12. Identify three commonly used pharmacologic components of non-opioid analgesic pain management.
13. Define prescription drug abuse, tolerance, dependence, and addiction.
14. List three patient populations that have experienced large increases in prescription opioid overdose deaths in recent years.
15. Summarize three approaches to curbing prescription opioid abuse.
16. Identify three traditional, non-pharmacologic treatments that have been shown to be effective in the treatment of pain.
17. Describe three complementary or integrative approaches that have been shown to be effective in the treatment of pain.
18. Discuss three barriers to the effective management of pain in the healthcare system.

Early Pain Theories and Remedies

Since ancient times, humans have sought to conquer pain using a variety of treatments ranging from the sublime to the bizarre. Although the Greeks and Romans first advanced a theory of sensation—the idea that the brain and nervous system have a role in producing the perception of pain—it was not until the Middle Ages and well into the Renaissance that evidence began to accumulate in support of these theories.

Advertisement for curing morphine addictions from *Overland Monthly*, January 1900.

The nineteenth century saw the development of morphine, codeine, and heroin—potent pain medications derived from opium. In the early 1800s morphine was marketed as a pain medication as well as treatment for opium and alcohol addiction. Soon thereafter, cocaine was successfully isolated from coca leaves by a German chemist.

Left: Bayer Heroin bottle, originally containing 5 grams of Heroin substance. Right: A 100-ml bottle of laudanum. Note the dosages on the label for infants, children, and adults. Source for both images: Wikimedia Commons.

Until the late 1800s laudanum, a popular tincture containing opium and alcohol and other ingredients such as honey, saffron, or cinnamon, was widely used—and completely legal. It was commonly used for pain, menstrual cramps, sleep aid, and a wide variety of other ailments both in children and adults.

At the turn of the nineteenth century, "pure" aspirin was isolated from salicylate-rich plants. This discovery represented a major breakthrough in the history of pain medications. To this day aspirin is the most commonly used pain reliever worldwide.

A 1923 advertisement for aspirin. Source Wikimedia Commons.

The Experience of Pain

The Institute of Medicine (IOM) estimates that treatment and management of pain costs about $635 billion annually in the United States in direct medical costs and lost productivity (IOM, 2011). Despite these costs—approaching two-thirds of a **trillion** dollars a year—our failure to enact policies on pain treatment, education, management, and palliative care, along with the failure to put in place functioning drug supply systems, has hampered the development of consistent pain policies throughout the United States.

Although vast amounts of money are spent each year on the treatment and management of pain, it is inadequately treated in vulnerable populations. This includes women, children, older adults, ethnic minorities, patients with cognitive impairment, cancer patients, nursing home residents, and those with active addiction or a history of substance abuse. Untreated pain has a profound impact on quality of life and can have physical, psychological, social, and economic consequences (King & Fraser, 2013).

Among African Americans, lower rates of clinician assessment and higher rates of undertreatment have been found in all settings and across all types of pain (IOM, 2011). Similar results have been found among Hispanics, Asian Americans, and Native Americans. These disparities among racial and ethnic minorities are related to lack of provider education, system-level lack of access to pain medications, and cultural beliefs about pain (Makris et al., 2015).

Surprisingly, undertreatment of pain can be an issue even for those with diseases and conditions known to cause pain, such as cancer, HIV, and trauma. Conservative estimates by the World Health Organization (WHO) suggest that 1 million terminal HIV/AIDS patients, 5.5 million cancer patients, and 800,000 trauma patients have little or no access to treatment for moderate to severe pain (King & Fraser, 2013).

Regulatory Issues re Pain Management

Patients, providers, communities, and healthcare systems have struggled to achieve balance in their pain policies. This is particularly evident when weighing the benefits and harms associated with opioid treatment for chronic pain and potential harmful consequences of long-term opioid therapy—especially misuse, addiction, and overdose. The Pain and Policies Study Group, the Joint Commission, and government guidelines all provide guidance to healthcare providers and organizations involved in the treatment and management of pain.

The Central Principle of Balance

For several years, the University of Wisconsin Pain and Policies Study Group has been grading state pain policies. A state's grade represents the quality of its policies affecting pain treatment, based on the **Central Principle of Balance**; higher grades mean more balanced state pain management policies, including the medical use of opioids. Oregon received an "A" in 2013, and joins 15 other states as having the most balanced pain policies in the country (PPSG, 2014a).

The Central Principle of Balance represents a state's obligation to establish a system of drug controls that prevent abuse, trafficking, and diversion of narcotic drugs while ensuring the adequate medical availability of needed medications. It encourages governments to ensure the adequate availability of opioids for medical and scientific purposes. This includes empowering medical professionals to provide opioids in the course of professional practice; allowing them to prescribe, dispense, and administer according to the individual medical needs of the patient; and ensuring that a sufficient supply of opioids is available to meet medical demand (PPSG, 2014b).

The Joint Commission

The Joint Commission, in collaboration with the University of Wisconsin, has developed pain management standards for accredited ambulatory care facilities, behavioral healthcare organizations, critical access hospitals, home care providers, hospitals, office-based surgery practices, and long-term care providers. The standards require organizations to:

1. Recognize the right of patients to appropriate assessment and management of pain
2. Screen patients for pain during their initial assessment and, when clinically required, during ongoing periodic re-assessments
3. Educate patients suffering from pain and their families about pain management as a part of care (Joint Commission, 2013)

The Joint Commission's pain guidelines further state that:

1. Clinicians must be competent in the assessment and management of pain.
2. Pain should not interfere with optimal level of function or rehabilitation.
3. Pain and symptom management must be included in discharge planning. (Joint Commission, 2013)

The Joint Commission does not require healthcare organizations to assess pain as a fifth vital sign (Joint Commission, 2016), although the Commission does require that patients be screened for pain during the initial assessment. Some large organizations, including the Veteran's Administration (VA), decided to describe pain as the *fifth vital sign*, to be assessed along with temperature, pulse, respiration, and blood pressure. Acknowledging that assessing pain as a fifth vital sign may have contributed to the overprescribing of opioids, in June 2016 the American Medical Association recommended that pain be removed as one of the vital signs for which patients are assessed.

Intractable Pain Treatment Acts

Intractable pain is commonly defined as "a pain state . . . which in the generally accepted course of medical practice no relief or cure of the cause of the pain is possible. . . ." (PPSG, 2014b).

Intractable pain treatment acts (IPTA) are statutes originally intended to improve access to pain management by providing physicians immunity from regulatory sanctions for prescribing opioids to patients with intractable pain. The first IPTA was adopted by Texas in 1989 (PPSG, 2014b).

In 1995 the Oregon Legislative Assembly passed its own Intractable Pain Act. This act allowed a physician to prescribe or administer controlled substances to a patient diagnosed with a condition causing intractable pain without fear of sanction from the Oregon Board of Medical Examiners, so long as that physician complied with the provisions of the statute.

IPTAs were probably not intended to formalize the use of opioids for pain as being within medical practice only when meeting the IPTA standards. The IPTA language was often ambiguous and was not consistent with the recognition that pain management, including the use of opioid medications, is part of general medicine and is a legitimate professional practice (PPSG, 2014b).

In 2008 Oregon repealed the definition of *intractable pain* from its IPTA. The resulting laws now govern the treatment of all types of pain. Instead of statutes, many states, including Oregon, have chosen to develop guidelines or regulations containing language aimed at enhancing pain management (PPSG, 2014b).

Oregon Pain Management Programs

The Oregon legislature has taken a number of positions on the treatment of pain, including establishing the Oregon Pain Management Commission, the Oregon Prescription Drug Monitoring Program, the Oregon Medical Marijuana Act, the Oregon Pain Guidance Group, and further medical and nursing policy statements.

Oregon Pain Management Commission

The Oregon Pain Management Commission (OPMC) was established to improve pain management in Oregon through education, pain management recommendations, research, policy analysis, and model projects. The Commission relates the concerns of patients in Oregon on issues of pain management to the Governor and the Legislative Assembly (OHA, 2015).

Most licensed healthcare professionals practicing in Oregon are required to take a comprehensive course on pain management. The pain management continuing-education requirement, which went into effect on January 1, 2006, includes six hours of coursework on a variety of pain topics and an additional one-hour requirement provided by the Oregon Pain Management Commission.

Currently, physicians who continually treat patients in chronic or terminal pain must complete a pain management education program for relicensure. In addition, physician assistants, nurses, psychologists, chiropractic physicians, naturopaths, acupuncturists, pharmacists, dentists, occupational therapists, and physical therapists licensed in Oregon must complete a pain management continuing-education course (OHA, 2015).

Oregon Prescription Drug Monitoring Program (PDMP)

The Oregon Prescription Drug Monitoring Program (PDMP) is a state-run, electronic database used to track the prescribing and dispensing of controlled prescription drugs to patients. It is designed to monitor suspected abuse or **diversion** (the channeling of the drug into an illegal use) by providing a prescriber or pharmacist with critical information regarding a patient's prescription history. This information helps identify high-risk patients who would benefit from early interventions (CDC, 2016a).

Oregon's prescription drug monitoring program (PDMP) was established in July 2009. In 2015 Senate Bill 71 was signed into law, which requires pharmacies to report data electronically no later than 72 hours after dispensing a prescription drug that is subject to the prescription monitoring program (OPDMP, 2016).

Pharmacies are required to submit prescription data to the PDMP system for all Schedules II, III and IV controlled substances dispensed to Oregon residents. The protected health information is collected and stored securely. Only Oregon-licensed healthcare providers and pharmacists are authorized to access information from the PDMP system. By law their access is limited to patients under their care.

During 2015 more than 7.5 million controlled-substance prescriptions were reported to the Oregon PDMP. The top 12 prescribed drugs were:

1. Hydrocodone (22.3%)
2. Oxycodone (16.6%)
3. Zolpidem (5.7%)
4. Lorazepam (5.7%)
5. Tramadol (5.4%)

6. Alprazolam (4.7%)
7. Amphet ASP/AMPHET/D-AMPHET (4.5%)
8. Clonazepam (4.5%)
9. Methylphenidate (3.4%)
10. Pseudoephedrine (3.4%)
11. Morphine (3.3%)
12. Diazepam (2.3%) (OHA, 2015)

Oregon Medical Marijuana Act

In 1998 Oregon voters approved Measure 67, which removed state-level criminal penalties on the use, possession, and cultivation of marijuana by patients who possess a signed recommendation from their physician stating that marijuana "may mitigate" debilitating symptoms. The Oregon Medical Marijuana Program oversees the medical marijuana cardholder registry for patients and regulates medical marijuana dispensaries, processors, and grow sites.

Cannabis Sativa

Source: Wikipedia Commons. Originally from the U.S. Fish and Wildlife Service.

The state has established state-run registries for patients and caregivers to document their eligibility to engage in medical marijuana use, which requires physician documentation of a person's debilitating condition. A physician must state in writing annually that the patient has a qualifying medical condition and that medical marijuana may lessen or relieve the symptoms or effects of that condition. The allowed medical conditions include:

- Cancer
- Glaucoma
- A degenerative or pervasive neurologic condition
- HIV/AIDS
- Posttraumatic stress disorder (PTSD)

Medical marijuana can also be used for any other medical condition or treatment that produces one or more of the following:

- Cachexia (a weight loss disease that can be caused by HIV or cancer)
- Severe pain
- Severe nausea
- Seizures, including but not limited to seizures caused by epilepsy
- Persistent muscle spasms, including but not limited to those caused by multiple sclerosis (OMMP, 2016)

More than 72,000 people are registered as medical marijuana users in Oregon as of April 25, 2016. More than 66,000 reported they used marijuana for severe pain, about 21,000 reported its use for muscle spasms, including for multiple sclerosis, and about 9,800 reported its use for nausea (OMMP, 2016).

Did you know . . .

It is now legal in Oregon for adults 21 and older to possess and use recreational marijuana from approved medical marijuana dispensaries within limits. Adults 21 and older can share or give away recreational marijuana, receive it as a gift, grow their own (four plants per residence), or purchase it from approved medical marijuana dispensaries (Oregon.gov, 2016).

Oregon Pain Guidance Group (OPG)

The OPG group is a group of seventy healthcare professionals from Jackson and Josephine Counties. The group was formed in response to the growing number of prescription opioid overdose deaths in their community. The goal of OPG is to decrease the morbidity and mortality associated with the inappropriate use of opiates and to shift the focus to non-opiate treatments for complex chronic pain, so that patients experience an overall improvement in well-being (OPG, 2015).

In 2016 the OPG published *Pain Treatment Guidelines*, a comprehensive resource that includes recommendations on the treatment of acute and chronic pain, pain in adolescents and children, pain control in older adults and those with dementia, trauma-informed pain care, and pain control for cancer and palliative care. The guidelines also discuss the use of opioids during pregnancy, managing pain in the emergency department, and recommended opioid policies for dentists. The guidelines are available online here [available online here].

Oregon Medical and Nursing Policy Statements

The Oregon Medical Board (OMB) urges the skillful use of effective pain control for all patients. Providers are encouraged to treat pain within the scope of their practice and refer patients to the appropriate specialists when indicated. In all cases of pain management, practitioners should maintain records to track prescriptions and coordinate care with other treating practitioners. Healthcare providers are encouraged to use the Oregon Prescription Drug Monitoring Program (PDMP) (OMB, 2016).

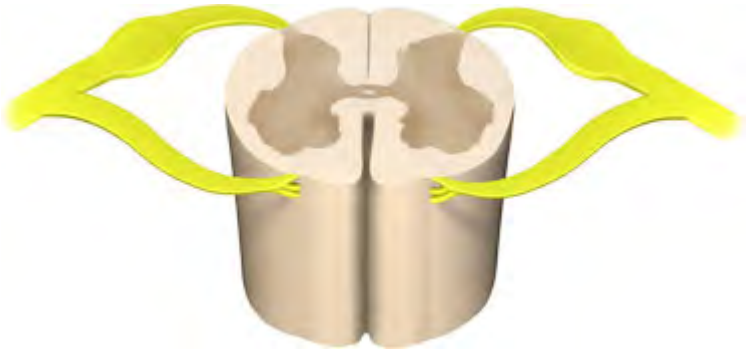
The Oregon State Board of Nursing maintains an interpretive statement on pain management. The statement promotes patient access to the appropriate, therapeutic, and effective assessment, diagnosis, and management of acute and chronic pain. The management of pain must be a priority for nurses and all others who provide care to individuals in pain. The interpretative statement:

- Promotes a balanced approach to pain management.
- Promotes the optimal level of nursing practice in pain management using pharmacologic, nonpharmacologic, and multimodal approaches.
- Establishes a framework leading to sound clinical judgment in managing acute, chronic, and end-of-life pain (OSBN, 2015)

The Physiology of Pain

Pain occurs when sensory nerve endings called **nociceptors** (also referred to as pain receptors) come into contact with a painful or noxious stimulus. The resulting painful impulse travels from the sensory nerve ending, enters the dorsal spinal cord, and travels to diverse parts the brain via nerve tracts in the spinal cord and brainstem. The brain processes the pain sensation and quickly makes a motor response in an attempt to cease the action causing the pain.

Sensory Nerves Entering the Spinal Cord



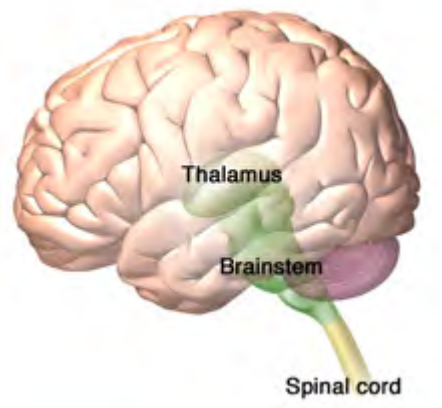
A section of a lumbar vertebra showing the sensory nerves (in yellow, with bulge) entering the dorsal part of the spinal cord. Illustration provided by 3DScience.com. Used by permission.

There are two major classes of nerve fibers associated with the transmission of pain:

1. Unmyelinated C fibers (small and slow)
2. Myelinated A-delta fibers (myelinated and fast)

The unmyelinated C fibers respond to thermal, mechanical, and chemical stimuli and produce the sensation of dull, diffuse, aching, burning, and delayed pain. The myelinated A-delta fibers respond to mechanical (pressure) stimulus and produce the sensation of sharp, localized, fast pain.

One of the most important central pain pathways is the spinothalamic tract, which originates in the spinal cord and extends to the thalamus. This spinal tract transmits sensory information related to pain, temperature, and crude touch. Another prominent pathway is the spinoreticular tract, which is involved in nociceptive processing. The spinoreticular tract is similar to the spinothalamic tract in that it is excited by similar sensory fibers. Rather than ascending to the thalamus however, spinoreticular neurons terminate within the brainstem reticular formation.



The thalamus is the destination of spinothalamic tract—the sensory pathway responsible for processing pain, temperature, and crude touch. The brainstem reticular formation, which forms a diffuse, central core within the brainstem is the destination of the spinoreticular tract. Source: Illustration provided by 3DScience.com. Used by permission.

Sensitization

Sensitization is a neurophysiologic response in which the pain pathways become more sensitive. This can include a drop in the threshold for activating nociceptors and an increase in the frequency of firing for all stimuli (IASP, 2012). **Hyperalgesia** (exaggerated responses to stimuli) and **allodynia** (in which a stimulus not normally painful is perceived as painful) are clinical markers used to detect the presence of sensitization (Zouikr et al., 2016). There are two types of sensitization: peripheral and central.

Peripheral sensitization occurs in response to the release of inflammatory molecules such as histamine, prostaglandins, and pro-inflammatory cytokines. These substances sensitize nociceptors by creating an "inflammatory soup" that enhances pain sensitivity by reducing the threshold of nociceptor activation (Zouikr et al., 2016). Under normal circumstances, peripheral hypersensitivity returns to normal when inflammation subsides or the source of the injury is removed (Kyranou & Puntillo, 2012).

In **central sensitization**, nociceptive-specific neurons progressively increase their response to repeated non-painful stimuli, develop spontaneous activity, and increase the area of the body that is involved with the pain. The hyperalgesia of central sensitization usually develops as part of ongoing pathology, such as damage to peripheral or central nerve fibers, cancer, or rheumatoid arthritis, and is considered maladaptive (Kyranou & Puntillo, 2012).

Using Neuroimaging to Understand Pain

The development of computed tomography (CT) and magnetic resonance imaging (MRI) has allowed researchers to look into the living brain and gain some understanding of the parts of the brain affected by pain. The subsequent development of positron emission tomography (PET) has allowed researchers, for the first time, to investigate neuronal activity throughout the entire brain (Casey, 2015).

Imaging techniques are helping us understand that pain is more complex than previously thought and involves diverse regions of the brain (ie, the amygdala, insula, and the anterior cingulate cortex). We are also learning that pain involves complex interactions between the immune, nervous, and endocrine systems (Zouikr et al., 2016).

In a study of patients with chronic low back pain, neuroimaging showed differences in brain *function* when compared to healthy controls. Chronic low back pain patients showed activation in pain-related brain regions during administration of experimental pain, differences in activation during emotional decision-making tasks, and changes in specific brain regions during a simple visual attention task (Kong et al., 2013).

Neuroimaging has also shown *structural* changes in the brain for patients with chronic low back pain. One study indicated that chronic low back pain patients showed 5% to 11% less neocortical gray matter volume than control subjects and that the decreased volume was related to pain duration. This indicates that chronic low back pain is associated with structural pathologic changes in the brain (Kong et al., 2013).

In patients with chronic pain, a number of research groups have reported significant changes in pain *processing* including alterations in basic processes in the brain and brainstem, changes in functional plasticity, and the development of **allodynia*** in which a stimulus not normally painful is perceived as painful. Imaging techniques using magnetic resonance spectroscopy have shown alterations in neurotransmitters in chronic pain patients. Such approaches have been applied to migraine, back pain, and spinal cord injury (Borsook et al., 2007).

***Allodynia** is a clinical feature of neuropathies, complex regional pain syndrome, post-herpetic neuralgia, migraine, and fibromyalgia.

A number of studies have shown changes in volume in brain regions in patients with chronic neuropathic pain, complex regional pain syndrome, and fibromyalgia. This insight has begun to transform our thinking on chronic pain, since these changes indicate the potential that chronic pain is a neurodegenerative disease (Borsook et al., 2007).

Physiologic Effects of Unrelieved Pain

Unrelieved pain can lead to physiologic changes and negative effects on multiple systems. The endocrine system reacts by releasing an excessive amount of hormones, ultimately resulting in carbohydrate, protein, and fat catabolism, poor glucose utilization, and other harmful effects. This reaction combined with inflammatory processes can produce weight loss, tachycardia, increased respiratory rate, fever, shock, and death.

The cardiovascular system responds to the stress of unrelieved pain by activating the sympathetic nervous system. Following a surgical procedure, this can include hypercoagulation and increased heart rate, blood pressure, cardiac workload, and oxygen demand. Since the stress response causes an increase in sympathetic nervous system activity, intestinal secretions and smooth muscle sphincter tone increase, and gastric emptying and intestinal motility decrease. This response can cause temporary impairment of gastrointestinal function and increase the risk of ileus (intestinal obstruction). Aggressive pain control may be needed to reduce these effects and prevent thromboembolic complications.

Unrelieved pain may be especially harmful for patients with metastatic cancers. Stress and pain can suppress immune function, including the natural killer cells that play a role in preventing tumor growth and controlling metastasis.

Defining and Categorizing Pain

The International Association for the Study of Pain (IASP) describes pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." Pain can be acute or chronic and if left untreated chronic pain can develop into what is referred to as a *chronic pain syndrome*.

Acute Pain

Acute pain comes on quickly and, although it can be severe, lasts a relatively short time (IOM, 2011). Its location is usually well-defined and there is usually an identifiable painful stimulus related to an injury, brief disease process, surgical procedure, or dysfunction of muscle or viscera. Acute pain is often successfully treated with patient education, mild pain medications, environmental changes, and stress reduction.

The Institute of Medicine (IOM) has targeted improved treatment of acute pain as an area of significant healthcare savings. Better treatment of acute pain, through education about self-management and better clinical treatment, can avoid its progression to chronic pain, which is more difficult and more expensive to treat (IOM, 2011).

Chronic Pain

Chronic pain refers to pain that exists for three or more months and does not resolve with treatment. The three-month time frame is not absolute and some conditions may become chronic in as little as a month. When pain becomes chronic, sensory pathways continue to transmit the sensation of pain even though the underlying condition or injury that originally caused the pain has healed. In such situations, the pain itself may need to be managed separately from the underlying condition.

Chronic pain is a symptom of many diseases. Up to 70% of cancer patients suffer from chronic pain and, among individuals living with HIV/AIDS, pain has been reported at all stages of infection (Lohman et al., 2010). Chronic pain is a silent epidemic that reduces quality of life, negatively impacts relationships and jobs, and increases rates of depression (Sessle, 2012).

Chronic pain affects 1 in 5 adults, is more prevalent among women and older adults, and is associated with physically demanding work and lower level of education (King & Fraser, 2013). A 2011 report from IOM places this cost at more than $500 billion per year in the United States, creating an economic burden that is higher than the healthcare costs for heart disease, cancer, and diabetes combined (Sessle, 2012).

Chronic pain can be difficult to distinguish from acute pain and can be difficult to treat. Chronic pain does not resolve quickly and opioids or sedatives are often needed for treatment. Because medical practitioners frequently approach chronic pain management from a medication perspective, other modalities are sometimes overlooked.

Prevention, assessment, and treatment of chronic pain are challenges for health providers and systems. Pain might go unrecognized, and patients—particularly members of racial and ethnic minority groups, women, elders, people with cognitive impairment, and those with cancer and at the end of life—can be at risk for inadequate pain treatment. Patients can experience persistent pain that is not well controlled (CDC, 2016a).

There are clinical, psychological, and social consequences associated with chronic pain including activity limitations, lost work productivity, reduced quality of life, and stigma, emphasizing the importance of appropriate and compassionate patient care. Patients should receive appropriate pain treatment based on a careful consideration of the benefits and risks of treatment options (CDC, 2016a).

Musculoskeletal pain, especially joint and back pain, is the most common type of chronic pain (IOM, 2011). Although musculoskeletal pain may not correspond exactly to the area of injury, it is nevertheless commonly classified according to pain location. However, most people with chronic pain have pain at multiple sites (Lillie et al., 2013).

Classifying Chronic Pain According to Pathophysiology

When classified according to pathophysiology, three types of chronic pain have been described by the International Association for the Study of Pain (IASP):

1. **Nociceptive pain:** caused by stimulation or sensitization of peripheral nociceptors. Nociceptors have a high threshold for activation and increase their output as the stimulus increases.
2. **Neuropathic pain:** "pain arising as a direct consequence of a lesion or disease affecting the somatosensory system" (IASP, 2012).
    a. Central neuropathic pain: originates from damage to the brain or spinal cord.

b. Peripheral neuropathic pain: originates from damage to the peripheral nerves or nerve plexuses, dorsal root ganglion, or nerve roots (IASP, 2012).

3. **Psychogenic pain*:** pain that persists despite the lack of any identified underlying physical cause.

*The term *psychogenic pain* is no longer considered an official diagnostic term. A more correct diagnostic term is **persistent somatoform pain disorder (PSPD),** which is defined in the ICD-10 Version 2016 as persistent, severe, and distressing pain, which cannot be explained fully by a physiological process or a physical disorder, and which occurs in association with emotional conflict or psychosocial problems that are sufficient to allow the conclusion that they are the main causative influences. The result is usually a marked increase in support and attention, either personal or medical (ICD-10, Version 2016).

Chronic Pain Syndromes

A chronic pain syndrome differs from chronic pain in that over time people with a syndrome develop a number of related life problems beyond the sensation of pain itself. Most individuals with chronic pain do not develop the more complicated and distressful chronic pain syndrome. Although they may experience the pain for the remainder of their lives, little change occurs in their daily activities, family relationships, work, or other life components. Many of these individuals never seek treatment for pain and those who do often require less intensive, single-modality interventions (VHA, 2015).

Those who develop chronic pain syndromes tend to experience increasing physical, emotional, and social deterioration over time. They may abuse pain medications and typically require more intensive, multimodal treatment to stop the cycle of increasing dysfunction (VHA, 2015).

Complex regional pain syndrome (CRPS) describes a chronic neuropathic pain condition that, in the past, was referred to by several other names including *causalgia* and *reflex sympathetic dystrophy*. The IASP has endorsed the term *complex regional pain syndrome*, intended to be descriptive, general, and not imply etiology. The term has been divided into “CRPS 1” and “CRPS 2” (Dutton & Littlejohn, 2015). CRPS I is characterized by intractable pain that is out of proportion to the trauma, while CRPS II is characterized by unrelenting pain that occurs subsequent to a nerve injury.

The pain in CRPS is regional, not in a specific nerve territory or dermatome, and it usually affects the hands or feet, with pain that is disproportionate in severity to any known trauma or underlying injury. It involves a variety of sensory and motor symptoms including swelling and edema, discoloration, joint stiffness, weakness, tremor, dystonia, sensory disturbances, abnormal patterns of sweating, and changes to the skin (O’Connell et al., 2013).

Complex Regional Pain Syndrome (CRPS) in Hand and Wrist

Source: Wikimedia Commons. Used by permission.

It has been common to explain the etiology of complex regional pain syndrome using the psychogenic model. Now however, neurocognitive deficits, neuroanatomic abnormalities, and distortions in cognitive mapping are known to be features of CRPS pathology (Hill et al., 2012).

What is Chronic Pain? (2:31)

https://www.youtube.com/watch?v=GTmE5X8NcXM

Pain Management Approaches

Pain has traditionally been managed in two ways: self-management or using the pain medicine model. The self-management model—especially for chronic pain—is supported by strong evidence and has the benefit of involving patients in their own care (NIH, 2013).

The pain medicine model (which includes primary and specialty care) is supported by relatively weak evidence, particularly in chronic pain care, and often fails to involve the recipient as an active participant. Although the pain medicine model has weaker demonstrated efficacy, it is widely used because of a strong business model, industry support, and focus of training in healthcare professionals (NIH, 2013).

Increasingly, these two models are being combined with complementary approaches into what is referred to as **integrative medicine** (discussed in a later part of this class). In this model, the strengths of the two models are combined: pain is viewed holistically and assessed and treated in conjunction with psychological, medical, social, spiritual, and environmental influences. Currently, an integrative approach to pain care is encouraged for all patients (PPSG, 2014b).

Self-Management of Pain

Self-management is defined as a strategy used by the patient to manage or minimize the impact of a chronic condition on everyday life. The basic tenets of self-management include:

- Active participation by the patient
- Treatment of the whole person, not just the disease
- Empowerment of the patient (NIH, 2013)

Although some people seek professional help immediately, most try to self-manage their pain. This can include talking to friends, searching the internet, or attending group classes or programs intended to educate a person about pain management. Self-management also includes exercise, ice, heat, positioning, limiting activity, over-the-counter (OTC) medications, and education. In many cases, self-management is highly successful.

Pain Medicine Model

The pain medicine model is widely accepted and widely used. It is based upon the idea that pain is an acute, treatable disease. This approach usually begins with the primary care physician followed by a referral to a pain specialist or pain clinic.

Primary care practitioners are an early step in the pain care journey, treating 52% of chronic pain patients in the United States (IOM, 2011). Primary care clinicians provide the initial assessment or diagnosis and serve as a starting point for specialty services, including prescription medications and referrals to imaging, physical and occupational therapy, or other integrative practitioners (IOM, 2011).

Primary care clinicians assist patients in making decisions about specialty services and elective procedures. They are also responsible for the majority of pain medicine prescriptions. In 2008 analgesics constituted 10.1% of all drugs prescribed for adults (IOM, 2011).

The development of a comprehensive treatment plan is important, utilizing appropriate pharmacologic and nonpharmacologic interventions. Treatments should be regularly re-evaluated for effectiveness, adjusted as needed, with side effects quickly addressed. The treatment plan should include a complete assessment and a clearly written plan of care (PPSG, 2014b).

Many hospitals have acute pain services (APS) that provide consistent pain management throughout the course of a patient's stay hospital stay. Hospitals with formally organized acute pain services are more likely to follow a formal written post operative pain protocol than hospitals without acute pain services (Nasir et al., 2011).

The personnel comprising the typical acute pain service included:

- Anesthesiologists (95%)
- Advanced practice nurses (45%), registered nurses (32.5%), pharmacists (11.3%)
- Physician assistants (8.8%)
- Physical medicine and rehabilitation physicians (6.3%)
- Surgeons (5%)
- Neurologists (3.8%)
- Others (oncologists, social workers, and psychologists) (Nasir et al., 2011)

Common Pain Conditions

Certain pain syndromes are pervasive. Low back pain, migraine headaches, post operative pain, cancer pain, and pain associated with arthritis are some of the most common reasons patients seek medical care for pain.

Low Back Pain

Low back pain affects approximately 80% of people at some stage in their lives. If low back pain becomes chronic it often results in lost wages and additional medical expenses and can increase the risk of incurring other medical conditions (Chou et al., 2016).

In the United States, the total indirect and direct costs due to low back pain are estimated to be greater than $100 billion annually (Wang et al., 2012). It is the fifth most common reason for all physician visits. Approximately one-quarter of U.S. adults reported having low back pain lasting at least 1 day in the past 3 months, and more than 7% reported at least one episode of severe low back pain in the previous year.

Clinically, the natural course of low back pain is usually favorable; acute low back pain frequently disappears within 1 to 2 weeks. Any of the spinal structures, including intervertebral discs, facet joints, vertebral bodies, ligaments, or muscles could be an origin of back pain, which is, unfortunately, difficult to determine. In those cases in which the origin of back pain cannot be determined, the diagnosis given is **nonspecific low back pain** (Aoki et al., 2012).

Assessing Low Back Pain

The vast majority of low back pain patients who present to primary care have pain that cannot be reliably attributed to a specific disease or spinal abnormality. Spinal imaging abnormalities such as degenerative disc disease, facet joint arthropathy, and bulging or herniated intervertebral discs are extremely common in patients with or without low back pain, particularly in older adults, and such findings are poor predictors for the presence or severity of low back pain (Chou et al., 2016).

Low back pain symptoms can arise from many anatomic sources, such as nerve roots, muscle, fascia, bones, joints, intervertebral discs, and organs within the abdominal cavity. Symptoms can also be caused by aberrant neurologic pain processing, a condition called neuropathic low back pain. The diagnostic evaluation of patients with low back pain can be challenging and requires complex clinical decision-making. Nevertheless, the identification of the source of the pain is of fundamental importance in determining the therapeutic approach (Allegri et al., 2016).

The location of pain, frequency of symptoms, duration of pain, history of previous symptoms, previous treatments, and response to treatment should be assessed. The possibility of low back pain due to pancreatitis, nephrolithiasis, or aortic aneurysm, or systemic illnesses such as endocarditis or viral syndromes, should also be considered. Low back pain can be influenced by psychological factors, such as stress, depression, or anxiety. History should include substance use exposure, detailed health history, work habits, and psychosocial factors (Allegri et al., 2016).

Back pain can be **referred** or felt at a site distant from the source of the pain. Pain can be **local** or referred from a painful stimulus occurring in and internal organ. An example of referred pain is when a heart attack occurs and pain in felt in the jaw, shoulder, or arm.

Pain may also be felt in the area or region within the territory of a *dermatome*, an area of skin supplied by a single sensory nerve. This is referred to as radiating pain and can be quite confusing for patients. If the nerve root is irritated or inflamed, pain can be evoked by any motion that stretches or compresses the root of the nerve; this is referred to as **radicular pain**, which can occur in patients with serious or progressive neurologic deficits or underlying conditions requiring prompt evaluation, as well as patients with other conditions that may respond to specific treatments.

Patients with back and leg pain have a fairly high sensitivity for herniated disc, with more than 90% of symptomatic lumbar disc herniation occurring at the L4/L5 and L5/S1 levels. A focused examination that includes straight leg–raise testing and a neurologic examination that includes evaluation of knee strength and reflexes (L4 nerve root), great toe and foot dorsiflexion strength (L5 nerve root), foot plantar flexion and ankle reflexes (S1 nerve root), and distribution of sensory symptoms should be done to assess the presence and severity of nerve root dysfunction.

Imaging tests such as magnetic resonance imaging (MRI) should be considered only in the presence of clinical elements that are not completely clear or in the presence of neurologic deficits or other medical conditions. The recommendation of the American College of Radiology is not to do imaging for low back pain within the first 6 weeks unless red flags are present. Red flags include recent significant trauma or milder trauma at age older than 50 years, unexplained weight loss, unexplained fever, immunosuppression, history of cancer, intravenous drug use, prolonged use of corticosteroids, osteoporosis, age older than 70 years, and focal neurologic deficits with progressive or disabling symptoms (Allegri et al., 2016).

Treating Low Back Pain

In Oregon changes to the Oregon Health Plan/Prioritized List of Health Services, effective July 1, 2016, have expanded coverage for the assessment and conservative treatment of uncomplicated back pain and conditions. Previously, the OHP has limited treatment to patients with muscle weakness or other signs of nerve damage. Beginning in 2016, treatments will be available for all back conditions. Before treatment begins, providers will assess patients to determine their level of risk for chronic back pain, and whether they meet criteria for a surgical consultation (OHA, 2016).

Based on the results, one or more of the following covered treatments may be appropriate:

- Acupuncture
- Chiropractic manipulation
- Cognitive behavioral therapy (a form of talk therapy)

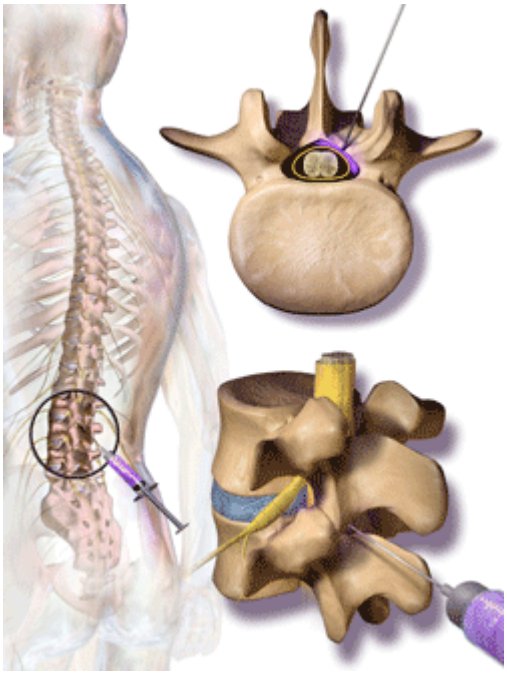
- Medications (including short-term opiate drugs, but not long-term prescriptions)
- Office visits
- Osteopathic manipulation
- Physical and occupational therapy
- Surgery (only for a limited number of conditions where evidence shows surgery is more effective than other treatment options) (OHA, 2016)

In addition, yoga, intensive rehabilitation, massage, or supervised exercise therapy are now recommended to be included in the comprehensive treatment plans. These services, which also have evidence of effectiveness, will be provided where available as determined by each Coordinated Care Organization (CCO) (OHA, 2016).

Interventional Pain Management Techniques

Interventional techniques are minimally invasive procedures that place drugs in targeted areas or ablate target nerves. This category includes epidural injections as well as some surgical techniques such as laser or endoscopic discectomy, intrathecal infusion pumps, and spinal cord stimulators, used for the diagnosis and management of chronic, persistent, or intractable pain (Manchikanti et al., 2010).

Epidural injections, in which steroids and anti-inflammatories are injected directly into the epidural space of the spinal cord, are the most commonly performed procedures in interventional pain management, comprising 46% of all interventional techniques. The most commonly performed procedures are lumbosacral interlaminar or caudal epidural injections. Facet joint interventions are the second most commonly performed procedures, constituting 38% of all interventional techniques in 2011 (Manchikanti et al., 2010).



Steroids are injected into the cerebrospinal fluid in the canal surrounding the spine. Nerves branch out from the spine. The nerve roots, which may be compressed, are at the base of the nerves. Source: Blausen.com staff. "Blausen gallery 2014." Wikiversity Journal of Medicine.

Analysis of various spinal interventional techniques indicates that there has been an overall increase in interventions of 177% per 100,000 in the Medicare fee-for-service population, with the highest increases seen for sacroiliac joint injections at 331%, facet joint interventions at 308%, and epidurals at 130% (Manchikanti et al., 2013). A systematic review of interventional therapies for low back and radicular pain

concluded: “Few nonsurgical interventional therapies for low back pain have been shown to be effective in randomized, placebo-controlled trials” (IOM, 2011).

Although interventional techniques are often considered to be surgical procedures, more invasive procedures such as joint replacement, spinal fusion, and disc replacement are also commonly and successfully used to relieve pain. These types of surgeries often occur after other conservative treatments have failed to relieve the pain.

Migraine Headaches

A migraine is a painful headache thought to result from vasodilation of blood vessels in the brain. Migraines cause intense, pulsing or throbbing pain on one or possibly both sides of the head. People with migraine headaches often describe pain in the temples or behind one eye or ear. Migraine sufferers may have symptoms of nausea, vomiting, and sensitivity to light and sound. Some people see spots or flashing lights or have a temporary loss of vision that forewarn of an impending headache. If a migraine occurs more than 15 days each month for 3 months, it is considered chronic.

Numerous imaging studies of migraine patients have described multiple changes in brain functions as a result of migraine attacks; these include enhanced cortical excitability, increased gray matter volume in some regions and decreased in others, enhanced brain blood flow, and altered pain modulatory systems (Maleki et al., 2011).

Migraine has no current cure. Drug therapies are broadly divided into two groups: (1) those designed to treat acute occurrences, and (2) those that are prophylactic (preventive) in nature. Many people who have migraines use both forms of treatment. The goal is to treat migraine symptoms as soon as possible and to minimize the number of migraine occurrences by avoiding triggers.

Post Operative Pain

In the United States, nearly 100 million surgeries take place annually—about 46 million inpatient and about 53 million outpatient procedures. Post operative pain is often underestimated and undertreated, leading to increased morbidity and mortality, mostly due to respiratory and thromboembolic complications, increased hospital stay, and impaired quality of life (EAU, 2013).

Post operative pain is common and can be caused by tissue damage, the presence of drains and tubes, post operative complications, prolonged time in an awkward position, or a combination of these factors. Good post operative pain management requires good pain assessment and measurement in all post operative patients. Assessment should focus on the patient's response to surgery as well as respiratory and cardiac complications. It should occur at scheduled intervals, in response to new pain, and prior to discharge (EAU, 2013).

Although much of the focus on post operative pain management is in hospitals, about 60% of surgical procedures in community hospitals are performed on an outpatient basis, and persistent problems exist with pain management after discharge (IOM, 2011). This may be because there is not enough time to assess post surgical pain prior to discharge or to establish a pain management program at home.

Psychological factors such as anxiety and depression can be important predictors in the development of post operative pain. Age has also been found as a predictor, with younger individuals being at higher risk for moderate to intense pain. Patients at high risk for severe post operative pain should be provided with special attention. Patients with good analgesia are more cooperative, recover more rapidly, and leave the hospital sooner. They also have a lower risk for prolonged pain after surgery (Ene et al., 2008).

Post operative pain that continues for more than 2 months and cannot be explained by other causes is referred to as *persistent post surgical pain* (Kehlet & Rathmell, 2010). About 10% to 50% of post operative patients develop persistent pain following common surgical procedures such as groin hernia repair, breast and thoracic surgery, leg amputation, and coronary artery bypass surgery, often due to nerve damage during the procedure (IOM, 2011).

Persistent post operative pain is a serious clinical problem. The factors that seem to affect its incidence include the extent of preoperative pain, trauma during surgery, and anxiety and depression. Cancer patients are particularly susceptible. Comorbidity of pain and depression provokes worsening of both conditions (Ghoneim & O'Hara, 2016).

To identify the scope of a person's pain following surgery, especially pain persisting more than 2 to 3 months, a careful clinical evaluation is needed. This includes history, physical examination, and appropriate special tests in order to identify or exclude reversible underlying conditions (Gilron & Kehlet, 2014). Be aware of risk of persistent pain following surgery in the following instances:

- If the patient was previously pain free but has now developed a new chronic pain syndrome
- If previous pain at the site of surgery still remains

- If the patient previously suffered from a chronic pain syndrome—unrelated to the surgery—and the pain persists (Gilron & Kehlet, 2014)

In the ICU, most, if not all, patients will experience pain at some point during their ICU stay. Pain can be related to injury, surgery, burns, or comorbidities such as cancer, or from procedures performed for diagnostic or treatment purposes. Some patients may even experience substantial pain at rest. Despite increased attention to assessment and pain management, pain remains a significant problem for ICU patients (Kyranou & Puntillo, 2012).

Unrelieved pain in adult ICU patients is far from benign. Medical and surgical ICU patients who recalled pain and other traumatic situations while in the ICU had a higher incidence of chronic pain and post traumatic stress disorder symptoms than did a comparative group of ICU patients. Concurrent or past pain may be the greatest risk factor for development of chronic pain (Kyranou & Puntillo, 2012).

Pain Associated with Cancer

Pain occurs in 20% to 50% of patients with cancer (NCI, 2016). It is one of the most feared and common symptoms of a variety of cancers and is a primary determinant of the poor quality of life in cancer patients (Bali et al., 2013). Cancer-associated pain—particularly neuropathic pain—is often resistant to conventional therapeutics whose application may be severely limited due to side effects (Bali et al., 2013). In the advanced stage, moderate to severe pain affects roughly 80% of cancer patients. Younger patients are more likely to experience cancer pain and pain flares than are older patients (NCI, 2016).

Research from Europe, Asia, Australia, and the United States indicates that cancer patients are repeatedly undertreated for pain, both as inpatients and outpatients—sometimes receiving no analgesia at all. Regardless of what stage the cancer has reached, it is necessary to determine the prevalence of pain in specific cancer types, both to raise awareness among clinicians and to improve patient management (Kuo et al., 2011).

Breakthrough pain is common in cancer patients. It is a temporary increase or flare of pain that occurs in the setting of relatively well-controlled acute or chronic pain (NCI, 2016).

Incident pain is a type of breakthrough pain related to certain activities or factors such as vertebral body pain from metastatic disease. Breakthrough and incident pain are often difficult to treat effectively because of their episodic nature. In one study, 75% of patients experienced breakthrough pain; 30% of this pain was incidental, 26% was non-incidental, 16% was caused by end-of-dose failure, and the rest had mixed etiologies (NCI, 2016).

Pain can be a side-effect of therapies used to treat cancer. Pain is reported by 59% of patients receiving anti-cancer treatment and 33% of patients after curative treatments (NCI, 2016). Pain syndromes caused by cancer therapies include:

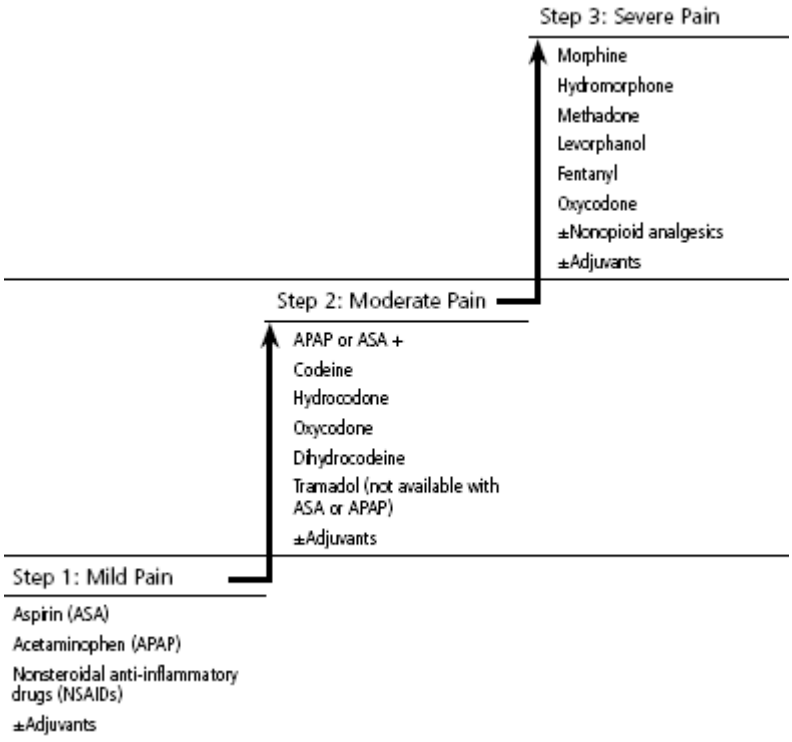
1. **Infusion-related pain syndromes** (venous spasm, chemical phlebitis, vesicant extravasation, and anthracycline-associated flare)
2. **Treatment-related mucositis**
3. **Chemotherapy-related musculoskeletal pain** (diffuse arthralgias and myalgias in 10% to 20% of patients)
4. **Dermatologic complications and chemotherapy** (acute herpetic neuralgia, tingling or burning in their palms and soles, rash)
5. **Pain from supportive care therapies** (osteonecrosis, avascular necrosis)
6. **Radiation-induced pain** (mucositis, mucosal inflammation in areas receiving radiation, pain flares, and radiation dermatitis) (NCI, 2016)

Clinical management of cancer pain is complex, driven by patient's response, and the need to have both shorter and longer acting preparations and equi-analgesic dose ratios. The process of combining or switching opioids is complex for the clinician, who must understand the different half-life, receptors, and conversion ratios of these opioids, which can vary greatly among individuals, opioids, and even by opioid dose (Gao et al., 2014).

The Pain Ladder was developed by the World Health Organization (WHO) in the context of cancer care. The WHO three-step analgesic ladder presents a stepped approach based on pain severity. If the pain is mild, begin with Step 1. If pain persists or worsens, a change to a Step 2 or Step 3 analgesic is indicated. At each step, an adjuvant drug* or modality such as radiation therapy may be considered in selected patients (WHO, 2016).

*Adjuvant drugs: can enhance the analgesic effect of opioid drugs in patients with cancer. Concurrent use of adjuvants is recommended by the WHO and has been recognized as an effective strategy in improving the balance between analgesia and side effects. However, consistent evidence suggests an under-utilization of adjuvants in cancer pain management, which may contribute to unnecessary opioid switching or rotation (Gao et al., 2014).

World Health Organization Analgesic Ladder



Source: Adapted from WHO, 1986. Used with permission.

In general, analgesics should be given "**by mouth, by the clock, by the ladder, and for the individual**" and should include regular scheduling of the analgesic, not just on an as-needed basis. In addition, rescue doses for breakthrough pain should be added. Each analgesic regimen should be adjusted for the patient's individual circumstances and physical condition (NCI, 2013).

Pain Associated with Arthritis

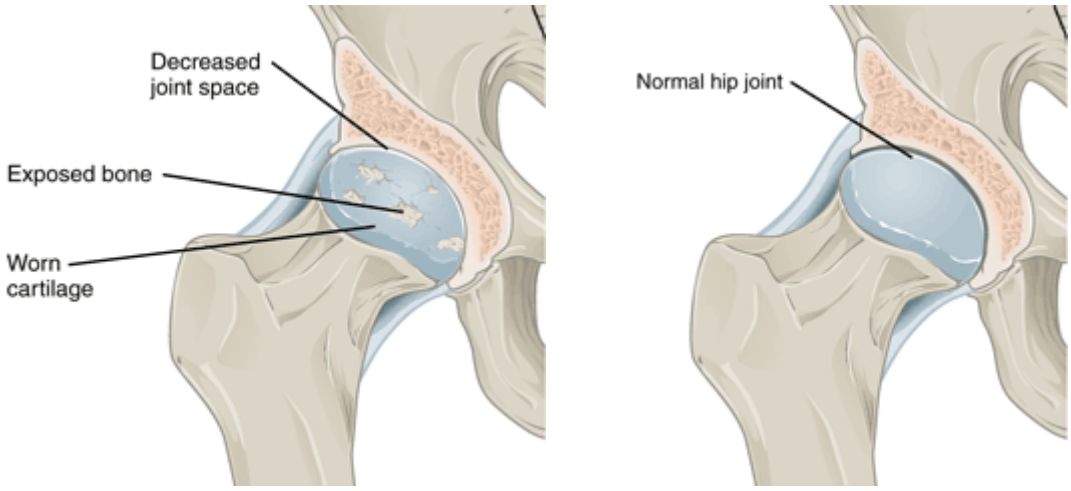
Arthritis and other rheumatic conditions are a leading cause of disability in adults in the United States. Negative consequences, including pain, reduced physical ability, depression, and reduced quality of life, can impact the physical functioning and psychological well-being of those living with these conditions (Schoffman et al., 2013).

Treatment of arthritis and other rheumatic conditions is costly, and given the growing number of people in the United States over the age of 65, these conditions are expected to be a large burden on the healthcare system in the coming years. The number of Americans with arthritis and other rheumatic conditions is expected to reach about 67 million by 2030 (25% of Americans) (Schoffman et al., 2013).

Osteoarthritis

Osteoarthritis (OA) is a joint disorder characterized by degeneration of joint cartilage. Spurs grow out from the edge of the bone, and synovial fluid increases, causing stiffness and pain (NIAMS, 2015). With OA, joint pain and stiffness worsens over time. OA is the most common form of arthritis and affects close to 27 million Americans. After the age of 65, 60% of men and 70% of women experience OA (Van Liew et al., 2013).

Hip Joint Showing Osteoarthritis Progression

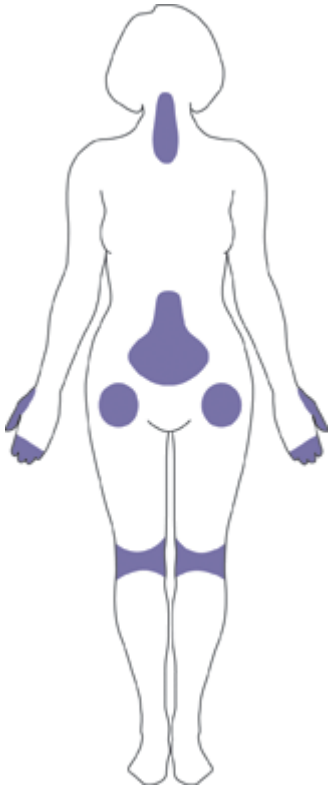


Left: Normal hip joint. Right: Hip joint with osteoarthritis. Source: Wikimedia Commons.

Although the prevalence of osteoarthritis increases with age, younger people can also develop it, usually as the result of a joint injury, a joint malformation, or a genetic defect in joint cartilage. Before age 45, more men than women have osteoarthritis; after age 45, it is more common in women. OA is more likely to occur in people who are overweight and in those with jobs that stress particular joints. The joints most commonly affected by OA are those at the ends of the fingers, thumbs, neck, lower back, knees, and hips (NIAMS, 2015).

Best practice guidelines focus on self-management: weight control, physical activity, and pharmacologic support for inflammation and pain. Although low-grade inflammation underlies chronic osteoarthritis, it has not been a focus of best practice guidelines. Obesity is an independent risk factor for osteoarthritis and there is an interactive relationship among osteoarthritis, obesity, and physical inactivity (Dean & Hansen, 2012).

Osteoarthritis in Joints



Physical exercise is widely recommended for individuals with OA. A meta-analysis on treatments for OA found that exercise programs reduced pain, improved physical functioning, and enhanced quality of life among individuals with OA (Van Liew et al., 2013). Despite this, close to 44% of adults with arthritis report not engaging in exercise.

Osteoarthritis most often occurs in the hands (at the ends of the fingers and thumbs), spine (neck and lower back), knees, and hips. Source: NIAMS, 2015.

Pain associated with osteoarthritis can lead to decreased physical activity, which is an independent risk factor for inflammation, likely due to the reduced expression of anti-inflammatory mediators. Physical inactivity also reduces daily energy expenditure and promotes weight gain (Dean & Hansen, 2012).

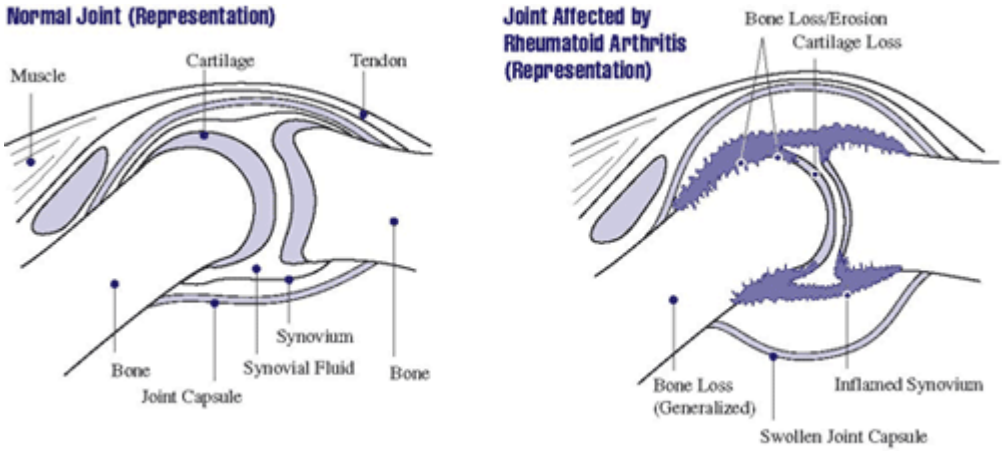
Psychological distress can adversely affect people with OA. Evidence suggests that anxiety and depression lead to reduced functioning and to lower levels of physical activity. Although depression may pose barriers to activity engagement, physical activity has been shown to improve its symptoms and is a common focus of behavioral therapies. Conversely, improvements in depression are also likely to lead to increases in activity levels and quality of life (Van Liew et al., 2013).

Rheumatoid Arthritis

Rheumatoid arthritis (RA) is among the most disabling forms of arthritis and it affects about 1% of the U.S. adult population (about 2 million people). RA is an autoimmune disease that involves inflammation of the synovium, a thin layer of tissue lining the joint space. As the disease worsens, there is a progressive erosion of bone, leading to misalignment of the affected joint, loss of function, and disability. Rheumatoid arthritis tends to affect the small joints of the hands and feet in a symmetric pattern, but other joint patterns are often seen.

Because of its systemic pro-inflammatory state, RA can damage virtually any extra-articular tissue. Cardiovascular disease is considered an extra-articular manifestation and a major predictor of poor prognosis. Traditional risk factors such as obesity, dyslipidemia, type 2 diabetes, metabolic syndrome, hypertension, physical inactivity, advanced age, male gender, family history of cardiovascular disease, hyperhomocysteinemia, and tobacco use have been associated with cardiovascular disease in RA patients. In fact, seropositive RA may, like diabetes, act as an independent risk factor for cardiovascular disease (Sarmiento-Monroy et al., 2012).

Joint Affected by Rheumatoid Arthritis



In rheumatoid arthritis, the synovium becomes inflamed, causing warmth, redness, swelling, and pain. As the disease progresses, the inflamed synovium invades and damages the cartilage and bone of the joint. Surrounding muscles, ligaments, and tendons become weakened. Rheumatoid arthritis can also cause more generalized bone loss that may lead to osteoporosis (fragile bones that are prone to fracture). Source: NIAMS, 2016.

Women are nearly three times more likely than men to develop rheumatoid arthritis—it can start at any age (mean age at the onset is 40 to 60 years). The precise cause of rheumatoid arthritis is unknown; like other autoimmune diseases it arises from a variable combination of genetic susceptibility, environmental factors, and the inappropriate activation of the immune responses. Multiple genes are associated with disease susceptibility, with the HLA locus accounting for 30% to 50% of the overall genetic risk (Fattahi & Mirshafiey, 2012).

Studies that explore the role of pain as a predictor of functional disability typically focus on concurrent pain, or treat pain as a variable when examining predictors of future function. Since factors other than pain are the main predictors of interest, these studies fail to fully characterize the association of pain with future function and, more important, do not explore how different measures of pain and the time periods they reference may impact results (Santiago et al., 2016).

Psoriatic Arthritis

Psoriatic arthritis is an inflammatory joint disease characterized by stiffness, pain, swelling, and tenderness of the joints, as well as the surrounding ligaments and tendons. It affects men and women equally, typically presents at the age of 30 to 50 years, and is associated with psoriasis in approximately 25% of patients. Cutaneous disease usually precedes the onset of psoriatic arthritis by an average of 10 years in the majority of patients but 14% to 21% of patients with psoriatic arthritis develop symptoms of arthritis prior to the development of skin disease. The presentation is variable and can range from a mild, nondestructive arthritis to a severe, debilitating, erosive joint disease (Lloyd et al., 2012).

Psoriatic arthritis affects fewer people in the United States than rheumatoid arthritis. It has a highly variable presentation, which generally involves pain and inflammation in joints and progressive joint involvement and damage. There are multiple clinical subsets of psoriatic arthritis, including:

- Monoarthritis of the large joints
- Distal interphalangeal arthritis
- Spondyloarthritis, or a symmetrical deforming polyarthropathy similar to that of rheumatoid arthritis (Lloyd et al., 2012)

Left untreated, a proportion of patients may develop persistent inflammation with deforming progressive joint damage which leads to severe physical limitation and disability (Lloyd et al., 2012).

Nonsteroidal anti-inflammatory drugs help with symptomatic relief, but they do not alter the disease course or prevent disease progression. Intra-articular steroid injections can be used for symptomatic relief. Physical or occupational therapy may also be helpful in symptomatic relief (Lloyd et al., 2012).

Disease-modifying anti-rheumatic drugs are the mainstay of treatment for patients suffering from psoriatic arthritis. Currently, the most effective class of therapeutic agents for treating psoriatic arthritis is the TNF-α inhibitors; however, these drugs show a 30% to 40% primary failure rate in both randomized clinical trials and registry-based longitudinal studies (Lloyd et al., 2012).

Pain in Special Populations

The extremes of age, as well as specific diseases such as cancer, provide special challenges to pain care. Infants and children, older adults, people with dementia, and cancer patients have little in common physiologically, but they share a propensity toward under-medication for pain. There is some evidence that the under-treatment of pain in these patient populations is improving, but acute care clinicians should pay particular attention to pain assessment and care in these patients (Thomas, 2013).

Pain in Infants, Children, and Adolescents

Although skepticism towards infant pain characterized much of the twentieth century, it is now well understood that an infant's pain transmission pathways are fully developed by 22 to 24 weeks of gestation. In addition, pain inhibitory pathways are not fully developed in infants, suggesting that infants may feel even more pain than older children (Waxman et al., 2016).

In spite of its frequency, pain in infants, children, and adolescents is often underestimated and undertreated. It has been shown that infants and children who experience pain in early life show long-term changes in terms of pain perception and related behaviors (Srouji et al., 2010).

In infants, improper management of acute pain has been associated with negative short- and long-term consequences. Increased metabolic rate during painful experiences has been associated with increased potential for chronic pain, delayed wound healing, increased risk of infection, and alterations in pain sensitivity. Long-lasting consequences include delays in motor and brain development, as well as deficits in cognition and emotional regulation (Waxman et al., 2016).

In adolescents, headaches, stomachaches, or backaches are common complaints. These pain conditions commonly coexist and are more prevalent in girls and older adolescents. In an international survey involving 28 countries, although there was some variation in pain prevalence, there were no countries where these three pains were uncommon (Swain et al., 2014).

A Danish twins study found adolescents with persistent low back pain were 3.5 times more likely to have low back pain in adulthood. Co-occurrence of low back pain and headache in adolescence further increases the risk of developing future pain (Swain et al., 2014).

Barriers to pain management in children are numerous and include inaccuracies regarding pathophysiologic mechanisms of pain, fears regarding the use of pharmacologic agents, and deficits in knowledge of pain assessment. Personal values and beliefs also prevent adequate identification and alleviation of pain for all children (Srouji et al., 2010).

Did You Know . . .

> Pain management in infants and children is an example of the influence of tradition, personal bias, persistence myths, and resistance to change. There is a substantial gap between evidence and practice, and some authors suggest that pediatric nursing, rooted deeply in tradition and ritual, is particularly resistant to evidence-based practice changes (Susan Lacey, 2008).

A significant percentage of children and adolescents (25%–33%) experience chronic pain, with prevalence increasing with age and occurring slightly more commonly in girls than boys. The most commonly reported *locations* of pain in children and adolescents are:

- Head
- Stomach

- Arms
- Legs (Carter & Threlkeld, 2012)

The most common chronic pain *conditions* in children include:

- Migraine
- Recurrent abdominal pain
- General musculoskeletal pain (Carter & Threlkeld, 2012)

Chronic pain can interfere with developmental functioning, increase levels of emotional distress, and disrupt school attendance. Parents are also adversely affected and must negotiate appointments with multiple providers, including both primary and secondary providers. This can lead to missed school for the child, missed work for parents, and depletion of emotional and financial resources (Gorodzinsky et al., 2012).

Families faced with addressing their child's chronic pain often report a loss of trust in providers when treatment fails to address the high levels of pain their child is experiencing. Parents express frustration with inconclusive medical tests, decreasing their hopes that any provider will be able to do anything for their child. With failure to reduce their child's pain, parents may experience reduced expectations for treatment (Gorodzinsky et al., 2012).

A multidisciplinary approach using a biopsychosocial perspective to assess and treat chronic pain in children is effective in reducing the pain experiences and consequences of pain. Families note that providers in multidisciplinary settings displayed an interest in understanding the pain and increasing the comfort of the families during the appointment. Including the family's perspective during treatment is an example of collaborative healthcare, which improves communication and more effectively implements the plan of care (Gorodzinsky et al., 2012).

Pain in Older Adults

Older adults have a high risk of experiencing daily pain and 20% report taking a painkiller regularly (Lillie et al., 2013). In older adults pain can produce unwanted consequences such as reduced quality of life, reduced engagement in social and recreational activities, and an increased risk of falls. Older adults with chronic pain conditions, such as back pain, are significantly less physically active compared with their counterparts who do not experience back pain (Ho et al., 2016).

Aging is associated with clinically important changes in pharmacokinetics and pharmacodynamics. Drug absorption is generally unchanged, but studies of drug distribution reveal increased plasma concentration of water-soluble drugs and increased half-life of fat-soluble drugs in older adults. For all opioids, half-life of the active drug and metabolites is increased in elders (Dalacorte et al., 2011).

Other issues that affect management of pain in older adults include:

- Decline in the cognitive function
- Low income
- Co-morbid conditions and polypharmacy
- Sedation, dizziness
- Managing pain medications
- Adhering to the prescribed schedule

Pain in People with Dementia

Pain is a very common problem in people with dementia: about 50% of people with dementia regularly experience pain. Pain in people with dementia pain can lead to neuropsychiatric symptoms and declines in cognitive functioning, as well as declines in the performance of activities of daily living. Next to neuropsychiatric symptoms, pain is the most cited reason for a decrease in quality of life in dementia. Therefore, recognition and adequate treatment of pain in people with dementia should have high priority (van Kooten et al., 2015).

There is evidence that people with advanced cognitive decline receive pain treatment, notably opioids, less frequently or in lower, insufficient doses as compared to their cognitively fit counterparts. Unable to properly communicate their pain, changes in behavior are often misinterpreted as behavioral symptoms, provoking inappropriate prescription of antipsychotics which, in turn, have been associated with compromised cognition, falls and fractures, and increased risk of death. The failure to accurately identify pain in cognitively impaired individuals is the primary cause of sub-optimal management of pain (Bauer et al., 2016).

While individuals with mild to moderate cognitive impairment are often able to report pain either verbally or by use of rating scales, these options are not available for those with advanced cognitive impairment, when the ability to communicate is severely impaired. As a result, self-reported pain may not always be reliable in people with advanced cognitive impairment and pain must be indirectly rated using a validated observational instrument. Various numerical and visual scales lack soundness in persons with cognitive impairment, due to their reliance on memory, abstract thinking, and speech comprehension (Bauer et al., 2016).

Among residents of nursing homes, it is estimated that 45% to 80% of residents have substantial pain that is undertreated. This suggests that when nursing home residents have moderate to severe pain, they have only about a 50% chance of obtaining adequate pain relief. Because cognitive impairment is common in many nursing home residents, assessing and managing pain can be particularly demanding. This often leads to both the underdiagnosis and undertreatment of pain (Bauer et al., 2016).

Pain at the End of Life

When a person is living with an advanced illness or coming to the end of life, preventing and relieving pain is often a high priority. Pain is among the most debilitating and feared symptoms faced by patients and their families. Despite this understanding, many severely ill patients spend the last days of their lives in moderate to severe pain.

Consistent assessment of pain is critical, as is involving the patient and family in establishing goals for palliative pain management. Patients and family members should be educated about dosing, compliance, addiction, tolerance, and side effects. Good pain management at the end of life involves listening to the patient's subjective measure of pain, properly assessing patients with cognitive impairment, and overcoming myths about opioid therapy related to fear of causing addiction or hastening death.

Palliative Care

Palliative care is an approach that aims to improve the quality of life of patients and their families who are facing the problems associated with life-threatening illness. This is accomplished through the prevention and relief of suffering by means of early identification, assessment, and treatment of pain and other symptoms.

In 2014 the National Consensus Project (NCS) released updated guidelines for palliative care. The new guidelines are organized according to the following domains: structure and processes of care; physical, psychological, and psychiatric aspects of care; spiritual, religious, existential, and cultural aspects of care; care of patients at the end of life; and ethical and legal aspects of care. *Clinical Practice Guidelines for Quality Palliative Care* (4th edition, 2014) is available at the National Consensus Project.

Cancer Pain at the End of Life

Undertreatment and inequitable access to pain treatment have been described among many cancer patients presenting with pain. The reported prevalence of moderate to severe pain in advanced cancer is approximately 64%, with a sharp increase to as high as 80% to 90% at the end of life (Gao et al., 2014).

A study evaluating the characteristics of patients with advanced cancer presenting to a palliative care service found the primary tumor as the chief cause of pain in 68% of patients. Most pain was somatic, and pain was as likely to be continuous as intermittent (NCI, 2016).

Musculoskeletal Pain at the End of Life

Although palliative care has in the past focused on cancer, it has recently expanded to include other conditions, including musculoskeletal pain at the end of life. Population-based studies indicate that musculoskeletal pain is such a common and significant issue at the end of life that **musculoskeletal disease may have as much, if not more, effect on whether a person dies in pain than the condition that is the cause of death** (Lillie et al., 2013).

Assessing and Documenting Pain

The most critical aspect of pain assessment is that it be done on a regular basis using a standard format. Pain should be re-assessed after each intervention to evaluate its effect and determine whether an intervention should be modified. The time frame for re-assessment should be directed by the needs of the patient and the hospital or unit policies and procedures.

A self-report by the patient has traditionally been the mainstay of pain assessment, although family caregivers can be used as proxies for patient reports, especially in situations in which communication barriers exist, such as cognitive impairment or language barriers. Family members who act as proxies typically report higher levels of pain than patient self-reports.

Both physiologic and behavioral responses can indicate the presence of pain and should be noted as part of a comprehensive assessment, particularly following surgery. Physiologic responses include tachycardia, increased respiratory rate, and hypertension. Behavioral responses include splinting, grimacing, moaning or grunting, distorted posture, and reluctance to move. A lack of physiologic responses or an absence of behaviors indicating pain may not mean there is an absence of pain.

Good documentation improves communication among clinicians about the current status of the patient's pain and responses to the plan of care. Documentation is also used as a means of monitoring the quality of pain management within the institution.

In the absence of an objective measure, pain is a subjective individual experience. How we respond to pain is related to genetic features as well as cognitive, motivational, emotional, and psychological states. Pain response is also related to gender, experiences and memories of pain, cultural and social influences, and general health (Sessle, 2012).

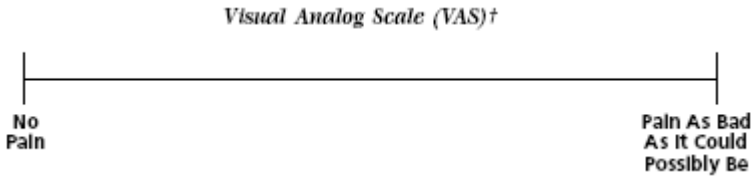
Pain Assessment Tools

Selecting a pain assessment tool should be, when possible, a collaborative decision between patient and provider to ensure that the patient is familiar with the tool. If the clinician selects the tool, consideration should be given to the patient's age; physical, emotional, and cognitive status; and personal preferences. Patients who are alert but unable to talk may be able to point to a number or a face to report their pain (AHRQ, 2008).

Pain Scales

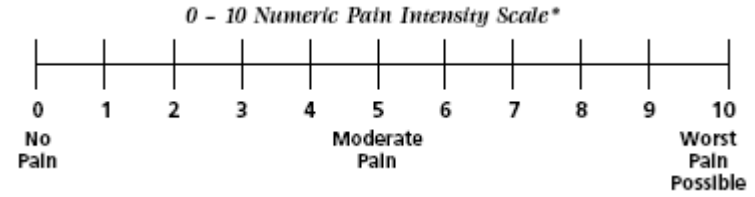
Many pain intensity measures have been developed and validated. Most measure only one aspect of pain (ie, pain intensity) and most use a numeric rating. Some tools measure both pain intensity and pain unpleasantness and use a sliding scale that allows the patient to identify small differences in intensity. The following illustrations show some commonly used pain scales.

Visual Analog Scale



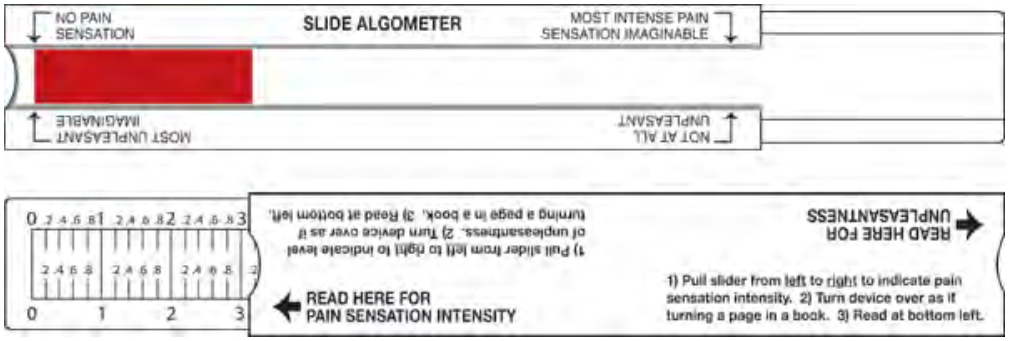
The Visual Analog Scale. The left endpoint corresponds to "no pain" and the right endpoint (100) is defined as "pain as intense as it can be."
†A 10-cm baseline is recommended for VAS scales.
Source: Adapted from Acute Pain Management Guideline Panel, 1992 (AHCPR, 1994). Public domain.

Numeric Rating Scale



The Numeric Rating Scale. Indicated for adults and children (>9 years old) in all patient care settings in which patients are able to use numbers to rate the intensity of their pain. The NRS consists of a straight horizontal line numbered at equal intervals from 0 to 10 with anchor words of "no pain," "moderate pain," and "worst pain." Source: Adapted from Acute Pain Management Guideline Panel, 1992 (AHCPR, 1994). Public domain.

The Pain Scale for Professionals



The Pain Scale for Professionals. The patient slides the middle part of the device to the right and left and views the amount of red as a measure of pain sensation. The arrow at the left means "no pain sensation" and the arrow at the right indicates the "most intense pain sensation imaginable." The sliding part of the device is moved on a different axis for the unpleasantness scale. The arrow at the left means "not at all unpleasant" and the arrow at the right represents pain that is the "most unpleasant imaginable." Source: The Risk Communication Institute. Used with permission.

Simpler tools such as the verbal rating scale (VRS) classify pain as mild, moderate, or severe. Some studies indicate that older adults prefer to characterize their pain using the VRS. The description can be translated to a number for charting (see following table) and works particularly well if everyone on the unit uses the same scale.

Verbal Rating Scale (VRS)	
Description	Points Assigned
No pain	0
Mild pain	2
Moderate	5
Severe	10

For patients with limited cognitive ability, scales with drawings or pictures, such as the Wong-Baker FACES™ scale, are useful. Patients with advanced dementia may require behavioral observation to determine the presence of pain.

Wong-Baker FACES™ Pain Rating Scale

The Wong-Baker FACES scale is especially useful for those who cannot read English and for pediatric patients. Source: Copyright 1983, Wong-Baker FACES™ Foundation, www.WongBakerFACES.org. Used with permission.

Pain Questionnaires

Pain questionnaires typically contain verbal descriptors that help patients distinguish different kinds of pain. One example, the McGill Pain Questionnaire asks patients to describe subjective psychological feelings of pain. Pain descriptors such as pulsing, shooting, stabbing, burning, grueling, radiating, and agonizing (and more than seventy other descriptors) are grouped together to convey a patient's pain response (Srouji et al., 2010).

The questionnaire combines a list of questions about the nature and frequency of pain with a body-map diagram to pinpoint its location. It uses word lists separated into four classes (sensory, affective, evaluative, and miscellaneous) to assess the total pain experience. After patients are finished rating their pain words, a numerical score is calculated, called the "Pain Rating Index." Scores vary from 0 to 78, with the higher score indicating greater pain (Srouji et al., 2010).

The Brief Pain Inventory (BPI), developed by the World Health Organization, also uses the questionnaire format to measure pain. The ability to resume activity, maintain a positive affect or mood, and sleep are relevant functions for patients. The BPI uses a numeric rating scale to assess difficulties with walking, general activity, mood, and sleep.

Assessing Pain in Children

Despite decades of research and the availability of effective analgesic approaches, many children continue to experience moderate to severe pain, especially after hospitalization. Overall, the factors affecting children's pain management are influenced by cooperation (nurses, doctors, parents, children), child (behavior, diagnosis, age), organization (lack of routine instructions for pain relief, lack of time, lack of pain clinics), and nurses (experience, knowledge, attitude) (Aziznejadroshan et al., 2016).

Pain evaluation in small children can be difficult. Previous experiences, fear, anxiety, and discomfort may alter pain perception; thus, poor agreement between instruments and raters is often the norm. In children younger than 7 years of age and in cognitively impaired children, evaluation of pain intensity through self-report instruments can be inaccurate due to poor understanding of the instrument and poor capacity to translate the painful experience into verbal language; therefore, complementary observational pain measurements should be used to assess pain intensity (Kolosovas-Machuca et al., 2016).

Three methods are commonly used to measure a child's pain intensity:

1. **Self-reporting**: what a child is saying.
2. **Behavioral measures**: what a child is doing (motor response, behavioral responses, facial expression, crying, sleep patterns, decreased activity or eating, body postures, and movements).
3. **Physiologic measures**: how the body is reacting (changes in heartrate, blood pressure, oxygen saturation, palmar sweating, respiration, and sometimes neuroendocrine responses (Srouji et al., 2010).

Children's capability to describe pain increases with age and experience, and changes throughout their developmental stages. Although observed reports of pain and distress provide helpful information, particularly for younger children, they are reliant on the individuals completing the report (Srouji et al., 2010).

Assessing Pain in Cognitively Intact Adults

For the cognitively intact adult, assessment of pain intensity is most often done by using the 0 to 10 numeric rating scale or the 0 to 5 Wong-Baker FACES scale, or the VRS. Once patients know how to use a pain intensity scale, they should establish "comfort-function" goals. With the clinician's input, patients can determine the pain intensity at which they are easily able to perform necessary activities with the fewest side effects.

In cognitively intact older adults, management of pain begins with an accurate assessment and includes the impact of pain on the patient's daily activities. When analgesic treatment and pain-modulating drugs are used, co-morbidities and other risk factors must be carefully considered. The least invasive method of administration should be used—in most cases the oral route is preferred (Age and Ageing, 2013).

Assessing Pain in Cognitively Impaired Adults

The assessment of pain in patients with cognitive impairment is a significant challenge. Cognitively impaired patients tend to voice fewer pain complaints but may become agitated or manifest unusual or sudden changes in behavior when they are in pain. Caregivers may have difficulty knowing when these patients are in pain and when they are experiencing pain relief. This makes the patient vulnerable to both undertreatment and overtreatment.

In the absence of accurate self-report, observational tools based on behavioral cues have been developed. The most structured observational tools are based on guidance published by the American Geriatrics Society, which describe six domains for pain assessment in cognitively impaired:

1. Facial expression
2. Negative vocalization
3. Body language
4. Changes in activity patterns
5. Changes in interpersonal interactions
6. Mental status changes (Lichtner et al., 2014)

The interpretation of these behaviors can be complex, due to overlap with other common symptoms such as boredom, hunger, anxiety, depression, or disorientation. This increases the complexity of accurately identifying of pain in patients with dementia and raises questions about the validity of existing instruments. As a result, there is no clear guidance for clinicians and staff on the effective assessment of pain, nor how this should inform treatment and care decision-making (Lichtner et al., 2014).

A large number of systematic reviews have analyzed the relative value and strength of evidence of existing pain tools. In a review of reliability, validity, feasibility, and clinical utility of 28 pain assessment tools used with older adults with dementia, no one tool appeared to be more reliable and valid than the others (Lichtner et al., 2014).

Patient self-report remains the gold standard for pain assessment but in nonverbal older adults the next best option, from a user-centered perspective, becomes the assessment of a person who is most familiar with the patient in everyday life in a hospital or other care setting; this is sometimes referred to as a "silver standard" (Lichtner et al., 2014).

A thorough review of pain assessment tools for nonverbal older adults by Herr, Bursch, and Black of The University of Iowa is available here.

Keeping these challenges in mind, three commonly used behavioral assessment tools serve as examples of those used in assessing pain and evaluating interventions in cognitively impaired adults: the Behavioral Pain Scale, the Pain Assessment Checklist, and the Advanced Dementia Scale.

Behavioral Pain Scale

The Behavioral Pain Scale (BPS) was developed for use with critically ill patients in the ICU. It evaluates and scores three categories of behavior on a 1 to 4 scale:

1. Facial expression: 1 for relaxed to 4 for grimacing
2. Upper-limb movement: 1 for no movement to 4 for permanently retracted
3. Ventilator compliance: 1 for tolerating ventilator to 4 for unable to control ventilation

A cumulative score above 3 may indicate pain is present; the score can be used to evaluate intervention, but cannot be interpreted to mean pain intensity. The patient must be able to respond in all categories of behavior—for example, the BPS should not be used in a patient who is receiving a neuromuscular blocking agent.

Pain Assessment Checklist

Pain behavior checklists differ from pain behavior scales in that they do not evaluate the degree of an observed behavior and do not require a patient to demonstrate all of the behaviors specified, although the patient must be responsive enough to demonstrate some of the behaviors. These checklists are useful in identifying a patient's "pain signature"—the pain behaviors unique to that individual.

The *Pain Assessment Checklist for Seniors with Limited Ability to Communicate* (PACSLAC) is a caregiver-administered tool that evaluates sixty behaviors divided into four subscales:

1. Facial expressions (13 items)
2. Activity/body movements (20 items)
3. Social/personality/mood (12 items)
4. Physiological indicators/eating and sleeping changes/vocal behaviors (15 items)

A checkmark is made next to any behavior the patient exhibits. The total number of behaviors may be scored but cannot be equated with a pain intensity score. It is unknown if a high score represents more pain than a low score. In other words, a patient who scores 10 out of 60 behaviors does not necessarily have less pain than a patient who scores 20. However, in an individual patient, a change in the total pain score may suggest more or less pain.

Advanced Dementia Scale (PAINAD)

The *Pain Assessment in Advanced Dementia Scale* (PAINAD) was developed to provide a clinically relevant and easy-to-use observational pain assessment tool for individuals with advanced dementia. The aim of the tool developers was to "develop a tool for measuring pain in non-communicative individuals that would be simple to administer and had a score from 0 to 10" (Herr, et al., 2008). This tool is used when severe dementia is present. This tool involves the assessment of breathing, negative vocalization, facial expression, body language, and consolability.

Pain Assessment in Advanced Dementia (PAINAD)				
	0	1	2	Score*
Breathing	Normal	▪ Occasional labored breathing ▪ Short period of hyperventilation	▪ Noisy labored breathing ▪ Long period of hyperventilation ▪ Cheyne-Stokes respirations	
Negative vocalization	None	▪ Occasional moan/groan ▪ Low level speech with a negative or disapproving quality	▪ Repeated, troubled calling out ▪ Loud moaning or groaning ▪ Crying	
Facial expression	Smiling or inexpressive	▪ Sad ▪ Frightened ▪ Frown	Facial grimacing	
Body language	Relaxed	▪ Tense ▪ Distressed ▪ Pacing ▪ Fidgeting	▪ Rigid ▪ Fists clenched ▪ Knees pulled up ▪ Pulling/pushing away ▪ Striking out	
Consolability	No need to console	Distracted or reassured by voice or touch	Unable to console, distract, or reassure	
PAINAD Scoring: 1-3 = Mild; 4-6 = Moderate; 7-10 = Severe * Some institutions have developed policies in which a PAINAD score of four or greater must be addressed in the nursing care plan. Public domain.				Total:

Assessment of Cancer Pain

Pain assessment in patients with pain secondary to cancer begins with a thorough discussion of the patient's goals and expectations for pain management, including balancing pain levels and other patient goals, such as mental alertness. Comprehensive pain assessment also includes pain history, pain intensity, quality of pain, and location of pain. For each pain location, the pattern of pain radiation should be assessed (NCI, 2016).

A review of the patient's current pain management plan and how he or she has responded to treatment is important. This includes how well the current treatment plan addresses breakthrough or episodic pain. A full assessment also reviews previously attempted pain therapies and reasons for discontinuation; other associated symptoms such as sleep difficulties, fatigue, depression, and anxiety; functional impairment; and any relevant laboratory data and diagnostic imaging. A focused physical examination includes clinical observation of pain behaviors, pain location, and functional limitations (NCI, 2016).

Psychosocial and existential factors that can affect pain must also be assessed and treated. Depression and anxiety in particular can strongly influence the pain experience. Across many different types of pain, research has shown the importance of considering a patient's sense of self-efficacy over their pain: low self-efficacy, or focus on solely pharmacologic solutions, is likely to increase the use of pain medication (NCI, 2016).

Patients who catastrophize pain (eg, patient reports pain higher than 10 on a 10-point scale) are more likely to require higher doses of pain medication than are patients who do not catastrophize. Catastrophizing is strongly associated with low self-efficacy and reliance on chemical coping strategies (NCI, 2016).

A high baseline pain intensity, neuropathic pain, and incident pain are often more difficult to manage. Certain patient characteristics, such as a personal or family history of illicit drug use, alcoholism, smoking, somatization, mental health issues such as depression or anxiety, and cognitive dysfunction are associated with higher pain expression, higher opioid doses, and longer time to achieve pain control (NCI, 2016).

Several risk-assessment tools have been developed to assist clinicians, such as the Edmonton Classification System for Cancer Pain (ECS-CP) and the Cancer Pain Prognostic Scale (CPPS) (NCI, 2016).

Assessing Gender Differences in Pain Sensitivity

Men and women experience and report pain differently. Specifically, women have been shown to have a lower pain threshold and pain tolerance and stronger responses to analgesics than do men. These differences are present in community-dwelling and clinical samples (Ho et al., 2016).

Differing biologic and psychosocial factors may account for gender differences in pain sensitivity. One commonly studied psychosocial factor is pain-related fear, which includes fear of the sensation of pain, fear of movement or re-injury, and fear of physical activities that are assumed to cause pain. Pain-related fear may contribute to the shift from acute low back pain to chronic low back pain, and numerous studies have demonstrated the association of pain-related fear with disability in patients with chronic and acute low back pain, hip and knee osteoarthritis, and foot and ankle dysfunction (Horn et al., 2014).

An experimental pain study using electrical stimuli found the increased pain experienced by women during a movement task was accounted for by higher reports of fear among women compared to men. In addition to pain-related fear, Robinson and colleagues found women to be more willing to report pain and consider themselves to be more sensitive to pain compared to males. Conversely, some males believe that they have higher pain endurance than women and as compared to the typical male (Horn et al., 2014).

Clinically, gender differences are relevant because a greater percentage of chronic pain sufferers are women. Women also generally report more areas of bodily pain and more pain-related disability compared to men (Horn et al., 2014).

Gender bias (an unintended and systematic neglect of one gender) may play a role in a patient's access to pain rehabilitation services. Swedish researchers found that men more often than women were referred to physiotherapy and x-ray independent of self-reported pain intensity, pain activity, and pain localization. Higher scores on self-reported pain did not trigger referral to rehabilitation. In fact, a negative trend was found among women. The higher the scores of pain, the less likely that women were referred to rehabilitation (Hammarström et al., 2015).

Psychosocial Aspects of Pain Management

Pain perception—the conscious recognition and awareness of a painful stimulus—is modulated and modified by many psychological and personality-related factors. These can include previous pain experiences, emotions and cognition, somatization and catastrophizing, the presence of acute and chronic stressful life events, fatigue, anxiety, fear, boredom, and anticipation of more pain. Pain perception is also influenced by socioeconomic factors such as social support, acceptance, incentives, education, occupation, and quality of life. In addition, pain perception differs among genders and ethnicities, and varies with age (Belfer, 2013).

Chronic pain in particular carries with it personal and economic costs and psychological distress, and psychological factors play a significant role in chronic pain. Pre-existing depression, anxiety, and stress may predispose some individuals to progress to a chronic pain condition, while chronic pain in turn leads to anxiety and depression, creating a vicious cycle (Rice et al., 2016).

Because of the cognitive, emotional, and psychological effects that may be associated with pain, a biopsychosocial concept of pain has emerged over the past two to three decades, along with considerable evidence supporting management approaches that address the psychosocial aspects of a patient with chronic pain (Sessle, 2012).

Within the biopsychosocial model, negative pain beliefs have a detrimental impact on patients' overall health, self-efficacy, and function. Thoughts can *positively* influence beliefs about the pain experience if there is control in managing pain, confidence that harm and disability will not occur, and expectations of recovery. Thoughts can *negatively* influence beliefs about pain if control is lacking and recovery is not possible. The consequence can be emotional distress and catastrophizing, as well as excessively negative and pessimistic beliefs and thoughts about pain (Pons et al., 2012).

Chronic Pain and Depression

It has been estimated that 35% of the chronic pain population has associated depression (Bromley Milton et al., 2013). Pain can be a symptom, a cause, or a consequence of depression. Studies investigating the association between pain and depression suggest that the stress of living with chronic pain can *cause* depression, but there is also evidence that pain develops *secondary to* depression, manifesting as increased pain sensitivity, and that high depression scores are associated with greater risk of developing chronic pain (Schneider et al., 2011). The association between depression and pain appears to increase with the severity of each condition (Bromley Milton et al., 2013).

In studies looking at the psychological factors associated with knee pain, researchers found strong evidence for a positive association between depression and knee pain in adults. Emerging evidence on the pathogenesis of depression suggests that physiologic similarities exist between depression and chronic pain. Depression and knee pain may also be related to reduced physical activity, which could be due to fear of pain or a consequence of depression (Phyomaung et al., 2014).

Extensive data support the value of tricyclic antidepressants for the alleviation of pain in chronic pain patients, and serotonin and noradrenaline reuptake inhibitors (SNRIs)—duloxetine, venlafaxine, and milnacipran—have shown to be useful in the treatment of pain and depression. Duloxetine is a SNRI with proven efficacy for painful physical symptoms of depression. Analyses from short-term trials demonstrated that a greater reduction in pain was associated with a higher probability of remission. The efficacy of duloxetine has also been proven for the treatment of painful diabetic neuropathy (Schneider et al., 2011).

Anxiety and Stress

Anxiety is common in chronic pain patients and anxious patients may interpret pain as being more intense than non-anxious patients. The presence of chronic pain makes it difficult to recognize and treat potential psychiatric disorders, and this delay may worsen the prognosis of psychiatric disorders (Mangerud et al., 2013).

In a cross-sectional study of Norwegian adolescents with psychiatric disorders, two-thirds reported chronic pain. Adolescents with mood or anxiety disorders had a significantly higher frequency of chronic pain and pain-related disability than those with hyperkinetic disorders. Adolescents with hyperkinetic and mood or anxiety disorders had a two- to three-fold increased risk of pain-related disability compared to those with hyperkinetic disorders alone (Mangerud et al., 2013).

Stress is the physiologic reaction that occurs in animals and people due to threatened or actual damage to the organism, and can include psychological challenges at the limits of the individual's coping capacity. Stress-inducing factors are collectively called **stressors** (Ellegaard & Peterson, 2012).

In the psychotherapeutic treatment of patients with chronic nonspecific low back pain and moderate depression, diverse psychological stressors have been identified, relating to both the past and present. When pain, stress, and depression become overwhelming and there are few resources available, stress seems to become prominent. Stressful situations can lower a person's ability to cope with back pain (Ellegaard & Peterson, 2012).

Non-Opioid and Adjuvant Analgesics

A wide variety of non-opioid analgesics are available for the treatment and management of pain. Each has a unique profile and differs in onset, peak action, duration of action, and side effects. A multimodal approach (balanced analgesia), which includes non-opioids, adjuvant medications, and opioids, is recommended.

Non-Opioid Analgesic Agents

The appropriate use of analgesics—the right drug at the right interval—provides good pain relief for the majority of patients. There are dozens, even scores, of drugs that can be used depending on the clinical circumstances. For patients needing "broadly effective analgesia," non-opioid approaches may offer overall safety and efficacy as compared to opioid analgesics. Rather than immediately moving to opioids, a clinician should consider whether non-opioid approaches may be appropriate (Thomas, 2013).

Nonsteroidal Anti-Inflammatories

Nonsteroidal anti-inflammatory drugs (NSAIDs) are medications with anti-inflammatory, analgesic, and antipyretic properties; they are among the most widely used drugs in the world. They are used to reduce short- and long-term pain, decrease stiffness, and improve function in patients with acute and chronic conditions such as arthritis, headache, dysmenorrhea, and post operative pain. Aspirin, the first NSAID, was developed in 1897.

NSAIDs—non-selective NSAIDs, cyclooxygenase 2 inhibitors (coxibs), and semi-selective NSAIDs—are most commonly prescribed to relieve pain and inflammation. They work by inhibiting cyclooxygenase (COX) enzymes from making prostaglandins, some of which cause pain and inflammation. Because certain prostaglandins protect the stomach lining from the stomach acid that helps to digest food, NSAIDs can cause gastrointestinal (GI) complications. A history of prior gastrointestinal symptoms or bleeding, the presence of other risk factors such as advancing age, higher doses of NSAID, duration of NSAID use, and the frailty of the patient all increase the risk for upper GI damage and consequent bleeding (Simon, 2013).

NSAIDs can be classified according to their mechanism of action. **Non-selective NSAIDs** like ibuprofen and naproxen inhibit both COX-1 and COX-2 enzymes. **Coxibs** such as celecoxib (Celebrex) and rofecoxib* are designed to selectively inhibit COX-2 enzymes.

*Rofecoxib (Vioxx) has been withdrawn from the market.

Semi-selective NSAIDs—indomethacin (Indocin), meloxicam (Mobic), and diclofenac (Voltaren)—have a higher affinity for COX-2 but tend to inhibit the COX-1 pathway also (Ghosh et al., 2015). COX selectivity is one of the determining factors to consider when giving NSAIDs to a patient.

A meta-analysis of more than 700 studies involving the use of certain NSAIDs for pain was conducted by The Coxib and Traditional NSAID Trialists' (CNT) Collaboration. Researchers looked at the risk of major vascular events, major cardiac events, and upper GI complications from high-dose, long-term use of certain NSAIDs. Concerns about the possible heart risks of NSAIDs, many of which have been on the market for several decades, arose after randomized trials showed that coxibs increased the risk of heart attacks (MRC, 2013).

Diclofenac (Voltaren) is the agent currently in use that is most associated with an increased risk of cardiovascular events: a 40% to 60% higher relative risk of serious cardiovascular events compared to non-use of NSAIDs has been reported. This is a rate equivalent to or possibly higher than that of rofecoxib (Vioxx), now withdrawn from the market (McGettigan & Henry, 2013).

In contrast, another traditional NSAID, naproxen, has been found to be relatively benign, with a cardiovascular risk that was observed to be neutral or much lower than that of diclofenac (McGettigan & Henry, 2013). The CNT Collaboration report indicated that naproxen might be safer for patients with cardiovascular risk but that it is one of the worst NSAIDs in terms of risk for a major GI complication (Simon, 2015).

Regardless of their mechanism of action, prolonged exposure to any class of NSAIDs has been shown to have potential adverse cardiovascular effects in patients with or without pre-existing cardiovascular conditions, depending on the duration and dosage of these drugs. Patients with pre-existing cardiovascular conditions such as coronary artery disease, hypertension, and history of stroke are at the greatest risk of cardiovascular events after taking NSAIDs. Patients who have recently had cardiovascular bypass surgery are advised not to take NSAIDs due to a high risk of heart attacks (Ghosh et al., 2015).

NSAID guidelines have been established to increase physician awareness of the complications associated with NSAID use; however, some physicians either do not recognize or do not adhere to such guidelines (Taylor et al., 2012). A recent survey of physicians identified six major barriers that affected their use of established NSAID guidelines:

1. Lack of familiarity with the guidelines
2. Perceived limited validity of the guidelines
3. Limited applicability of the guidelines to specific patient populations
4. Clinical inertia
5. Anecdotal experiences

6. Clinical heuristics (experience-based problem solving, learning by trial and error rather that following a pre-established formula) (Taylor et al., 2012)

Acetaminophen

Acetaminophen, the active ingredient in Tylenol, is also known as paracetamol and N-acetyl-p-aminophenol (APAP), and has been marketed in the United States as an OTC antipyretic and analgesic agent since 1953. It is widely available in a variety of strengths and formulations for children and adults as a single-ingredient product.

Acetaminophen has been in clinical use for decades, yet its mechanism of action is not fully understood. It is thought to inhibit cyclooxygenases both centrally and peripherally. Researchers have suggested that the inhibition of cyclooxygenase in the brain is responsible for the antipyretic effect of acetaminophen, suggesting a central mechanism of action. Some have suggested classifying acetaminophen as an *atypical* NSAID (Chavez et al., 2015).

At the same time, research has shown that acetaminophen is a prodrug,* and indicating that the analgesic effect of acetaminophen arises from the indirect activation of cannabinoid CB1 receptors. Acetaminophen also has an effect on the descending serotonergic pathway, and may interact with opioidergic** systems or nitric oxide pathways—and also may act as a selective COX-2 inhibitor in humans (Chavez et al., 2015).

*Prodrug. A prodrug is a medication or compound that, after administration, is metabolized into a pharmacologically active drug (Wikipedia, 2016).

**Opioidergic. An opioidergic agent is a chemical that functions to directly modulate the opioid neuropeptide systems (ie, endorphin, enkephalin, dynorphin, nociceptin) in the body or brain.

In the United States, acetaminophen is available as 325 mg and 500 mg preparations and as a 650 mg extended-release medication intended for arthritis treatment. It is available in drops, capsules, and pills, as well as various children's dissolvable, chewable, and liquid formulations. To reduce the risk of accidental overdose, in 2014 the FDA announced that medications containing a combination of acetaminophen and an opioid can no longer contain more than 325 mg of acetaminophen per tablet or capsule.

Acetaminophen is used in combination with many prescription opioid drugs (Vicodin, Percocet) to give more pain relief while minimizing the dose of the addictive narcotic component. It is generally considered safe at recommended doses, but if more is taken—even just a little more—it can cause serious and even fatal liver damage. In fact, acetaminophen poisoning is a leading cause of liver failure in the United States (Hodgman & Garrard, 2012).

Prescription Acetaminophen/Opioid Combinations: Making Pain Medicines Safer (2014)—Video (1:53)

https://www.youtube.com/watch?v=gOuSYNuXHRk

Although acetaminophen is effective as an antipyretic and analgesic, its anti-inflammatory properties are much weaker than those of aspirin and other NSAIDs. It is therefore less effective for chronic inflammatory pain conditions such as rheumatoid arthritis. Acetaminophen is, however, a good choice for osteoarthritis, especially in those patients where aspirin is contraindicated. Acetaminophen lacks the antithrombotic, blood-thinning properties of aspirin and other NSAIDS and therefore does not inhibit coagulation, an important consideration for pain therapy following minor surgical or dental procedures.

From both a GI and cardiovascular perspective, acetaminophen may not be as safe as previously believed—especially at doses higher than 3 g daily. Indeed, use of acetaminophen (any dose) is associated with a small but significant risk of upper GI complications. In addition, although women from the Nurses' Health Study, who reported occasional use of acetaminophen, did not experience a significant increase in the risk of cardiovascular events, those who reported a frequent use (6–14 tablets/week) had a small increased risk (Scarpignato et al., 2015).

Regular acetaminophen has also been associated with an increased risk of hypertension both in women and men. At doses of 3 g daily, acetaminophen induces a significant increase in ambulatory blood pressure in patients with coronary artery disease (Scarpignato et al., 2015).

Because the risks of acetaminophen-related liver damage are so serious and because the public is often unaware of these risks, the Acetaminophen Best Practices Task Group has published recommendations intended to make it easier for consumers to identify whether a prescription pain reliever contains acetaminophen, to compare active ingredients on labels, and to take action to avoid taking two medicines with acetaminophen. The Task Group also recommended coordinating prescription container labeling with the labeling that already exists for OTC medicines, providing consistency in labeling across all acetaminophen-containing medicines (FDA, 2013a).

Use of NSAIDs and Acetaminophen in Older Adults

Nonsteroidal anti-inflammatory drugs have been a mainstay for chronic pain management for many years but should be used with caution in older adults (Age and Ageing, 2013). Introduction of new drugs into the marketplace and the continual stream of new research data have recently called into question the use and prescribing guidelines of NSAIDs in older adults, especially "complex" older patients (Taylor et al., 2012).

Adverse reactions associated with NSAIDs including GI, cardiovascular, renal, and hematologic side effects, have been known for a long time (Age and Ageing, 2013). Prescribing NSAIDs to older adults requires knowledge of individual patient risk factors, benefits and risks of the NSAID, and patient education. Monitoring for effectiveness and side effects is essential. A recent report demonstrated that more than 50% of patients were not properly informed by a physician or pharmacist on the side effects associated with prescribed or OTC NSAIDs (Taylor et al., 2012).

Medical Cannabis

In the early 1960s cannabidiol (CBD) and the psychoactive cannabinoid delta-9-tetrahydrocannabinol (THC) were identified in cannabis (Lanz et al., 2016). Cannabinoid 1 (CB_1) receptors in the human brain were first identified in 1988. In 1992 researchers in Israel discovered an endogenous cannabinoid neurotransmitter, which they called anandamide. By 1993 another group of scientists found cannabinoid receptors in the immune system (CB_2). To date, five endocannabinoids have been discovered. By 2009 more than 525 constituents have been identified, among them about a hundred different cannabinoids.

THC, other cannabinoids, and non-cannabinoids, such as terpenoids,* likely contribute to and modulate the overall pharmacologic effects of cannabis. Numerous recent studies have proven the anti-inflammatory and neuroprotective properties of THC and CBD. CBD is known to reduce the psychoactive effects of THC; in addition, THC and CBD act synergistically (Lanz et al., 2016).

*Terpenoid: a terpene is a hydrocarbon found in the essential oils of many plants, especially conifers and citrus trees. Terpenes are also found in cannabis plants; terpenoids are formed when cannabis is dried and cured. Terpenes are non-cannabinoids and are responsible for the distinctive smell of cannabis.

CB_1 receptors are found mainly on neurons in the brain, spinal cord, and peripheral nervous system, but are also present in other organs and tissues. There are only a small number of CB_1 receptors in the brainstem, which may help explain the absence of cannabis overdoses due to the depression of respirations. CB_2 receptors are primarily found in immune cells, among them leukocytes, the spleen, and tonsils.

The effectiveness of cannabis in decreasing pain is thought to be related to the role of the CB_2 cannabinoid receptor, which suppresses microglial cell activation and decreases neuro-inflammation. In addition, cannabinoid receptors may couple to other effectors that are critical for the transmission of pain signals (Gadotti et al., 2013).

THC, which is a partial agonist* to CB_1 receptors and to a smaller extent to CB_2 receptors, is available in many countries and is administered orally to treat pain, nausea, spasticity, and loss of appetite. It has proven to be effective in patients suffering from cancer, multiple sclerosis, amyotrophic lateral sclerosis, chronic pain, and other diseases (Lanz et al., 2016).

*Partial agonist: an agonist activates certain receptors in the brain. A partial agonist binds to and activates receptors in the brain but not as strongly as a full agonist. A partial agonist can also compete with a full agonist for a receptor site, lessening the effectiveness of the full agonist.

Studies conducted at University of California, San Diego have shown the value of cannabis for some pain-related conditions. One study looked at the effect of cannabis on HIV-related peripheral neuropathy and found that pain relief was greater with cannabis than placebo. Additionally, mood and daily functioning improved among the group using cannabis for pain relief. In another study, researchers looked at the effect of smoked cannabis on 30 participants with spasticity due to multiple sclerosis. Results indicated that smoked cannabis was superior to placebo in symptom and pain reduction in participants with treatment-resistant spasticity (Corey-Bloom et al., 2012).

Adjuvant Medications

Adjuvant analgesics (or co-analgesics) are drugs with a primary indication other than pain that have analgesic properties. Although not primarily identified as an analgesic in nature, they have been found in clinical practice to have either an independent analgesic effect or additive analgesic properties when used with opioids (Khan et al., 2011).

This group includes drugs such as antidepressants, anticonvulsants, corticosteroids, neuroleptics, and other drugs with narrower adjuvant functions. Adjuvant drugs can be used to enhance the effects of pain medications, treat concurrent symptoms, and provide analgesia for other types of pain. Adjuvant analgesics are particularly useful when evidence of decreased opioid responsiveness is present (Prommer, 2015).

Adjuvants commonly used to enhance the effects of pain medications include:

- Antidepressants
- Anticonvulsants
- Local anesthetics
- Corticosteroids
- Bisphosphonates

Using Opioids to Manage Pain

> Despite low-quality evidence supporting practice change, use of chronic opioid therapy for chronic non-cancer pain increased dramatically over the past two decades. Concurrently, opioid analgesic overdose deaths, addiction, misuse, and diversion have increased markedly.
>
> Physicians for Responsible Opioid Prescribing, 2012

Opioids are chemicals that produce morphine-like effects in the body; they are commonly prescribed for the treatment of both acute and chronic pain and for pain associated with cancer. Opioids have a **narcotic effect**, that is, they induce sedation and are effective for the management of many types of pain.

An estimated 20% of patients presenting to physician offices with noncancer pain symptoms or pain-related diagnoses (including acute and chronic pain) receive an opioid prescription. In 2012 healthcare providers wrote 259 million prescriptions for opioid pain medication, enough for every adult in the United States to have a bottle of pills (CDC, 2016a).

Dozens of compounds fall within this class of opioid analgesics, including hydrocodone, oxycodone, morphine, fentanyl, codeine, propoxyphene (recalled in 2010), hydromorphone (Dilaudid), and meperidine (Demerol). In addition to their effective pain-relieving properties, some of these medications are used to relieve severe diarrhea (eg, Lomotil, or diphenoxylate) or severe coughs (codeine).

Opioids act by attaching **opioid receptors**, which are found throughout the nervous system as well as in vascular, gut, lung airway, cardiac, and some immune system cells. There are three types of opioid receptors: *mu*, *delta*, and *kappa*.

Mu opioid receptors are thought to give most of their analgesic effects in the CNS, as well as many side effects including sedation, respiratory depression, euphoria, and dependence. Most analgesic opioids are agonists on *mu* opioid receptors. Of all the analgesics used in pain control, the most safety issues arise with the use of *mu* opioids, or morphine-like drugs such as morphine, etorphine, methadone, hydromorphone (Dilaudid), sufentanil, and fentanyl.

The *delta* opioid receptors are more prevalent for analgesia in the peripheral nervous system. The *kappa* opioid receptors contribute to analgesia in the spine and may cause dysphoria and sedation, but do not generally lead to dependence.

In 2016 the CDC issued *Guideline for Prescribing Opioids for Chronic Pain*. The guideline calls for a drastic reduction in the use of opioids for the treatment of chronic, noncancer pain. Dosage recommendations for exercising caution are lower than older opioid prescribing guidelines and recognize that even relatively low doses (20–50 morphine milligram equivalents per day) increase risk (CDC, 2016b).

In addition, the CDC Guideline cautions that opioids pose risk to all patients, and currently tools cannot rule out risk for abuse or other serious harm. The Guideline encourages use of recent technological advances, such as state prescription drug monitoring programs, and provides more specific recommendations than previous guidelines on monitoring and discontinuing opioids when risks and harms outweigh benefits (CDC, 2016b).

Benefits and Harms of Opioid Therapy

Balance between benefits and harm is a critical factor influencing the strength of clinical recommendations. The CDC has considered what is known about benefits and harms related to specific opioids and formulations, high-dose therapy, co-prescription with other controlled substances, duration of use, special populations, and risk stratification and mitigation approaches (CDC, 2016a):

1. Serious risks have been associated with the use of extended release/long-acting (ER/LA) opioid formulations.
2. Serious risks have been associated with time-scheduled opioid use, specifically substantially higher average daily opioid dosage than as-needed opioid use.
3. Overdose risk is dose-dependent, with higher opioid dosages associated with increased overdose risk.

4. Concurrent use of benzodiazepines and opioids might put patients at greater risk for potentially fatal overdose.
5. Patients with sleep apnea, sleep-disordered breathing, renal or hepatic insufficiency, older adults, pregnant women, patients with depression or other mental health conditions, and patients with alcohol or other substance use disorders have been found to have an increased risk for harm from opioids.
6. Reduced renal or hepatic function can lead to a greater peak effect and longer duration of action and reduce the dose at which respiratory depression and overdose occurs.
7. Age-related changes in patients aged ≥65 years, such as reduced renal function and medication clearance, even in the absence of renal disease, result in a smaller therapeutic window for safe dosages.
8. Opioids used during pregnancy can be associated with additional risks to both mother and fetus.
9. Patients with mental health comorbidities and patients with a history of substance use disorders might be at higher risk than other patients for opioid use disorder.
10. Prescription drug monitoring programs and urine drug testing provide potential benefits, including the ability to identify patients who might be at higher risk for opioid overdose or opioid use disorder.
11. Dose reduction might be associated with unintended negative consequences, such as patients seeking heroin or other illicitly obtained opioids or interference with appropriate pain treatment.
12. For the treatment of opioid use disorder, methadone and buprenorphine have been found to increase retention in treatment and to decrease illicit opioid use among patients with opioid use disorder involving heroin. (CDC, 2016a)

Paradoxically, despite an enormous rise in spending and prescription, there is limited evidence to support the efficacy of opioids in chronic noncancer pain management. In a European survey on chronic pain, 15% of respondents felt that their medications were not very, or not at all, effective (Xu & Johnson, 2013).

A systematic review by Chou and colleagues suggested limited efficacy of long-term opioid therapy over short-term treatment or placebo, while an evidence review by the Institute of Medicine concluded that the effectiveness of opioids as pain relievers, especially over the long term, is somewhat unclear (Xu & Johnson, 2013).

Opioid-Induced Hyperalgesia

Apart from potential side effects, tolerance, and addiction, opioid use can be associated with **opioid-induced hyperalgesia**, which is defined as a state of nociceptive sensitization caused by exposure to opioids. It is characterized by a paradoxical response whereby a patient receiving opioids for the treatment of pain actually becomes more sensitive to pain (Suzan et al., 2013).

Opioid-induced hyperalgesia in the post operative period has been reported following the administration of short-acting opioids during surgery. Additional evidence comes from opioid addicts on methadone maintenance therapy, in whom decreased tolerance to cold pain has been reported. Mixed results are found regarding hyperalgesia in patients with chronic pain who receive intermediate-term opioid treatment (Suzan et al., 2013).

Tolerance, Dependence, and Addiction

Thirty years ago, I attended medical school in New York. In the key lecture on pain management, the professor told us confidently that patients who received prescription narcotics for pain would not become addicted.

> While pain management remains an essential patient right, a generation of healthcare professionals, patients, and families have learned the hard way how deeply misguided that assertion was. Narcotics—both illegal and legal—are dangerous drugs that can destroy lives and communities.
>
> Thomas Frieden, MD
> Director, CDC

A number of terms and definitions are regularly used to define behaviors that are associated with the misuse and abuse of drugs. These terms are imprecise and at times confusing and can reflect societal attitudes and beliefs about drug abuse. To address this issue and to clarify the terms *dependence* and *addiction*, particularly in opioid-treated patients, new definitions for drug addiction have been included in the 2013 DSM-V update. The term "substance dependence"—used in DSM-III and DSM-IV—has been replaced by the terms "substance use disorder" and "opioid use disorder" (IASP, 2013).

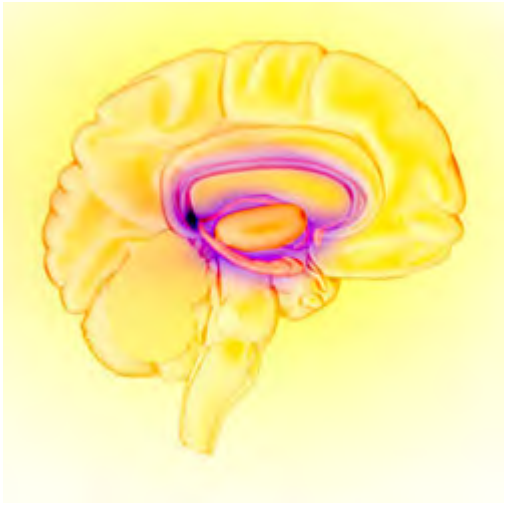
Opioid use disorder is a problematic pattern of opioid use leading to clinically significant impairment or distress. It is manifested by specific criteria such as unsuccessful efforts to cut down or control use and use resulting in social problems and a failure to fulfill major role obligations at work, school, or home. This diagnosis has also been referred to as "abuse or dependence" and "addiction" in the literature, and is different from tolerance (diminished response to a drug with repeated use) and physical dependence (adaptation to a drug that produces symptoms of withdrawal when the drug is stopped), both of which can exist without a diagnosed disorder (CDC, 2016b).

Changes in the DSM-V state that two items (not including tolerance and withdrawal) are needed from a list of behaviors suggesting compulsive use to meet the criteria for **substance use disorder (SUD).** Tolerance and withdrawal are not counted for those taking prescribed medications under medical supervision such as analgesics, antidepressants, anti-anxiety medications, or beta-blockers (IASP, 2013).

Tolerance

Tolerance is a state of adaptation in which a drug becomes less effective over time, which means a larger dose is needed to achieve the same effect. Tolerance occurs because some drugs cause the brain to release 2 to 10 times the amount of dopamine than natural rewards do. In some cases, this occurs almost immediately—especially when drugs are smoked or injected—and the effects can last much longer than those produced by natural means. The resulting effects on the brain's pleasure circuit dwarfs those produced by naturally rewarding behaviors.

The Brain's Reward Circuit



The limbic system—the brain's reward circuit. Source: National Institute on Drug Abuse.

The brain adapts to these overwhelming surges in dopamine by producing less dopamine or by reducing the number of dopamine receptors in the reward circuit. This reduces the user's ability to enjoy not only the drugs but also other things in life that previously brought pleasure. This decrease compels the person to keep abusing drugs in an attempt to bring the dopamine function back to normal, but now larger amounts of the drug are required to achieve the same dopamine high (NIDA, 2016a).

Dependence

Dependence is a state of adaptation characterized by symptoms of withdrawal when a medication is abruptly stopped, the dose is rapidly reduced, or an antagonist is administered. The seriousness of the withdrawal symptoms depends upon the drug being used and the extent of its use. It is a term often misused as a synonym for addiction, but the two terms are not synonymous. For some drugs, such as alcohol or benzodiazepines, withdrawal symptoms can be serious and life-threatening.

An example of dependence is a patient who is on morphine for several months for chronic back pain. If the morphine is discontinued all at once, a flu-like syndrome will quickly develop, accompanied by nausea, stomach pains, and malaise. These symptoms of physical dependence will disappear if the morphine is resumed. Once a person has been on opioids for a period of time, the medication must be tapered off to avoid withdrawal symptoms.

Addiction

It is often said that addiction is easy to recognize, that it rarely arises during the treatment of pain with addictive drugs, and that cases of addiction during pain treatment can be managed in much the same way as other addictions, but such generalizations grossly oversimplify the real situation.

International Association for the Study of Pain

Addiction is defined as a chronic, relapsing disease that is characterized by compulsive drug seeking and use, despite the known, harmful consequences. Addiction involves a psychological craving and is considered a brain disease because drugs change the brain's structure and function. Brain changes can be long lasting and can lead to the harmful behaviors seen in people who abuse drugs. Although taking drugs at any age can lead to addiction, research shows that the earlier a person begins to use drugs the more likely they are to progress to more serious abuse (NIDA, 2014a).

Addiction

The term *addiction* may be regarded as equivalent to a severe substance use disorder as defined by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5, 2013) (NIDA, 2014a).

Opioids are highly addictive and rates of addiction among patients receiving opioids for the management of pain vary from 1% to 50%, which suggests uncertainty about what addiction really is and how often it occurs (IASP, 2013). Savage and colleagues introduced the four "Cs" criteria for identifying opioid addiction in chronic pain population:

1. Impaired **C**ontrol over drug use
2. **C**ompulsive use
3. **C**ontinued use despite harm
4. Unmanageable drug **C**raving (Chang & Compton, 2013).

Opioids in Patients with a History of Substance Abuse

Treating chronic pain with chronic opioid therapy in individuals with a history of a substance use disorder (SUD), whether active or in remission, presents a challenge to pain clinicians. This is, in part, due to concerns about the patient relapsing to active substance abuse. In addition, clinicians may confuse "drug-seeking" behaviors with addictive disease (Chang & Compton, 2013).

The goal of chronic pain treatment in patients with SUD is the same as that for patients without SUD: specifically, to maximize functionality while providing pain relief. However, reluctance to prescribe opioids and poor understanding of the complex relationship between pain and addiction often results in undertreated pain in this population (Chang & Compton, 2013).

When estimating the presence of substance use disorder in chronic pain patients, terminology is important. It is increasingly understood that SUD cannot be defined by physical dependence and tolerance, as these are predictable physiologic consequences of chronic opioid use. Reflecting this, in the DSM-V, tolerance and withdrawal are not counted as criteria for the substance use and addictive disorder diagnosis if a patient is taking an opioid analgesic under medical supervision (Chang & Compton, 2013).

The overall prevalence of substance use disorders in chronic pain patients ranges from 3% to 48% depending on the population sampled. It has been reported that 3% to 11% of chronic pain patients *with* a history of substance use disorder may develop opioid addiction or abuse, whereas only less than 1% of those *without* a prior or current history of SUD develop the same (Chang & Compton, 2013).

When screening patients for a history of substance abuse, one of the easiest tools to use is the National Institute on Drug Abuse (NIDA) Drug Use Screening Tool. It begins with a Quick Screen, which recommends that clinicians ask one question:

"In the past year, how often have you used alcohol, tobacco products, prescription drugs for nonmedical reasons, or illegal drugs?"

Patients are asked to respond on a 5-point continuum: never, once or twice, monthly, weekly, or daily/almost daily. A response of "at least 1 time" when asked about frequency of prescription or illegal drug use is considered a positive result. Recent research has identified that this single-question screening test is highly sensitive and specific for identifying drug use and drug use disorders (NIDA, 2014a).

For those who screen positive for illicit or nonmedical prescription drug use, clinicians can administer the full NIDA-modified Alcohol, Smoking, and Substance Involvement Screening Test (NM-ASSIST). The NM-ASSIST automatically generates a risk level to indicate the level of intervention needed and provides additional resources, such as scripts, on how to discuss drug use with patients, plus resources to link patients to specialty care (NIDA, 2016b).

Untreated Addiction

Patients with an active substance use disorder should be referred to formal addiction treatment. The prescribing clinician should maintain a referral network of substance abuse treatment providers willing to collaborate on providing care to patients with co-morbid pain and substance use disorder. After referral, a pain clinician should continue to work closely with the SUD treatment provider to monitor use behaviors and pain outcomes (Chang & Compton, 2013).

Addiction in Remission

Exposure to psychoactive medications can lead to relapse in patients with a recently or poorly treated substance use disorder. Although concerns of relapse may contribute to clinicians' reluctance to prescribe chronic opioid therapy for patients whose addiction is in remission, there is evidence that patients with successfully treated addiction can be effectively treated with opioids for chronic pain (Chang & Compton, 2013).

For individuals with addiction in remission, the goal of treatment is the same as that as for all chronic pain patients: to improve pain and maintain functionality. Indicators of successful pain management include:

1. The patient's ability to comply with regimens
2. The ability to engage in cognitive-behavioral pain management strategies
3. Utilization of positive coping skills to manage stress and
4. The ability to establish better social support systems (Chang & Compton, 2013)

The ability to manage a relapse episode is a necessary skill of any chronic opioid therapy prescriber. To assess risk of relapse, a series of questions should be asked at each visit to allow for early identification of high-risk situations and potential coping responses to these stressors (Chang & Compton, 2013):

1. How long you been in recovery?
2. How engaged are you in addiction recovery efforts and treatment?
3. What types of drugs have you abused?

4. What are current stressors that might precipitate relapse?
5. What are your current protective factors against relapse, including improved coping responses and a social support system?
6. How stable you feel in recovery? (Chang & Compton, 2013)

A relapse contract can be developed early in treatment, which is individualized to the patient and specifies steps or actions that will be taken by both the patient and clinician if relapse occurs. The patient's behaviors with respect to the opioid analgesic regimen provide the best evidence for the presence of active addiction (Chang & Compton, 2013)

Seeking a higher dose of a prescribed medication does not necessarily mean that the patient is drug-seeking. However, losing or forging prescriptions, stealing or having others steal for you, visiting multiple providers for duplicate prescriptions, and injecting oral formulations are signs that the patient is not using the medication appropriately.

Management of pain requires a great degree of trust on both sides. Being consistent, open, and fair are important attributes for the provider. Providing positive feedback, reducing harm through education, and attempting to understand individual circumstances are helpful to the patient. When managing patients with complex chronic pain on long-term opioid therapy, a multi-disciplinary team approach is recommended.

In some instances, a program called *opioid reassessment* has had success in assessing, monitoring, and treating patients with complex chronic pain on long-term opioid therapy. The Opioid Reassessment Clinic (ORC) at VA Connecticut Healthcare System is an example. Located in the primary care setting, the clinic is staffed by an addiction psychiatrist, an internist with addiction and pain training, a behavioral health advanced practice nurse, and a clinical health psychologist. The clinic has served as a learning opportunity for management of complex chronic pain and opioids over the past several years (Becker et al., 2016).

Using Opioids to Treat Pain in Children

> Thankfully, not many children experience the types of cancer pain, extensive trauma, or surgeries that require long-term pain management. However, few pain management products have specific information on their label about their safety and effectiveness in pediatric patients. This even includes several new pain medications that have been approved for use in adults.
>
> To manage pain in pediatric patients, physicians often have to rely on their own experience to interpret and translate adult data into dosing information for pediatric patients.

Sharon Hertz, MD, Director
FDA, Office of New Drugs

Center for Drug Evaluation and Research, Division of Anesthesia, Analgesia, and Addiction Products

The use of opioids to treat pain in infants and children presents challenges. With rare exceptions, opioids have not been labeled for use in individuals under 18 years of age. There is a dearth of quality studies on pharmacokinetics, pharmacodynamics, safety, and clinical effectiveness. Although acute pain problems in children have many characteristics in common with adults, persistent, recurrent, and chronic pain in infants, children, and adolescents are often qualitatively different from chronic pain problems in adults (Oregon Pain Guidance, 2016).

As with adults, this vulnerable population also appears to be at high risk for opioid toxicity. A study of 960 randomly selected medical records from 12 children's hospitals in the United States identified 107 adverse drug events with more than half attributable to opioid analgesics. Deaths have been reported in young children related to therapeutic use of codeine and hydrocodone in doses within or moderately exceeding recommended pediatric limits (Chung et al., 2015).

Despite their potential for serious adverse events, opioids are increasingly prescribed for adolescents. Opioid prescriptions for patients between 15 and 19 years of age doubled from 1994 to 2007, with estimates that opioids are prescribed in nearly 6% of ambulatory and emergency department visits made by adolescents in the United States (Chung et al., 2015).

Given the large number of pediatric patients receiving prescribed opioids, there is an urgent need for fundamental epidemiologic studies to inform the risk–benefit decisions of prescribers and families. An essential component of these studies is the identification of serious adverse reactions related to opioids. Epidemiologic studies in adults have developed procedures to identify hospitalizations and deaths related to opioid use. However, similar studies in children are lacking (Chung et al., 2015).

Clinical recommendations for chronic non-malignant pain in children and adolescents include (Walco, 2015):

1. Prescribe opioids for acute pain in infants and children only if knowledgeable in pediatric medicine, developmental elements of pain systems, and differences in pharmacokinetics and pharmacodynamics in young children.

2. Avoid opioids in the vast majority of chronic nonmalignant pain problems in children and adolescents, as evidence shows no indication.
3. Consult or refer to a pediatric pain specialist when chronic pain problems in children and adolescents are complicated or persistent.

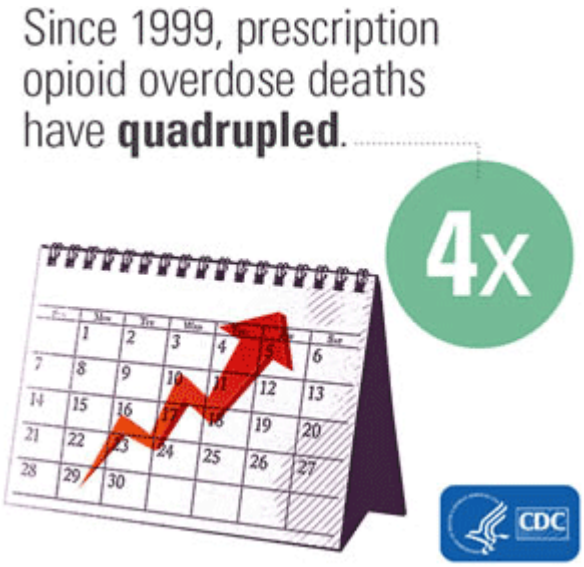
Opioids are indicated for a small number of persistent painful conditions, including those with clear pathophysiology and when an endpoint to usage may be defined.

Abuse of Opioid Analgesics

> Here I lie in my hospital bed
>
> Tell me, sister morphine, when are you coming round again?
>
> Oh, I don't think I can wait that long
>
> Oh, you see that my pain is so strong
>
> The scream of the ambulance is soundin' in my ear
>
> Tell me, sister morphine, how long have I been lying here?
>
> What am I doing in this place?
>
> Why does the doctor have no face?
>
> Marianne Faithfull, *Sister Morphine*

The United States is in the midst of an unprecedented drug overdose epidemic. Since 1999 prescription drug overdose death rates have quadrupled (CDC, 2016b). In 2009, for the first time in U.S. history, drug overdose deaths outnumbered motor vehicle deaths (CDC, 2013a). Since pain was coined "the fifth vital sign" in the 1990s, sales of prescription opioids in the Unites States have quadrupled (see below) (Bartels et al., 2016).

This increase in the prescription of opioids for pain management has been accompanied by a dramatic rise in prescription opioid-associated morbidity and mortality. In 2010 more than 16,000 deaths were attributed to prescription opioids, making them a leading cause of injury death in the general population (Bartels et al., 2016). There are now more deaths from opioid-related overdoses than from all other illicit drugs combined. Emergency department visits, substance treatment admissions, and economic costs associated with opioid abuse have all soared (CDC, 2013a).

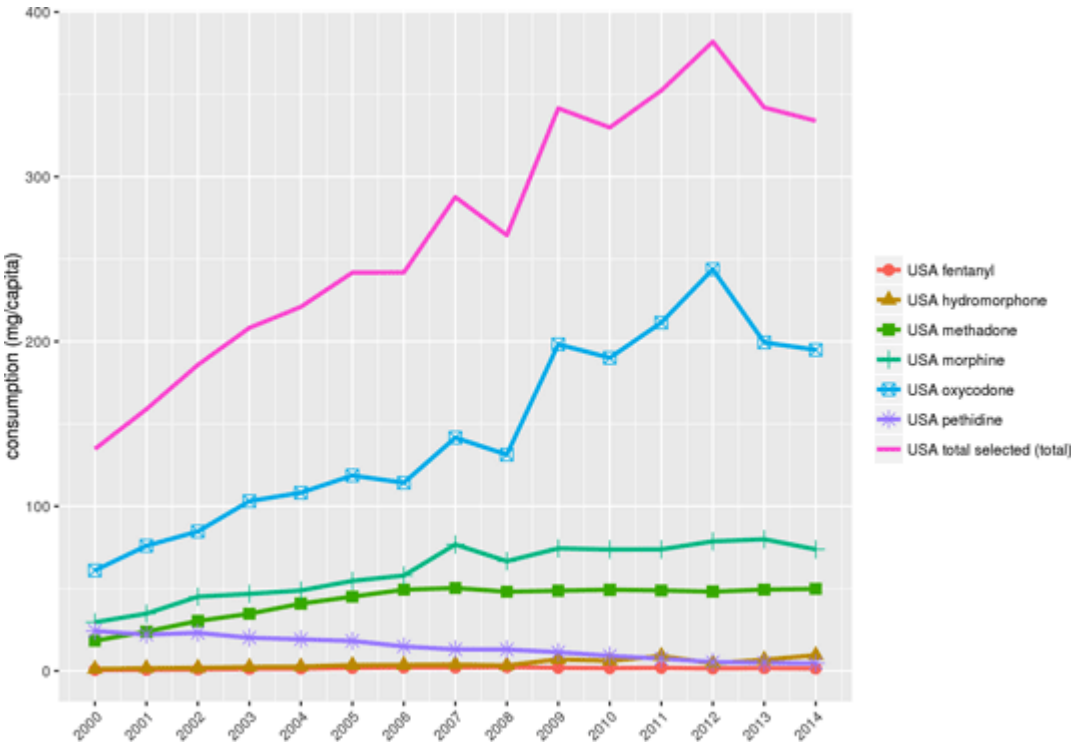


Source: CDC, 2016a.

Some startling statistics illustrate the magnitude of the abuse problem. Between 1997 and 2011 the U.S. population increased only 16%, however the number of prescription pain medications sold by pharmacies increased significantly more than that. Between 1997 and 2011:

- Oxycodone sales increased by 1,259%
- Hydrocodone sales increased by 356%
- Methadone sales increased by 1,099%
- Fentanyl sales increased by 711%
- Morphine sales increased by 246%
- Buprenorphine sales increased from 17 grams in 2002 to 1,639 kg in 2011 (McDonald & Carlson, 2013)

USA Opioid Consumption (mg/capita), 2000—2014

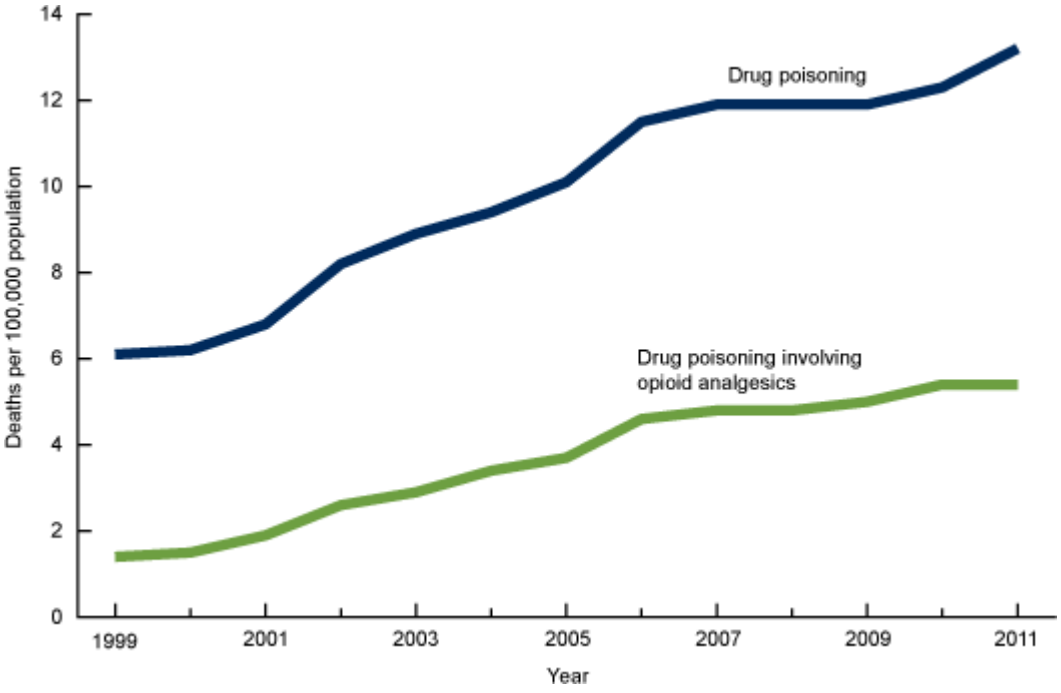


Sources: International Narcotics Control Board; World Health Organization population data
By: Pain and Policy Studies Group, University of Wisconsin/WHO Collaborating Center, 2016.

The increased availability of opioid analgesics means they are being used in ways that are unsafe or unintended. OxyContin, for example, which was designed as a slow-release, oral medication is now being crushed, then snorted or injected, with lethal consequences. To combat this, new formulations are being designed to deter some of these abuses. For example, a new formulation of OxyContin releases from 21% to 48% less opioid when tampered with (milled, manually crushed, dissolved, and boiled) than the original version (Raffa et al., 2012).

Benzodiazepines have been reported frequently in deaths involving opioid analgesics. Over the past decade, there has been an upward trend in the presence of benzodiazepines in opioid-analgesic poisoning deaths. In 1999 benzodiazepines were involved in 13% of the opioid analgesic poisoning deaths; by 2011, 31% of the opioid analgesic–related drug-poisoning deaths also involved benzodiazepines (NCHS, 2014).

Age-Adjusted Drug-Poisoning and Opioid-Analgesic Poisoning Death Rates
United States, 1999–2011



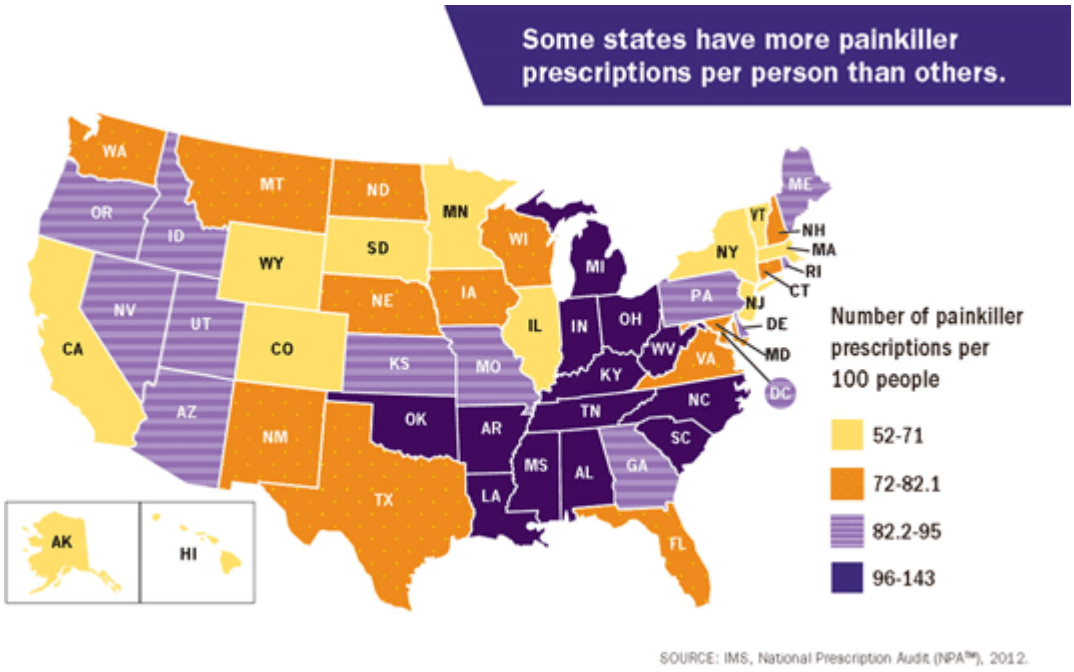
Source: NCHS, 2014.

Prescription Drug Abuse

Prescription drug abuse is the use of a medication without a prescription, in a way other than as prescribed, or for the experience or feelings elicited. According to several national surveys, prescription medications, such as those used to treat pain, attention deficit disorders, and anxiety, are being abused at a rate second only to marijuana among illicit drug users. The consequences of this abuse have been steadily worsening, reflected in increased treatment admissions, emergency room visits, and overdose deaths (NIDA, 2014b).

Prescription drug abuse can include taking a drug prescribed for someone else, taking more of the medication than was prescribed, taking medication more frequently than was directed, or altering the formulation (crushing, snorting) so as to obtain a greater amount of active agent than was originally intended (NIDA, 2012).

Prescribing rates for opioids vary widely across states. In 2012 healthcare providers in the highest-prescribing state wrote almost 3 times as many opioid painkiller prescriptions per person as those in the lowest prescribing state. Some of the increased demand for prescription opioids is from people who use them non-medically, who sell them, or who obtain them from multiple prescribers. Many states report problems with for-profit, high-volume pain clinics (so-called pill mills) that prescribe large quantities of painkillers to people who don't need them medically (CDC, 2016a).



Source: CDC, 2016a.

Opioid pain medication abuse presents serious risks: from 1999 to 2014, more than 165,000 persons died from overdose related to opioid pain medication in the United States (CDC, 2016b). In the past decade, while the death rates for the top leading causes of death such as heart disease and cancer have *decreased* substantially, the death rate associated with opioid pain medication has *increased* markedly. Sales of opioid pain medication have increased in parallel with opioid-related overdose deaths. The Drug Abuse Warning Network estimated that >420,000 ED visits were related to the misuse or abuse of narcotic pain relievers in 2011, the most recent year for which data are available (CDC, 2016b).

Having a history of a prescription for an opioid pain medication increases the risk for overdose and opioid use disorder, highlighting the value of guidance on safer prescribing practices for clinicians. A recent study of patients aged 15 to 64 years receiving opioids for chronic noncancer pain and followed for up to 13 years revealed that:

1. 1 in 550 patients died from opioid-related overdose at a median of 2.6 years from their first opioid prescription, and

2. 1 in 32 patients who escalated to opioid dosages >200 morphine milligram equivalents (MME) died from opioid-related overdose. (CDC, 2016b)

Did You Know. . .

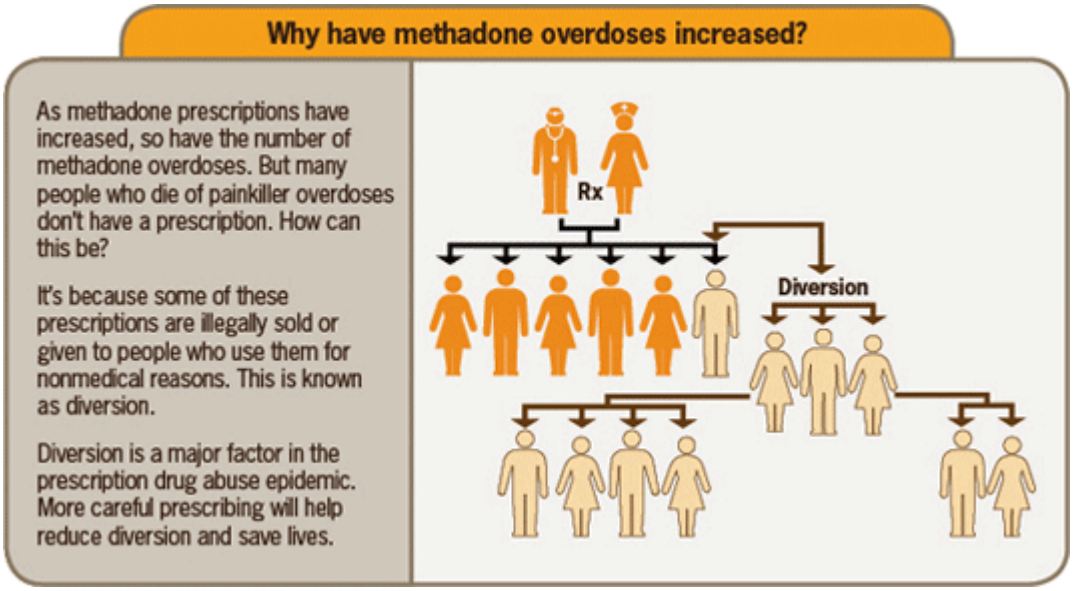
Enough prescription painkillers were prescribed in 2010 to medicate every American adult around-the-clock for one month (CDC, n.d.).

Several factors have contributed to the rise in opioid prescriptions for chronic noncancer. These include reservations against alternative pain therapies, especially those related to adverse events associated with long-term use of NSAIDs, aggressive and, at times, misleading product marketing by the manufacturers, and the widespread belief that opioid therapy carries a low risk of addiction potential (Xu & Johnson, 2013).

Methadone

Methadone is a synthetic narcotic first developed by German scientists during World War II to address a shortage of morphine. Methadone was introduced into the United States in 1947 as an analgesic (Dolophinel) and has emerged as a commonly prescribed medication for the management of pain. Methadone is also used for the treatment of opioid dependence, in which case it may be dispensed only in federally approved Opioid Treatment Programs.

Methadone has been associated with disproportionate numbers of overdose deaths relative to the frequency with which it is prescribed for pain. Methadone has been found to account for as much as one-third of opioid-related overdose deaths involving single or multiple drugs in states that participated in the Drug Abuse Warning Network, which was more than any opioid other than oxycodone, despite representing <2% of opioid prescriptions outside of opioid treatment programs in the United States; further, methadone was involved in twice as many single-drug deaths as any other prescription opioid (MMWR, 2016).



Source: CDC, 2012.

Methadone differs from most other opioids because of its long half-life, delayed onset, narrow therapeutic window, and interactions with drugs such as alcohol and benzodiazepines. Methadone is less expensive than other opioids and is increasingly being prescribed as a cost-effective alternative, partly due to pressure from insurance companies.

Fentanyl

> Drug incidents and overdoses related to fentanyl are occurring at an alarming rate throughout the United States and represent a significant threat to public health and safety. Often laced in heroin, fentanyl and fentanyl analogues produced in illicit clandestine labs are up to 100 times more powerful than morphine and 30 to 50 times more powerful than heroin.
>
> DEA Administrator Michele M. Leonhart, 2015

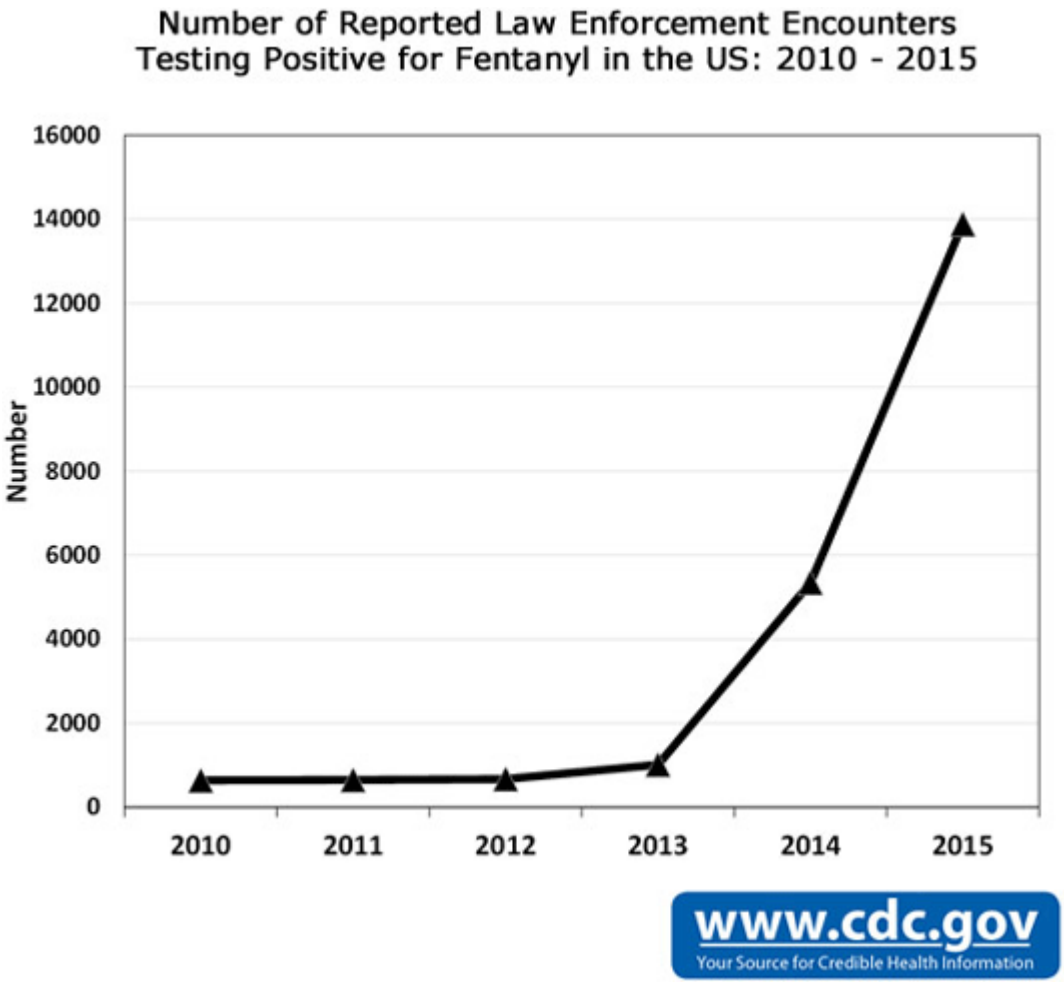
Fentanyl is a synthetic opioid analgesic that is similar to morphine but is 50 to 100 times more potent. It is a schedule II prescription drug, and it is typically used to treat patients with severe pain or to manage pain after surgery. It is also sometimes used to treat patients with chronic pain who are physically tolerant to other opioids.

Fentanyl can be absorbed through the skin (fentanyl patch), by IV injection, by mouth (for breakthrough cancer pain), and intranasally. There are two types of fentanyl:

1. Pharmaceutical fentanyl, which is primarily prescribed to manage acute and chronic pain associated with advanced cancer.
2. Non-pharmaceutical fentanyl, which is illegally made, and is often mixed with heroin and/or cocaine—with or without the user's knowledge—in order to

increase the drug's effect.

There has been a sharp increase in the number of fentanyl overdoses in recent years. Most of the increases in fentanyl deaths over the last three years do not involve prescription fentanyl but are related to illicitly made fentanyl that is being mixed with or sold as heroin —with or without the users' knowledge—and increasingly as counterfeit pills. In July 2016 the Drug Enforcement Administration (DEA) issued a nationwide report indicating hundreds of thousands of counterfeit prescription pills have been entering the U.S. drug market since 2014, some containing deadly amounts of fentanyl and fentanyl analogs. The current fentanyl crisis continues to expand in size and scope across the United States (CDC, 2016a).



This graph uses data from the DEA National Forensic Laboratory Information System (NFLIS) on the number of law enforcement drug submissions that test positive for fentanyl from 2014 to 2015 as of July 1, 2016. Source: CDC.

Buprenorphine

Buprenorphine is used in medication-assisted treatment (MAT) to help people reduce or quit their use of heroin or other opiates, such as pain relievers like morphine (SAMHSA, 2016). Buprenorphine and Suboxone (a combination of buprenorphine and naloxone) are used to treat opioid dependence. These medications work to prevent withdrawal symptoms when someone stops taking opioid drugs by producing similar effects to these drugs. In recent years, buprenorphine has surpassed methadone as a drug of diversion and abuse (Medline Plus, 2016).

Buprenorphine is the first medication to treat opioid dependency that is permitted to be prescribed or dispensed in physician offices, significantly increasing treatment access. Because of buprenorphine's opioid effects, it can be misused, particularly by people who do not have an opioid dependency. Naloxone is added to buprenorphine to decrease the likelihood of diversion and misuse of the combination drug product. When these products are taken as sublingual tablets, buprenorphine's opioid effects dominate and naloxone blocks opioid withdrawals. If the sublingual tablets are crushed and injected, however, the naloxone effect dominates and can bring on opioid withdrawals (SAMHSA, 2016).

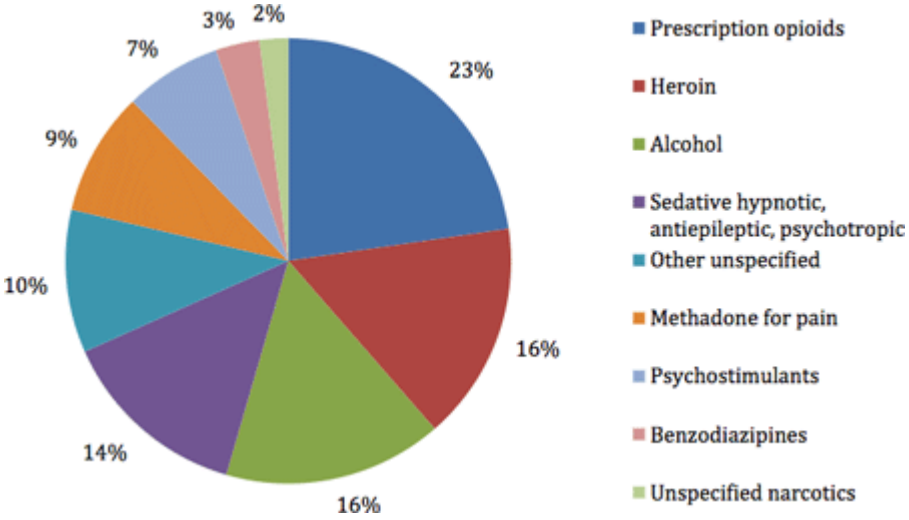
Analysis of law enforcement samples by the National Forensic Laboratory Information System indicated that, in contrast to methadone, the number of buprenorphine reports increased from 90 in 2003 (one year after buprenorphine was approved to treat opioid dependence) to more than 10,000 in 2010, but has increased more slowly since then, reaching a high of nearly 12,000 in 2013. The majority of buprenorphine reports were from the Northeast U.S. census region, while the West had the lowest number (CESAR, 2014).

Drug-Related Deaths in Oregon

In 2012 Oregon had the highest rate of non-medical use of prescription pain relievers in the nation. That year, a total of 346 individuals died due to drug overdose (OHA, 2014).

Prescription opioids accounted for about a quarter of unintentional and undetermined overdose deaths in Oregon in 2012. Methadone (prescribed for pain) accounted for 40% of the 164 prescription opioid deaths in 2012. Although methadone overdose death rates peaked in 2006 and have declined since 2006–2008, the rates in 2012 are nearly double the rates in 2000. More than 16,000 individuals had at least one prescription for methadone in 2012 (OHA, 2014).

Percent of Unintentional and Undetermined Overdose Deaths Due to Prescribed Medications, Illicit Drug, and Alcohol Oregon, 2012



Source: Oregon Health Authority, 2014.

Although drug poisoning deaths associated with illicit drugs such as heroin and cocaine have increased in recent years, prescription opioid analgesics are increasingly a factor in drug poisoning deaths. In Oregon, between 2000 and 2012:

1. 4,182 people died in Oregon due to unintentional and undetermined drug overdose (322 per year).
2. Unintentional and undetermined drug overdose death rates appear to have peaked in 2007 at 11.4 per 100,000 and declined to 8.9 per 100,000 in 2012. Nonetheless, the overdose death rate in 2012 remains 1.9 times higher than in 2000.
3. The highest rates of death due to unintentional and undetermined drug overdose occurred among Caucasian and non-Latino Oregonians for every type of drug. (OHA, 2014)

In Oregon, more males than females have died from unintentional prescription drug overdose with a ratio of 1.5 males to 1 female. Unintentional overdose death rates significantly increase for males and females starting at age 25. The peak ages for deaths are ages 45-54 (OHA, 2014).

Success in Oregon

As a Core Violence and Injury Prevention Program funded grantee, the Oregon Health Authority (OHA) reports the rate of poisoning due to prescription opioid overdose in Oregon declined 38% between 2006 and 2013. Oregon's rate of death associated with methadone poisoning decreased 58% in the same time period.

Key initiatives to address the problem include the:

1. establishment of a PDMP to track prescriptions of controlled substances;
2. implementation of prior authorization for Methadone doses >100mg/day under Medicaid;
3. education and access of lay persons to provide naloxone to persons suspected of overdose; and
4. physician and allied health care trainings about safe and effective pain care.

OHA continues to promote adoption of their PDMP, and works with health systems, insurers and other partners to increase access to medication assisted treatment and non-pharmaceutical pain care for chronic non-cancer pain.

Source: CDC, 2016a.

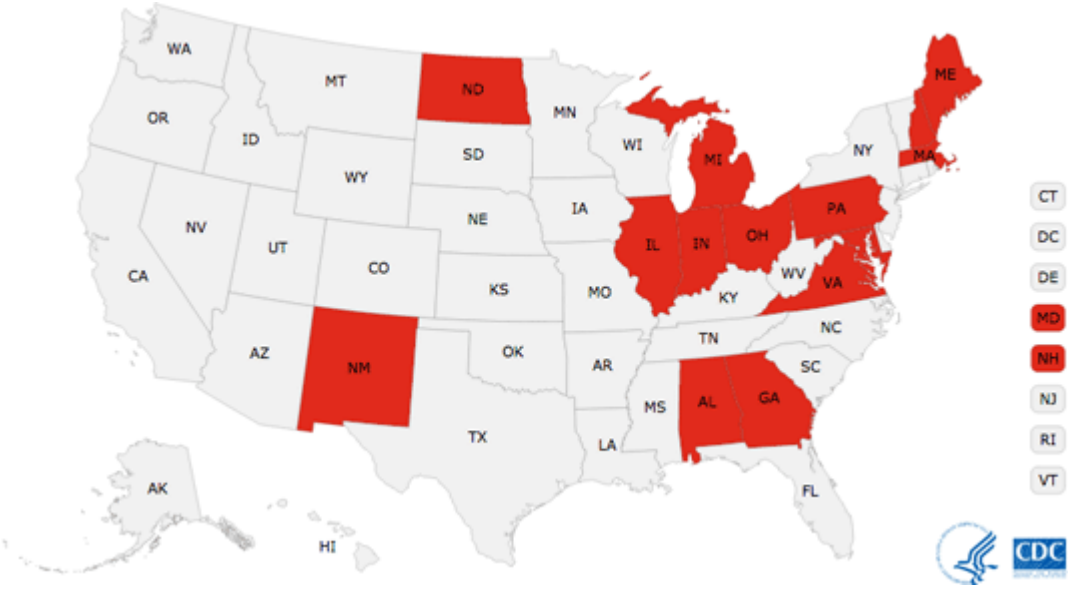
Intertwined Epidemics: Prescription Opioids and Heroin

The enormous increase in the availability of prescription pain medications is drawing new users to these drugs and changing the geography and age-grouping of opiate-related overdoses. While many drugs and medicines have potential for overdose, the use of both prescription opioids and heroin (often taken in combination with other medicines and drugs) has increased since 1999. With increased use of opioids, communities have seen increases in overdose hospitalizations and deaths and need for treatment (OHA, 2014).

Most of the current cases of opioid-related overdoses can be traced to two fronts: (1) illegal heroin consumption, and (2) the illicit use or misuse of prescription opioids. The rise in prescription opioid-related overdose deaths has been particularly alarming in rural areas; between 1999 and 2004 prescription opioid-related overdose deaths increased 52% in large urban counties and a staggering 371% in non-urban counties (Unick et al., 2013).

Significant increases in drug overdose death rates were seen in the Northeast, Midwest and South census regions. In 2014 the five states with the highest rates of death due to drug overdose were West Virginia, New Mexico, New Hampshire, Kentucky, and Ohio. Fourteen other states reported statistically significant increases in the rate from 2013 to 2014: Alabama, Georgia, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Mexico, North Dakota, Ohio, Pennsylvania, and Virginia (CDC, 2016b).

Drug Overdose Increase, 2013–2014



Statistically significant drug overdose death rate increase from 2013 to 2014, U.S. states.

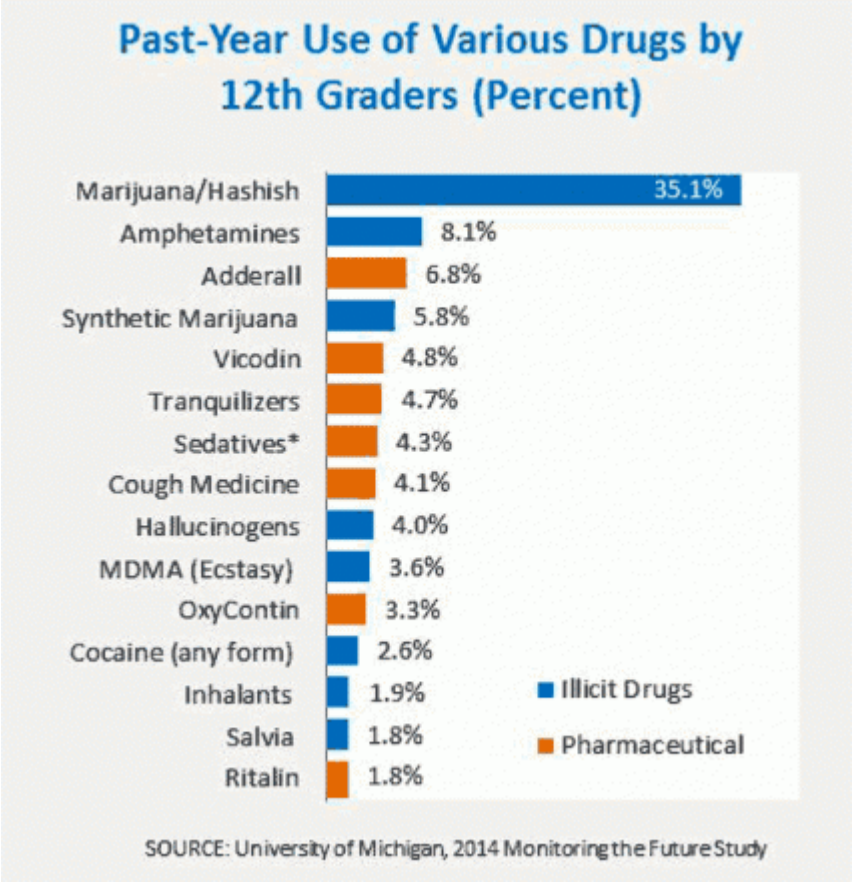
There is an evolving flux between prescription opioid use and heroin use in urban areas. Ethnographic work from Montreal shows that individuals at risk for heroin use have begun shifting to injecting prescription opioids. Additional evidence from Baltimore and Washington State suggests a high prevalence of prescription abuse in injection drug using populations, often preceding heroin use. Interestingly, recent changes to the formulation of OxyContin, the brand name long-acting form of oxycodone, have been linked to a self-reported rise in heroin use. What these studies suggest is that prescription opioid misuse and heroin use are intertwined (Unick et al., 2013).

Opioid Abuse Among Adolescents and Young Adults

Adolescents and young adults are especially vulnerable to prescription drug abuse, particularly opioids and stimulants. According to the Monitoring the Future (MTF) survey, an ongoing study of the behavior and attitudes of American youth involving nearly 45,000 8th, 10th, and 12th grade students, although there has been a decline in the use of certain illicit drugs, psychotherapeutic drugs now make up a significantly larger part of the overall U.S. drug problem than was true 10 to 15 years ago. This is in part because use increased for many prescription drugs over that period, and in part because use of a number of street drugs has declined substantially since the mid to late 1990s (Johnston et al., 2015).

It seems likely that young people are less concerned about the dangers of using these prescription drugs because they are widely used for legitimate purposes. Also, prescription psychotherapeutic drugs are now being advertised directly to the consumer, which implies that they are safe to use. Fortunately, the use of most of these drugs has either leveled or begun to decline in the past few years. The proportion of 12th graders misusing any of these prescription drugs (eg, amphetamines, sedatives, tranquilizers, or narcotics other than heroin) in the prior year continued to decline in 2015 down from its high in 2005 (Johnston et al., 2015).

Amphetamine use without a doctor’s orders—currently the second most widely used class of illicit drugs after marijuana—continued a gradual decline in 2015 in all grades, though the one-year declines did not reach statistical significance. Use of narcotics other than heroin without a doctor’s orders (measured only in 12th grade) also continued a gradual decline begun after 2009 (Johnston et al., 2015).



Source: National Institute on Drug Abuse, 2015.

Opioid Abuse Among Middle-Aged and Older Adults

Prescription opioid–related overdoses rates are increasing the most in middle-aged individuals. Older adults represent another area of concern. Although older adults currently comprise just 13% of the population, they account for more than one-third of total outpatient spending on prescription medications in the United States. Older patients are more likely to be prescribed long-term and multiple prescriptions, which could lead to misuse or abuse (NIDA, 2014b).

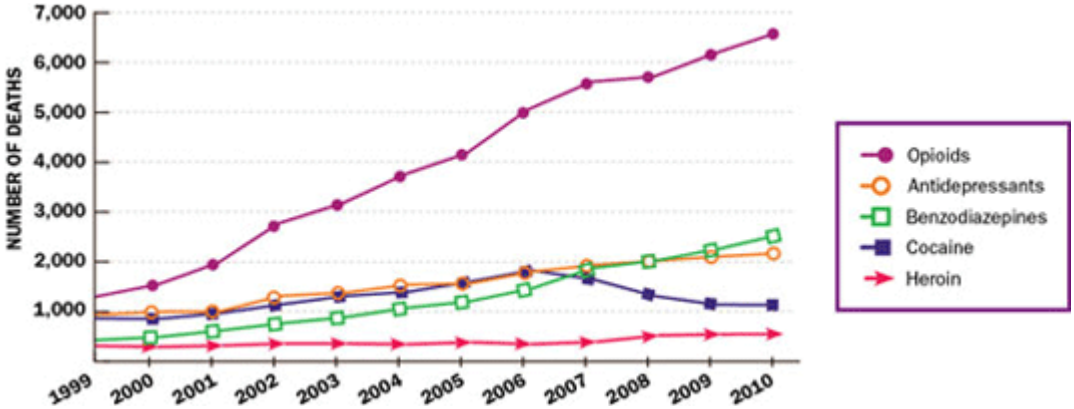
The high rates of comorbid illnesses in older populations, age-related changes in drug metabolism, and the potential for drug interactions may make any of these practices more dangerous than in younger populations. Further, a large percentage of older adults also use over-the-counter medicines and dietary supplements, which (in addition to alcohol) could compound any adverse health consequences resulting from prescription drug abuse (NIDA, 2014b).

Gender Differences in Opioid Abuse

Overall, adult men and women have roughly similar rates of nonmedical use of prescription drugs, although some studies suggest that women are more likely than men to be prescribed drugs, particularly narcotics and anti-anxiety drugs. Adolescent females are more likely than males to use psychotherapeutic drugs nonmedically. Research has also suggested that women are at increased risk for nonmedical use of narcotic analgesics and tranquilizers such as benzodiazepines (CDC, 2013b).

Prescription pain medication overdoses are increasing among women. Although men are still more likely to die of prescription painkiller overdoses (more than 10,000 deaths in 2010), the gap between men and women is closing. Deaths from prescription painkiller overdose among women have risen more sharply than among men; since 1999 the percentage increase in deaths was more than 400% among women compared to 265% in men. This rise relates closely to increased prescribing of these drugs during the past decade (CDC, 2013b).

Deaths of Women from Prescription Painkillers, 1999–2010



Prescription painkiller deaths among women have increased dramatically since 1999. Source: CDC, 2013b.

Prescription Painkillers: Growing Problem Among Women

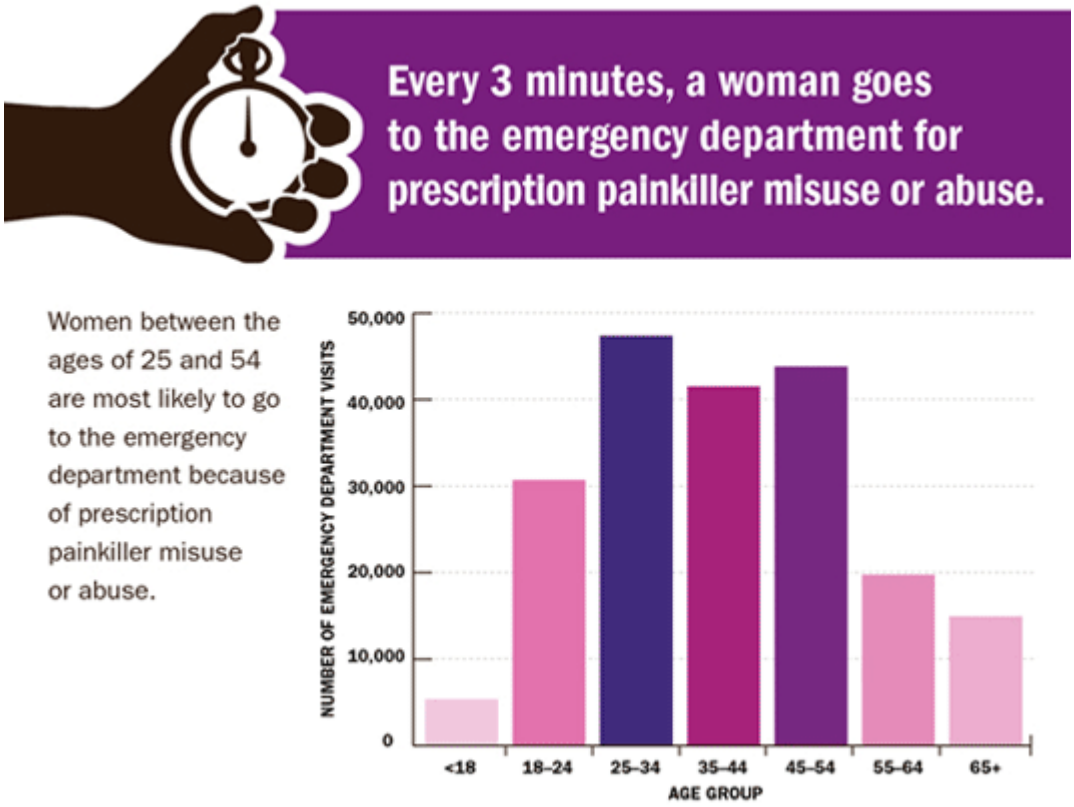
1. More than 5 times as many women died from prescription painkiller overdoses in 2010 than in 1999.
2. Women between the ages of 25 and 54 are more likely than other age groups to go to the emergency department from prescription painkiller misuse or abuse.
3. Women ages 45 to 54 have the highest risk of dying from a prescription painkiller overdose.*
4. Non-Hispanic white and American Indian or Alaska Native women have the highest risk of dying from a prescription painkiller overdose.
5. Prescription painkillers are involved in 1 in 10 suicides among women.

*Death data include unintentional, suicide, and other deaths. Emergency department visits only include suicide attempts if an illicit drug was involved in the attempt.

Prescription Painkillers Affect Women Differently than Men

1. Women are more likely to have chronic pain, be prescribed prescription painkillers, be given higher doses, and use them for longer time periods than men.
2. Women may become dependent on prescription painkillers more quickly than men.
3. Women may be more likely than men to engage in "doctor shopping" (obtaining prescriptions from multiple prescribers).
4. Abuse of prescription painkillers by pregnant women can put an infant at risk.

Source: CDC, 2013b.



Source: CDC.

Opioid Abuse in Patients with Chronic Pain

Diagnosed chronic pain patients make up less than 1% of the insured population in the United States but consume about 45% of all prescription opioids. It has been estimated that up to 40% of pain patients on chronic opioid therapy display *aberrant drug-related behaviors* (Raffa et al., 2012).

Chronic pain has been intertwined with substance abuse: 33% of individuals in a substance abuse program reported suffering from chronic pain and individuals in substance abuse treatment programs with chronic pain were significantly more likely to abuse opioids than those not reporting chronic pain. The term *rational abuse* has been put forth to describe chronic pain patients who abuse opioids because of undertreated pain, but very little is known about this population (Raffa et al., 2012).

Curbing Opioid Abuse

Medicine and drug use is highly regulated by the federal government and states to protect people from harm. Regulations require pharmaceutical companies to place warnings on packaging of over-the-counter and prescribed medicines. Federal and state regulations control who is able to prescribe medicines with a high risk for abuse. Medical training institutions teach students to prescribe controlled substances and over the counter medicines safely. Schools of pharmacy teach pharmacists to dispense medicines safely. Pharmaceutical boards regulate the practice of dispensing medicines (OHA, 2014).

Many states require prescriber education on pain and the use of pharmaceutical medicines to control pain. States regulate the age at which individuals can legally purchase and consume alcohol. Federal and state laws establish penalties to control and punish infractions of laws and regulations by individuals (patients, prescribers, and pharmacists), institutions, corporations, and criminal organizations that promote and control drug trade. Yet all of these laws and regulations have not prevented misuse, abuse, addiction, and overdoses due to the use of prescribed medicines, alcohol, and illegal drugs (OHA, 2014).

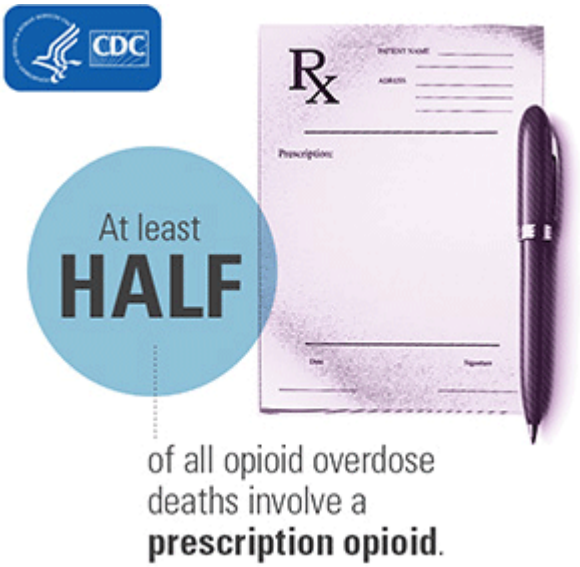
The increase in non-medical use of pharmaceuticals suggests that prevention measures—such as provider and patient education and restrictions on the use of specific formulations—have not been adequate to curb widespread abuse and misuse. Given the societal burden of the problem, additional interventions are needed, such as more systematic provider education, universal use of state prescription drug monitoring programs by providers, routine monitoring of insurance claims information for signs of inappropriate use, and efforts by providers and insurers to intervene when patients use drugs inappropriately (MMWR, 2010).

Preventing Diversion

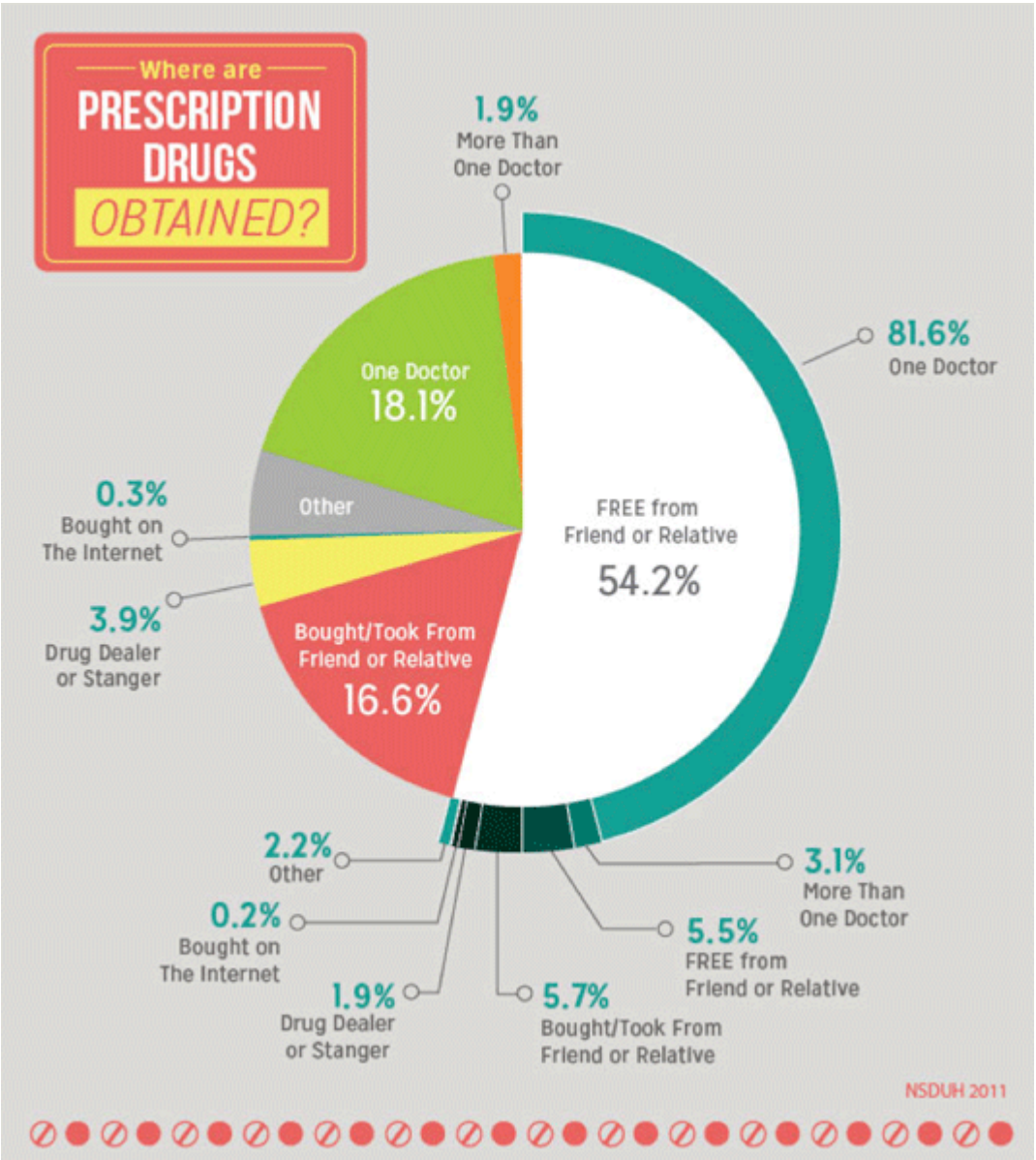
Diversion is the use of drugs for other than medically necessary or legal purposes or for non-medical or not–medically authorized purposes. Diversion involves, but is not limited to, physicians who sell prescriptions to drug dealers or abusers; pharmacists who falsify records and subsequently sell the drugs; employees who steal from inventory and falsify orders to cover illicit sales; prescription forgers; and individuals who commit armed robbery of pharmacies and drug distributors (DEA, n.d.).

Surveys reveal that diversion of prescription drugs is endemic in communities. Diversion takes place in many contexts, most often when friends and relatives share their prescription pain relievers. Fifty-four percent of those surveyed in the United States reported the source of the pain relievers that they used non-medically was free from their family and friends (OHA, 2014).

Almost all prescription drugs involved in overdoses originate from prescriptions; very few come from pharmacy theft. However, once they are prescribed and dispensed, prescription drugs are frequently diverted to people using them without prescriptions. More than 3 out of 4 people who misuse prescription painkillers use drugs prescribed to someone else. Most prescription painkillers are prescribed by primary care and internal medicine doctors and dentists, not specialists. About 20% of prescribers prescribe 80% of all prescription painkillers (CDC, 2013a).



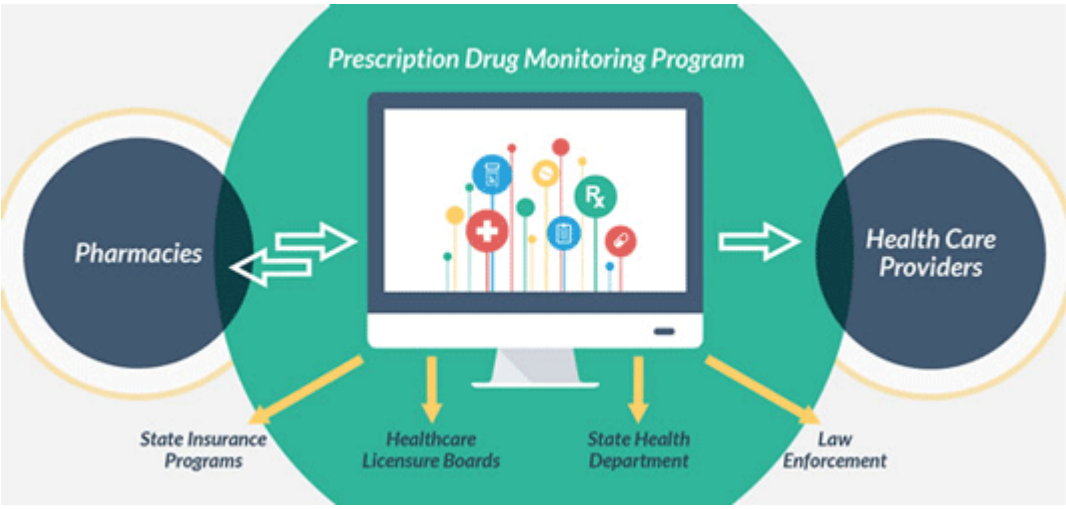
Source: CDC.



More than half of prescription drugs are obtained from a friend or relative. Source: NIDA, 2014.

A large number of new unregulated substances (designer drugs) are being abused for their psychoactive properties, often resulting in violent and unpredictable behavior. This growing phenomenon is particularly challenging, first because of the speed with which rogue chemists can modify existing drugs and market them and second because of the ease with which the Internet allows for the sharing of information about and purchase of products such as "spice" and "bath salts" (Volkow, 2013).

Prescription Drug Monitoring Programs



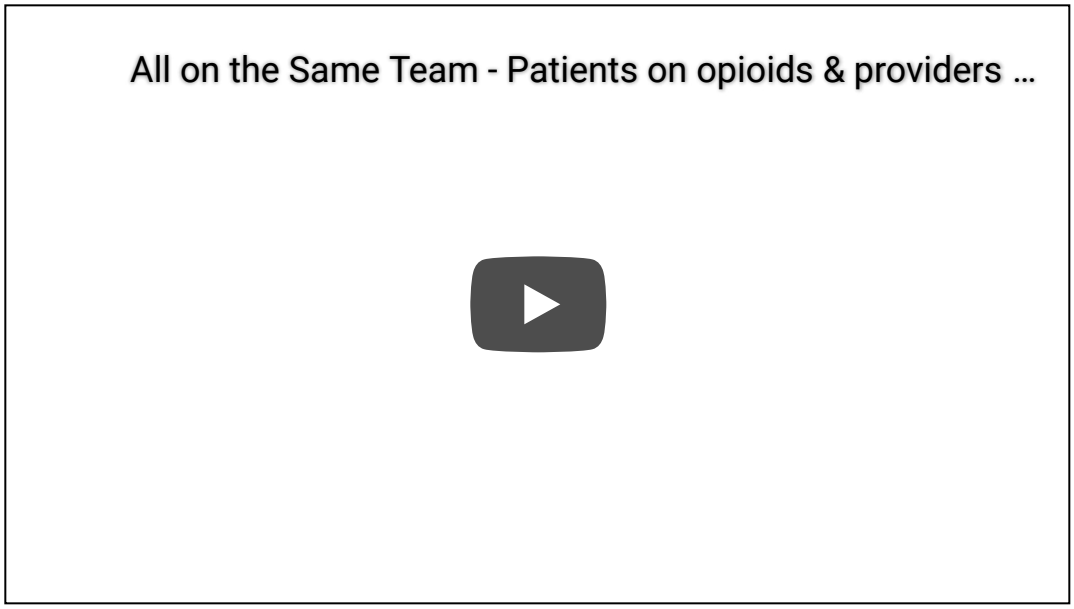
Source: cdc.gov.

AMA Recommendations

The American Medical Association acknowledges that opioid addiction is a national problem that has reached epidemic proportions. They urge physicians to take the following steps to address opioid abuse (AMA, 2016b):

1. Register and use your state prescription drug monitoring program to check your patient's prescription history.
2. Educate yourself on managing pain and promoting safe, responsible opioid prescribing.
3. Support overdose prevention measures, such as increased access to naloxone.
4. Reduce the stigma of substance use disorder and enhance access to treatment.
5. Ensure patients in pain aren't stigmatized and can receive comprehensive treatment.

All on the Same Team: Managing Chronic Pain (9:03)



Patients on opioids and providers work to improve their quality of life. Oregon Pain Guidance (2016).
https://www.youtube.com/watch?v=2kP10Z228Os&feature=youtu.be

Providing Naloxone (Narcan) to Laypeople

Since 1996 an increasing number of programs provide laypeople with training and kits containing the opioid antagonist naloxone hydrochloride (Narcan) to reverse the potentially fatal respiratory depression caused by heroin and other opioids. In 2014 the Harm Reduction Coalition (HRC), a national advocacy and capacity-building organization, surveyed managers of organizations in the U.S. known to provide naloxone kits to laypeople. Managers reported on the amount of naloxone distributed, overdose reversals by bystanders, and other program data for 644 sites that were providing naloxone kits to laypersons as of June 2014. From 1996 through June 2014, surveyed organizations provided naloxone kits to 152,283 laypeople and received reports of 26,463 overdose reversals (Wheeler et al., 2015).

Providing naloxone kits to laypeople reduces overdose deaths, is safe, and is cost-effective. U.S. and international health organizations recommend providing naloxone kits to laypeople who might witness an opioid overdose; to patients in substance use treatment programs; to persons leaving prison and jail; and as a component of responsible opioid prescribing (Wheeler et al., 2015).

Although the number of organizations providing naloxone kits to laypeople is increasing, in 2013 twenty states had no such organization, and nine had less than one layperson per 100,000 population who had received a naloxone kit. Among these 29 states with minimal or no access to naloxone kits for laypeople, 11 had age-adjusted 2013 drug overdose death rates higher than the national median (Wheeler et al., 2015).

At their annual meeting in June 2016, the AMA adopted new policies that encourage physicians to co-prescribe naloxone to patients at risk of an overdose; promote timely and appropriate access to non-opioid and non-pharmacologic treatments for pain; and support efforts to delink payments to healthcare facilities with patient satisfaction scores relating to the evaluation and management of pain (AMA, 2016a).

The new naloxone policies are intended to increase access to the overdose-reversing drug for friends and family members of patients at risk of overdose. The policy also encourages private and public payers to include all forms of naloxone on their preferred drug lists and formularies with nominal or no cost sharing. The policy supports liability protections for physicians and other authorized health care professionals to prescribe, dispense and administer naloxone. Delegates called for policies to enable law enforcement agencies to carry and administer naloxone, as many states have done (AMA, 2016a).

Probuphine: Fighting Opioid Dependence

Medications like buprenorphine and methadone have revolutionized the treatment of people with opioid use disorder. By controlling cravings and withdrawal symptoms without producing a high, these medications enable the patient to engage in treatment and make healthier choices while balance is gradually restored in brain circuits involved in reward and self-control. In people with severe disorders, these circuits are greatly disrupted (NIDA, 2016c).

One of the challenges with all addiction medications, however, is making sure patients adhere to their prescribed regimen. For the medication to be effective, the patient must take their prescription or show up at the clinic daily. This can be challenging for anyone managing life’s responsibilities, especially in times of stress. Failing at this challenge may mean relapse, which can delay recovery (NIDA, 2016c).

In May of 2016 the FDA approved a long-acting buprenorphine implant called Probuphine. This subdermal implant delivers a constant low dose of buprenorphine over six months, the first such tool in the treatment of opioid use disorder. The implant is approved for individuals with opioid dependence who have already been treated with, and are medically stable on, existing orally absorbed buprenorphine formulations. It is a valuable new therapeutic tool for this subset of patients (NIDA, 2016c).

Buprenorphine, which in numerous studies has been shown to significantly improve outcomes for patients, has previously only been available in products that must be taken daily. The Probuphine implant, created by marrying buprenorphine to a polymer, delivers the drug steadily in the body at a low dose, eliminating the need for daily dosing (NIDA, 2016c).

Traditional Nondrug Approaches to Pain Management

Professionals approaching pain management from a non-pharmacologic perspective use diverse techniques to address the needs of their clients. Those trained in the Western medical model are increasingly working in interdisciplinary teams. Within mainstream healthcare, this can include physical and occupational therapists, psychologists, and nurses —all under the direction of a physician.

Interdisciplinary Pain Rehabilitation

Interdisciplinary pain rehabilitation programs are becoming more common, especially for the treatment of chronic pain. In this model, healthcare professionals work from the same facility, with daily meetings about the patients' progress, sharing the same treatment vision and passing the same message to the patients (Kurklinsky et al., 2016).

In one such program at the Mayo Clinic Comprehensive Pain Rehabilitation Center in Jacksonville, Florida, the goal is to improve function in people with chronic pain. The program provides physical therapy, occupational therapy, a pain psychologist, and a nurse patient-care coordinator.

The physical therapy component focuses on general reconditioning with graded exposure to activity, gradual reduction of fear-avoidance behaviors, and incremental elimination of other pain behaviors. The occupational therapy component focuses on the role of moderation and balance in daily activities. The pain psychologist leads up to three group therapy sessions each day—addressing anger, anxiety, and fear; identifying pain cycles; and discussing behavioral change, pain, and depression. A nurse manages medications and medication tapering and also communicates with primary and specialty care providers outside of the pain team to assist with continuity of care into the future (Kurklinsky et al., 2016).

Physical and Occupational Therapy

As non-drug practitioners, physical and occupational therapists are well positioned to provide education on pain management for patients with acute and chronic pain. Education focuses on assessing and changing habits and patterns of movement that cause pain and dysfunction. Treatment often involves individual or small group sessions, and can include manual therapy, movement analysis, and supportive technologies and equipment. Clients are instructed to mobilize and strengthen muscles and improve patterns of movement, often focusing on restrictions in tendons, joints, and connective tissue.

Therapeutic exercise and proprioceptive training are active treatment techniques designed to address pain, improve strength and range of motion, increase blood flow, improve proprioception,* and prevent muscle guarding, spasms, and contractures. Exercise programs directed by a physical or occupational therapist are tailored to the individual patient, based on assessment of impairments, patient preference, and co-morbidities.

*Proprioception: Our unconscious sensory awareness of balance and equilibrium, our body's position in space, and the force and direction of movement. Proprioception allows us to control our limbs and move about in the world without having to consciously decide the force and direction of each movement.

Therapeutic exercise is particularly effective for patients with low back pain. It has been shown to decrease pain intensity, alleviate disability, and improve physical functions for up to 12 months following treatment (Ishak et al., 2016).

Proprioceptive training, in which passive and active sensory feedback exercises are used to improve motor function, may be more effective than traditional exercise in the treatment of low back and neck pain. For patients with musculoskeletal conditions such as chronic neck pain, knee ligament reconstruction, ankle injury, and osteoarthritis, training consists of active multi-joint or whole body movement as well as whole body balance training. Proprioceptive training proved most beneficial for improving function in knee osteoarthritis, leading to significant functional improvement (Aman et al., 2015).

Manual Therapy

Manual therapy is a specialized area within many professions, particularly physical therapy, osteopathy, and chiropractic. Manual therapists use a variety of non-surgical techniques directed to the patient's spine and extremities for the purpose of assessing, diagnosing, and treating various symptoms and conditions. Manual therapy techniques can be categorized into four major groups: (1) manipulation, (2) mobilization, (3) static stretching, and (4) muscle energy techniques. The definition and purpose of manual therapy varies across healthcare professionals (Clar et al., 2014).

Manual therapists mobilize areas of the spine or other painful joints using their hands, forearms, or elbows to apply a force with a therapeutic intent. Spinal manipulation and mobilization are commonly used treatment modalities for back pain, particularly by physical therapists, osteopaths, and chiropractors (Clar et al., 2014).

A 2010 review of scientific evidence on manual therapies for a range of conditions concluded that spinal manipulation or mobilization may be helpful for several conditions in addition to back pain, including migraine and neck-related headaches, neck pain, upper- and lower-extremity joint conditions, and whiplash-associated disorders. The review also identified a number of conditions for which spinal manipulation or mobilization appears not to be helpful (including asthma, hypertension, and menstrual pain) or the evidence is inconclusive (fibromyalgia, mid-back pain, premenstrual syndrome, sciatica, and temporomandibular joint disorders) (NCCIH, 2012).

Other Non-Drug Techniques

Other common pain management techniques used to treat and manage pain include electrical stimulation, therapeutic ultrasound, heat/cold therapy, and dry needling. These techniques are widely used by physical and occupational therapists, osteopaths, and chiropractors.

TENS

Transcutaneous electrical nerve stimulation (TENS) is used to relieve a variety of painful conditions. Controlled clinical trials have demonstrated that TENS can relieve pain, but the mechanism remains largely unknown. For this reason, clinicians use TENS largely by trial and error, and the optimal setting of stimulation parameters is still a matter of debate (Buonocore et al., 2013).

TENS (Transcutaneous Electrical Nerve Stimulator)

Transcutaneous Electrical Nerve Stimulator. Source: Wikipedia.

Therapeutic Ultrasound

Therapeutic ultrasound is used for the treatment of soft tissue injuries and pain. It involves the use of ultrasonic sound waves applied directly to a patient's skin, which causes the underlying tissue to vibrate and mildly heat, improving blood flow to the affected tissue. The thermal effect is thought to cause changes in nerve conduction velocity, increase enzymatic activity, cause changes in contractile activity of skeletal muscles, increase collagen tissue extensibility, increase local blood flow, increase the pain threshold, and reduce muscle spasm (Ebadi et al., 2012).

Non-thermal, mechanical effects are achieved through the application of pulsed, low-intensity ultrasound. In animal studies, pulsed low-intensity therapeutic ultrasound has been used with beneficial effects on cartilage repair (MacIntyre et al., 2013).

Heat/Cold Therapy

The application of heat and cold to reduce pain or promote comfort is a common intervention. However, there are few studies investigating the impact of heat or cold on pain or function. Heat is commonly used to treat pain in combination with other treatments. Thermal agents apply heat either superficially or deeply. Superficial methods include hot packs, warm whirlpools, and paraffin. Deep heat, such as ultrasound, can increase the temperature of the tissues 3 to 5 centimeters in depth. Heat has the advantage of inducing relaxation and decreasing joint stiffness, muscle spasm, and guarding. It assists in increasing range of motion and increases superficial circulation.

Dry Needling

Dry needling is the penetration of a needle through the skin without introduction of any drug (Chou et al., 2012). Dry needling uses a thin, flexible needle to stimulate underlying myofascial trigger points,* muscular, and connective tissues for the management of neuro-musculoskeletal pain and movement impairments. Dry needling is used by physical therapists to treat pain and reduce or restore impairments of body structure and function (APTA, 2013).

*Trigger point: a hyperirritable nodule or knot in the fascia surrounding the muscle.

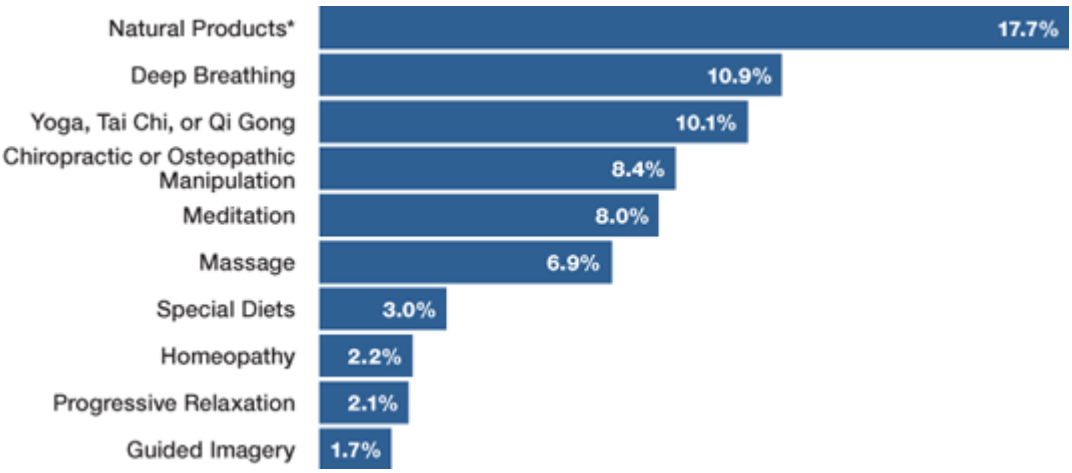
Although there is strong evidence to support the use of dry needling in the treatment of various neuromuscular pain syndromes, the American Physical Therapy Association and several State Boards of Physical Therapy have narrowed their definition of dry needling to an "intramuscular" procedure. These professional organizations have equated dry needling with the term "intramuscular manual therapy" (IMT) or "trigger point dry needling" (TDN) (Dunning et al., 2014).

Complementary, Alternative, and Integrative Therapies

Alternative practitioners make up an ever larger piece of the pain management universe. Most are trained in what would be considered complementary and alternative techniques, increasingly referred to as **integrative medicine**.

Complementary, alternative, and integrative health approaches are used to treat or manage disorders or symptoms associated with acute and chronic pain. Common complementary health approaches include mind and body interventions such as meditation, spinal manipulation, yoga, massage, tai chi, and acupuncture. A variety of natural products, including herbs, dietary supplements, and prebiotic or probiotic products are also commonly used (NCCIM, 2016a).

10 Most Common Complementary Health Approaches Among Adults—2012



*Dietary supplements other than vitamins and minerals.
Source: Clarke TC, Black LI, Stussman BJ, Barnes PM, Nahin RL. Trends in the use of complementary health approaches among adults: United States, 2002–2012. National health statistics reports; no 79. Hyattsville, MD: National Center for Health Statistics, 2015.

Integrative Pain Management

"Integrative" healthcare brings conventional and complementary approaches together in a coordinated way. Researchers are exploring the benefits of integrative health in a variety of situations, including pain management for military personnel and veterans, relief of symptoms in cancer patients and survivors, and programs to promote healthy behaviors (NCCIH, 2016a).

Complementary and integrative medicine provides patient-centered care, addressing physical, emotional, mental, social, spiritual, and environmental influences that affect a person's health. It uses the most appropriate interventions from an array of disciplines to heal illness and help people regain and maintain optimum health (Abrams et al., 2013).

Integrative medicine is a popular approach to pain management, although for a large, structured healthcare organization, integrating diverse practices can be challenging. Healthcare organizations must balance supply and demand for services as well as combine the integrative medicine program into the established culture of a large hospital (Nate et al., 2015).

In an effort to capture data on patient-reported outcomes in integrative medicine, a number of leading clinics have collaborated to form the first practice-based research network in the field: the Bravewell Integrative Medicine Research Network (BraveNet). BraveNet's initial project involved 4182 patients seeking care at nine clinical sites. The data confirmed the high utilization of integrative medicine by chronic pain patients and led to a Study on Integrative Medicine Treatment Approaches for Pain (SIMTAP). In this study, researchers reported the impact of a six-month integrative approach on chronic pain and a number of other related patient-reported outcome measures (Abrams et al., 2013).

In the SIMTAP study, practitioners at each of the sites devised treatment plans for participating chronic pain patients. All BraveNet sites include integrative physicians, acupuncturists, mindfulness instructors, and yoga instructors; some also incorporate massage therapists, manual medicine therapists, fitness and movement specialists, dieticians and nutritionists, psychologists, healing touch therapists, and other energy practitioners. The results of this study suggest that the tailored, multimodal approach to treating chronic pain combining conventional and complementary therapies improves quality of life and reduces pain, stress, and depressive symptoms (Abrams et al., 2013).

The National Center on Complementary and Integrative Health (NCCIH) and the U.S. Department of Veterans Affairs are sponsoring research to see whether integrative approaches can help active-duty military personnel and veterans experiencing chronic pain. NCCIH-funded studies are testing the effects of adding mindfulness meditation, self-hypnosis, or other complementary approaches to pain management programs for veterans. The goal is to help patients feel and function better and reduce their need for pain medicines that can have serious side effects (NCCIH, 2016a).

Some cancer treatment centers are using integrative healthcare programs such as acupuncture and meditation to help manage symptoms and side effects for patients who are receiving conventional cancer treatment. Although research on the potential value of these integrative programs is in its early stages, some NCCIH-funded studies have had promising results:

- Cancer patients who receive integrative therapies while in the hospital have less pain and anxiety.
- Massage therapy may lead to short-term improvements in pain and mood in patients with advanced cancer.
- Yoga may relieve the persistent fatigue that some women experience after breast cancer treatment. (NCCIH, 2016a)

A growing body of evidence supports the efficacy and safety of non-drug and complementary health approaches to reduce pain and increase patients' coping ability and general well-being. Many of these techniques have the potential to reduce the need for costly pain medications with harmful side effects. At a minimum, providers should have a basic understanding of the scientific evidence on complementary health approaches so that patients will not be reluctant to disclose their use.

Mind and Body Practices

Mind and body practices include a diverse group of procedures and techniques administered or taught by a trained practitioner. A 2012 National Health Interview Survey showed that yoga, chiropractic and osteopathic manipulation, meditation, and massage therapy are among the most popular mind and body practices used by adults. The popularity of yoga has grown dramatically in recent years, with almost twice as many U.S. adults practicing yoga in 2012 as in 2002 (NCCIH, 2016a).

Yoga

The various styles of yoga typically combine physical postures, breathing techniques, and meditation or relaxation. Hatha yoga, the most commonly practiced in the United States and Europe, emphasizes postures (asanas) and breathing exercises (pranayama) (NCCIH, 2016b).

Yoga typically combines a series of stretching exercises, breathing techniques, and progressive, deep relaxation.

A study involving ninety-five people aged 18 to 64 from six health centers in a low-income, predominantly minority area of Boston found that once- or twice-weekly yoga classes relieved pain, improved function, and reduced the need for pain medication in participants with chronic low back pain. The participants had moderate to severe chronic low back pain and significant related impairment. Most were unemployed or disabled, with annual household incomes of $40,000 or less. The program included home practice, keeping a log, meditation, and information on yoga philosophy (Saper et al., 2013).

Source: Photograph by Kennguru. Own work, CC BY 3.0.

Researchers found statistically significant and clinically meaningful improvements in pain and back-related function in both the once per week and twice per week groups. The most benefit was experienced within the first 6 weeks. Adverse events, mostly musculoskeletal pain, were common; they generally resolved on their own and were not serious (Saper et al., 2013).

In another study, regular and long-term practice of yoga was shown to improve pain tolerance. Findings showed that yoga practitioners have more gray matter in multiple brain regions compared with individually matched people who did not practice yoga. The study involved 14 experienced yoga practitioners, as well as 14 people who did not practice any mind-body techniques. Participants underwent a cold pain tolerance test by immersing a hand in cold water until they could no longer tolerate the pain. Researchers then asked participants about strategies they used to tolerate the pain. The researchers also conducted brain imaging scans to examine the structural differences in gray matter and white matter between the yoga practitioner group and the control group (Villemure et al., 2013).

Researchers found that yoga practitioners tolerated cold pain more than twice as long as the controls. They found no significant difference in total gray matter volume between groups, but yoga practitioners had greater gray matter volume in brain regions related to pain processing, pain regulation, and attention (Villemure et al., 2013).

The volume of insular gray matter in yoga practitioners positively correlated with the duration of yoga practice, suggesting that yoga experience contributed to these structural differences in the brain. In addition, yoga practitioners had increased white matter integrity within the left insula. Researchers observed that, to tolerate pain, yoga practitioners used cognitive strategies that are integral parts of yoga practice, such as observing the sensation without reacting, accepting the sensation, using the breath, and relaxation (Villemure et al., 2013).

Other studies suggest that a carefully adapted set of yoga poses may reduce low-back pain and improve function. One NCCIH-funded study of 90 people with chronic low-back pain found that participants who practiced Iyengar yoga had significantly less disability, pain, and depression after 6 months (NCCIH, 2016b).

Chiropractic Medicine

Chiropractic Manipulation

Chiropractic is a healthcare profession that focuses on the relationship between the body's structure—mainly the spine—and its functioning. Although practitioners may use a variety of treatment approaches, they primarily perform adjustments (manipulations) to the spine or other parts of the body with the goal of correcting alignment problems, alleviating pain, improving function, and supporting the body's natural ability to heal itself (NCCIH, 2012).

A chiropractor demonstrating an adjustment on the patient's thoracic spine. Source: Michael Dorausch, Creative Commons Attribution-Share Alike 2.0 Generic.

In the United States, chiropractic is often considered a complementary health approach. According to the 2007 National Health Interview Survey (NHIS), which included a comprehensive survey of the use of complementary health approaches by Americans, about 8% of adults and nearly 3% of children had received chiropractic or osteopathic manipulation in the past 12 months (NCCIH, 2012).

Massage Therapy

Massage therapy, as one of the complementary and alternative treatments, is defined as a therapeutic manipulation using the hands or a mechanical device that includes numerous specific and general techniques often used in sequence, such as effleurage (stroking), petrissage (kneading), and percussion. It may be the earliest and most primitive tool used to improve pain. The most ancient references to the use of massage come from China (around 2700 B.C.). Common types of massage therapy include Swedish massage, Shiatsu, Rolfing, reflexology, myofascial release, and craniosacral therapy (Kong et al., 2013).

Massage mechanically assists in venous and lymphatic flow, improves skin integrity and mobility, desensitizes tissue, and provides comfort and psychological support. Massage may be used to stretch muscles and is usually used in combination with other treatments.

Massage has proved effective in reducing pain, anxiety, and tension after cardiovascular surgery. In a study at Mayo Clinic, patients were randomized either to receive a massage or to have quiet relaxation time following surgery. Those who received massage therapy had significantly less pain, anxiety, and tension than the control group (Braun et al., 2012).

Massage Therapy

Photograph of a man massaging a woman's foot using baby oil as a lubricant. Attribution: Lubyanka, Creative Commons Attribution Share-Alike Unported 3.0 license.

Burn victims suffer some of the most severe physical and psychological pain imaginable. Turkish researchers found that massage therapy reduced pain, itching, and anxiety levels in adolescents in the burn unit of a large university hospital. Massage therapy reduced all three symptoms from the first day of the study until the last (Parlak et al., 2010).

Researchers in Spain studied the effects of massage combined with myofascial release therapy* on patients diagnosed with fibromyalgia. Patients were randomized to receive either the combination therapy or a sham treatment during 20 weekly sessions. Immediately after treatment and 1 month later, the researchers found that anxiety levels, quality of sleep, pain, and quality of life were improved in the experimental group (Castro-Sánchez et al., 2011).

*Myofascial release therapy is a type of physiotherapy requiring special training that aims to release myofascial restrictions at the sites of certain painful points called trigger points.

A 2010 AHRQ evidence report, which summarized, critically appraised, and compared the evidence on clinical benefits, costs, and harms associated with use of complementary and integrative medicine and other therapies for the treatment of adults with low back, neck, and thoracic pain, found that massage was superior to placebo or no treatment in reducing pain and disability immediately post treatment only in subjects with acute/subacute but not in subjects with chronic low back pain (AHRQ, 2014).

Meditation

Meditation refers to a group of techniques rooted in ancient religious and spiritual traditions. It is used to increase calm, promote relaxation, improve psychological balance, cope with illness, or enhance overall health and well-being. People also use meditation for various health problems, including anxiety, pain, depression, stress, insomnia, physical or emotional symptoms associated with chronic illness and their treatment.

Monk in Meditation

Phra Ajan Jerapunyo, Abbot of Watkungtaphao meditating in Sirikit Dam, Thailand. Creative Commons Attribution 3.0 Unported.

Mindfulness meditation is one of the most studied and practiced forms of meditation in America. In a study conducted by researchers at Wake Forest School of Medicine and Cincinnati Children's Hospital Medical Center, researchers recorded pain reports in 78 healthy adults during meditation with a non-meditation control in response to painful heat stimuli and intravenous administration of the opioid antagonist naloxone (a drug that blocks the transmission of opioid activity) or placebo saline. Participants were randomized to 1 of 4 treatment groups: (1) meditation plus naloxone, (2) control plus naloxone, (3) meditation plus saline, or (4) control plus saline. People in the control groups were instructed to "close your eyes and relax until the end of the experiment" (NCCIH, 2016c).

Researchers found that participants who meditated during saline administration had significantly lower pain intensity and unpleasantness ratings compared to those who did not meditate while receiving saline. Importantly, data from the meditation plus naloxone group showed that naloxone did not block meditation's pain-relieving effects. No significant differences in reductions of pain intensity or pain unpleasantness were seen between the meditation plus naloxone and the meditation plus saline groups. Participants who meditated during naloxone administration also had significantly greater reductions in pain intensity and unpleasantness than the control groups (NCCIH, 2016c).

These findings demonstrate that mindfulness meditation reduces pain independent of opioid neurotransmitter mechanisms. The researchers noted that because opioid and non-opioid mechanisms of pain relief interact synergistically, the results of this study suggest that combining mindfulness-based and drug/nondrug pain-relieving approaches that rely on opioid signaling may be particularly effective in treating pain (NCCIH, 2016c).

Traditional Chinese Medicine

Traditional Chinese medicine views the body as a system of channels through which energy flows. The Chinese call this energy *qi* or *chi*. Disease or illness is caused when the energy gets blocked or stagnates and doesn't flow freely through the body. Herbs, acupuncture, qi gong, tai chi, and Chinese massage are mind-body techniques to help unblock the flow of chi through normal channels and thereby restore health. Practitioners of traditional Chinese medicine devise individualized treatment plans based on each patient's unique diagnosis rather than following a standard intervention based on the complaint (Abrams et al., 2013).

In China, traditional medicine is one of the conservative treatments for lumbar disc herniation, and several studies have confirmed that it has certain effects on low back pain caused by lumbar disc herniation. Treatments include acupuncture, oral administration of Chinese medicine, external application of Chinese medicine, Chinese tuina (massage), and TCM-characteristic functional exercise. Clinically, these therapeutic methods are not used alone but in combination (Yuan et al., 2013).

In the treatment of pain due to lumbar disc herniation, different traditional Chinese medicine therapies have different advantages. Pain is the main symptom in the acute stage and acupuncture has good analgesic effect. Lumbar dysfunction is the main symptom in the remission stage and Chinese massage has good effect on improving dysfunction. Oral Chinese herbal formulae, external use of Chinese medicine, and Chinese herbal injection also showed good effect in relieving pain and improving dysfunction caused by lumbar disc herniation (Yuan et al., 2013).

Acupuncture

The term *acupuncture* describes a family of procedures involving the stimulation of anatomic points on the body using a variety of techniques. The acupuncture technique most often studied scientifically involves penetrating the skin with hair-thin metallic needles that are inserted a few millimeters into the skin.

Researchers from the Acupuncture Trialists' Collaboration analyzed data from randomized trials using acupuncture for chronic pain. These trials investigated the use of acupuncture for back and neck pain, osteoarthritis, shoulder pain, or chronic headache. For all pain types studied, the researchers found modest but statistically significant differences between acupuncture and simulated acupuncture approaches, and larger differences between acupuncture and non-acupuncture controls. The sizes of the effects were generally similar across all pain conditions studied (Vickers, 2012).

Acupuncture Points

Acupuncture sites. Source: NCCIH.

Acupuncture Treatment

These findings suggest that the total effects of acupuncture, as experienced by patients in clinical practice, are clinically relevant. They also noted that their study provides the most robust evidence to date that acupuncture is more than just placebo and a reasonable referral option for patients with chronic pain (Vickers, 2012).

Basic acupuncture. Photo by Kyle Hunter, public domain.

How acupuncture works to relieve pain and other symptoms is still incompletely understood, although functional MRI (fMRI) studies are beginning to provide some answers. Acupuncture seems to change the way the brain perceives and processes pain. Using fMRI in 18 volunteers, German researchers viewed pain centers in the brain while applying an electrical pain stimulus to subjects' ankles before and after acupuncture treatment. They reported that "activation of brain areas involved in pain perception was significantly reduced or modulated under acupuncture" (Theysohn et al., 2010).

Chinese Tuina (Massage)

Tuina is a form of bodywork or massage therapy that is usually used in conjunction with other types of traditional Chinese medicine. Among non-drug therapies, Chinese tuina is widely used in China for pain management. Tuina is thought to relieve pain by harmonizing the yin and yang of the organs. Tuina is considered gentle on the body and as such, patients often prefer tuina over pharmaceutical drugs (Zhang et al., 2015).

Tuina involves a wide range of technical manipulations conducted by a practitioner's finger, hand, elbow, knee, or foot applied to muscle or soft tissue at specific body locations. It incorporates many of the principles of acupuncture, including the use of acupoints. For instance, tuina often uses manual techniques such as pushing, rubbing, kneading, or high-intensity, high-frequency patting to clear energy blocks along specific meridians associated with particular conditions (Yang et al., 2014).

According to traditional Chinese medicine, pain is usually caused by obstruction of qi, and consequently of blood circulation in the affected body region. Pathogenic factors such as blood stasis, qi stagnation, phlegm, dampness, and others can be identified as causative factors in the blockage. The central therapeutic goal of tuina is to remove energetic blocks which lead to qi stagnation. This leads to increased circulation and reduction of localized edema, which helps to reduce associated pain (Yang et al., 2014).

The *A-Shi* point in acupuncture theory is the tender, local dermal or muscular area or site on the body surface which reproduces the specific pain being treated when it is gently pressed. Its location indicates the precise place where qi and blood are blocked. Manipulation at the *A-Shi* point is done with the intention of removing the energetic block there to promote the free movement of qi and improve blood circulation in the region. Studies have demonstrated that one mechanism by which this type of massage therapy appears to be clinically beneficial is by reducing inflammation and promoting mitochondrial biogenesis for repair of damaged skeletal muscle (Yang et al., 2014).

Cupping

Cupping therapy (CT) is a traditional Chinese medical treatment which has been practiced for thousands of years. The World Health Organization's defines cupping as a therapeutic method involving the application of suction by creating a vacuum. This is typically done using fire in a cup or jar on the dermis of the affected part of the body (Chi et al., 2016).

Cupping is used by acupuncturists or other therapists, utilizing a glass or bamboo cup to create suction on the skin over a painful area or acupuncture point. It is mostly used in Asian and Middle Eastern countries and has been claimed to reduce pain as well as a host of other symptoms. There are two types of cupping. Dry cupping pulls the skin into the cup without drawing blood. In wet cupping the skin is lacerated so that blood is drawn into the cup (Kim et al., 2011).

Cupping in Practice

A woman receiving fire cupping in Haikou, Hainan, China. Source: Anna Frodesiak. Public domain.

Dry cupping creates a vacuum on the skin, with the ensuing negative pressure resulting in capillary rupture. The skin of the localized area becomes flushed and may show petechiae and ecchymosis or bruising, in which the duration is therapeutically beneficial. Cupping has multiple therapeutic functions which include (1) warming the channels to remove cold, (2) promoting *qi* and blood circulation, (3) relieving swelling, (4) accelerating healing, (5) adjusting body temperature, (6) treating fibromyalgia, (7) for stroke rehabilitation, hypertension, musculoskeletal pain, herpes zoster, (8) for the treatment of facial paralysis, acne, and cervical spondylosis, and (9) alleviating pain, including chronic neck, shoulder pain, and low back pain (Chi et al., 2016).

Movement-Based Therapies

Qi Gong and Tai Chi

Tai chi and qi gong are centuries old, related mind and body practices. They involve certain postures and gentle movements with mental focus, breathing, and relaxation. The movements can be adapted or practiced while walking, standing, or sitting. In contrast to qi gong, tai chi movements, if practiced quickly, can be a form of combat or self-defense (NCCIH, 2015).

Qi gong practice includes movement, body posture, mind exercises, concentration, relaxation, and breathing exercises. Tai chi involves slow movements emphasizing balanced postures, regular breathing, and concentration, integrating mind and body. Tai chi is used to help manage stress and anger; to improve strength, flexibility, and coordination; to improve lung function; to improve balance; and to reduce pain (Selfe & Innes, 2009).

Practitioners of Tai Chi

Tai chi. Source: NCCIH, public domain.

In a study partly funded by the National Center for Complementary and Integrative Health involving patients with painful knee osteoarthritis, tai chi was as helpful as physical therapy in reducing pain and improving physical functioning. In this study, 204 patients age 40 or older, who had knee pain and proven osteoarthritis of the knee, were randomly assigned to standardized group tai chi training or standard one-on-one physical therapy. Both groups were then encouraged to continue their tai chi practice or home exercises for a total of 52 weeks. Patients in the two groups had similar decreases in pain and improvements in physical functioning after 12 weeks, and the benefits of treatment were maintained for the full 52 weeks of the study. Patients in the tai chi group had more improvement in depression symptoms and quality of life than those in the physical therapy group (NCCIH, 2016d).

Feldenkrais Method

The Feldenkrais Method (FM) is a type of exercise therapy that was developed over a period of decades in the last century by Moshe Feldenkrais. Feldenkrais put into practice an experiential process or set of processes, whereby an individual or a group could be guided through a series of movement- and sensation-based explorations (Hillier & Worley, 2015).

The purpose of the explorations is to learn to sense the difference between two or more movement options and discern which feels easier and is performed with less effort. This is compared with experiencing less favorable feedback such as pain, strain, or discomfort. Participants are encouraged to try many alternative movements to increase their awareness of distinctions and improvements (Hillier & Worley, 2015).

Because it promotes gentle movement within a comfortable range of motion, the Feldenkrais Method is particularly effective for older adults experiencing pain and stiffness from arthritis. It is taught in two parallel forms, Awareness Through Movement (conducted as a group exercise) and Functional Integration (one-on one approach) (Webb et al., 2013).

Feldenkrais for Everyday Life (3:33)

https://www.youtube.com/watch?v=uCM_C0Ly0Dc&index=4&list=PLx83c-HVFBfA5quYOUCc3F0z4ox3K054-

Single, randomized controlled studies of Feldenkrais exercises have reported statistically significant positive benefits compared to control interventions and include the following improvements:

- Improved neck flexion and less perceived effort after a single Feldenkrais lesson for neck comfort

- Reduced prevalence of neck pain and disability in symptomatic women after Feldenkrais, and
- Reduced perceived effort in Feldenkrais group for people with upper torso/limb discomfort (Hillier & Worley, 2015)

In a small Australian study seeking to understand if participation in a Feldenkrais program improved mobility and decreased pain in participants with osteoarthritis, feedback was positive. Participants were asked to comment on their experience of pain and, in particular, the pain associated with their osteoarthritis after participating in the program. Ten of the fifteen participants said their pain level had improved, three were unsure, and two said they had not noticed any difference. Comments included "The pain is continual, but I manage it better," "At the end of the session I was free from pain and felt energized," "I can experience less pain in the knees, which is where the osteoarthritis appears for my body," "The lessons…eased the pain in my lower back," "No pain in the knees when going up stairs," and "It is not a cure, however it is the best 'exercise' I have experienced for managing my osteoarthritis" (Webb et al., 2013).

Barriers to Effective Pain Management

> The [Institute of Medicine] committee [has] identified several important barriers to adequate pain care in the United States. These include the magnitude of the problem, provider attitudes and training, insurance coverage, cultural attitudes of patients, geographic barriers, and regulatory barriers.
>
> Institute of Medicine, 2011

The complexity of our fragmented healthcare system creates significant barriers to effective pain management in all areas of medicine and across all age groups. Treating pain in a system that is struggling to contain costs means better education and training, better interdisciplinary communication and cooperation, and better reimbursement for proven treatment options are desperately needed.

According to the Institute of Medicine, treatment of pain is often disorganized, ineffective, and inaccessible. Many members of the public, people with pain, and many health professionals are not adequately prepared to take preventive action, recognize warning signs, initiate timely and appropriate treatment, or seek specialty consultation when needed (IOM, 2011).

Costly, inappropriate, or inadequate procedures are sometimes carried out when other approaches—such as counseling, prevention, and self-management—might be more appropriate. There is significant variability among clinicians in applying new and even existing knowledge about pain and its management. This is reflected in the documentation of inappropriate—or indeed lack of—treatment for cancer patients, HIV/AIDS patients, and neonates, and post operative pain (Sessle, 2012).

To address these barriers, the Institute of Medicine (IOM, 2011) has recommended:

1. Providers should promote and enable self-management of pain.
2. There should be easily accessible and cost-effective educational opportunities in pain assessment and treatment in primary care.
3. Collaboration must be improved between pain specialists and primary care clinicians, including referral to pain centers when appropriate.
4. Reimbursement policies must be revised to foster coordinated and evidence-based pain care.
5. Providers must provide consistent and complete pain assessments.

The inadequate education of healthcare professionals is a major and persistent barrier to effective pain management. Despite the health professions' development of competencies in pain management, as well as the myriad guidelines and position articles on pain management issued by numerous professional bodies, core pain management competencies for pre-licensure, entry-level health professionals have not yet been established. The limited pain education that is currently provided may be ineffective because it focuses on traditional, impersonal topics such as anatomy and physiology that may have little direct relevance to the complex daily problems faced by patients, families, and clinicians (Fishman et al., 2013).

The Institute of Medicine has stated that pain education is critically important and that the federal government is in a position to contribute to improvements in patient and professional education about pain. The IOM recommends that the medical professionals (1) expand and redesign education programs, (2) improve curriculum and education for healthcare professionals, and (3) increase the number of health professionals with advanced expertise in pain care (IOM, 2011).

The American Academy of Pain Medicine has echoed the IOM recommendations by publishing a set of inter-professional core competencies for pain management, which are categorized within four domains. These domains address (1) the fundamental concepts and complexity of pain; (2) how pain is observed and assessed; (3) collaborative approaches to treatment options; and (4) application of competencies across the lifespan in the context of various settings, populations, and care team models (Fishman et al., 2013).

Understanding of the phenomenon of pain, its immediate and long-term consequences, and its effective management is lacking or is minimal in many health science curricula, including those for nursing. This lack of knowledge and effective translation into a usable form for practitioners raises the following question: Do graduates have sufficient knowledge and skills to be competent in giving appropriate pain management to their patients (Herr et al., 2015)?

Concluding Remarks on Pain

Pain remains one of the great, unaddressed issues of modern society, particularly in poor countries. One of the great hopes of modern pain treatment, opioid analgesics, has led to an epidemic of overuse and diversion in some countries while at the same time being completely unavailable to those suffering from severe pain in other countries.

Pain management policies have been developed by a number of regulatory agencies, which provide voluntary and mandatory guidelines about pain management in healthcare organizations. A balanced, multi-modal approach to pain and its management is a key concept for healthcare organizations and clinicians.

Non-opioid, opioid, and adjuvant analgesics are recommended for the treatment and management of pain. However, opioid analgesics carry a high potential for misuse, abuse, and diversion, even when prescribed for legitimate medical purposes, and clinicians must educate themselves about these issues and understand that opioid analgesics have the potential for misuse.

Consistent assessment and documentation of pain using an individualized approach is recommended by a number of organizations. Clinicians should be familiar with a variety of pain assessment tools and understand the necessity for regular assessment of pain based upon the needs of patient.

In addition to analgesics, non-pharmacologic techniques are available for the treatment of pain. Physical and occupational therapy, chiropractic techniques, traditional Chinese medication, and complementary, alternative, and integrative practices are popular and well-tolerated. Although evidence-based studies are limited, there is increasing evidence that many of these techniques successfully decrease pain, and more research into these techniques is underway.

The Institute of Medicine (2011) sums up the underlying principles related to effective management and treatment of pain, which provides a fitting conclusion to this course:

- Pain is a moral imperative.
- Chronic pain can be a disease in itself.
- Comprehensive treatment is critical.
- Interdisciplinary assessment and treatment may yield the best results.
- Prevention is important.
- Existing knowledge must be used more widely.
- Opioids present a conundrum.
- The clinician-patient relationship is of utmost importance.
- Public health and community-based approaches are invaluable.

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Post Test: OR Pain (191)

Use the answer sheet following the test to record your answers.

1. When morphine was first developed in 1805:

    a. It was unpopular because it caused constipation.
    b. It was used to treat opium addiction.
    c. It was soon shown to be ineffective for the treatment of pain.
    d. It was largely ignored.

2. Heroin was first marketed by the Bayer pharmaceutical company as:

    a. An effective asthma medication.
    b. A "reversal" drug for morphine overdoses.
    c. A less-addictive substitute for opium.
    d. A non-addictive morphine substitute.

3. Pain is often undertreated in which of the following groups?:

    a. Young and middle-aged men, pregnant women, and cancer patients.
    b. Nursing home residents, cancer patients, and Native Americans.
    c. Patients with arthritis, professional athletes, and white men.
    d. Patients newly diagnosed with HIV and middle-aged white women.

4. The Central Principle of Balance, as it applies to pain policy, represents a government's responsibility to:

    a. Remove opioid analgesics from the list of scheduled drugs, making it easier for patients to obtain pain medications.
    b. Establish a system of drug controls that prevent abuse, trafficking, and diversion of narcotic drugs.
    c. Restrict the supply of opioid analgesics (including for medical use) to prevent abuse, trafficking, and diversion.
    d. Ensure that prescribers are prosecuted for failing to prescribe opioid analgesics needed for pain management.

5. The Joint Commission's pain management standards state that:

    a. Pain and symptom management must be included in discharge planning.

b. Because pain management is a specialty, most clinicians do not need to be competent in the assessment and management of pain.

c. Clinicians should understand that pain can and does interfere with optimal levels of function and rehabilitation.

d. Evidence-based clinical practice guidelines are not necessarily needed for good pain management.

6. Intractable pain treatment acts:

a. Should be added to statute in Oregon to ensure adequate management of intractable pain.

b. State that the use of opioids for pain management is not a part of legitimate professional practice.

c. Often contain ambiguous and contradictory language and have been deleted from statute in Oregon.

d. Use the most recent evidence to restrict the use of opioid analgesics for management of severe pain.

7. Oregon’s Prescription Drug Monitoring Program is:

a. A federally run electronic database used to track physicians who prescribe and dispense controlled prescription drugs to patients.

b. A state-run electronic database used to track the prescribing and dispensing of controlled prescription drugs to patients.

c. A state-run program put into place to oversee Oregon’s medical marijuana program.

d. A program that monitors the prescribing of all Schedule I–V medications.

8. The allowed medical conditions for legal use of marijuana in Oregon include:

a. Acute pain syndromes such as tendonitis and ligament strains.

b. Severe depression and dementia related to Alzheimer’s disease.

c. Cancer, severe pain, and PTSD.

d. Any condition deemed appropriate by the clinician and patient.

9. A nociceptor is:

a. A collection of neurons in the nasal passageway responsible for sensing dangerous or noxious smells.

b. A type of motor nerve that is responsible for transmitting pain motor signals to the brain.

c. A collection of sensory nerves in the dorsal part of the spinal cord.

d. A sensory nerve ending that responds to painful or noxious stimuli.

10. Sensitization is:

a. Intense pain that lasts a relatively short time.

b. The increased responsiveness of nociceptive neurons to normal sensory input.

c. Pain from a stimulus that does not usually cause pain.

d. A type of intense, uncontrolled, peripheral pain.

11. Neuroimaging studies in patients with chronic pain have found:

a. Anatomic and functional changes in brain images.

b. No anatomic changes in the brain images of people with chronic low back pain.

c. Anatomic changes only in people with acute pain.

d. Functional and chemical changes in the brain images of matched, healthy control subjects.

12. Unrelieved or undertreated pain:

a. Is rarely an issue with HIV-infected women.

b. Decreases the risk of ileus.

c. Can produce weight gain and decreased respiratory response.

d. Can suppress immune function in cancer patients.

13. Acute pain is:

a. Usually resistant to treatments used to treat chronic pain.

b. Pain that comes on quickly but lasts a relatively short time.

c. Easily distinguished from chronic pain.

d. Generally not effectively treated with self-management techniques.

14. Chronic pain:

a. Usually responds to treatments and medications used in the treatment of acute pain.

b. Is caused by psychiatric disorders.

c. Rarely lasts more than 3 or 4 months.

d. Persists and is resistant to treatments and medications used in the treatment of acute pain.

15. Neuropathic pain:

a. Tends to be acutely painful but short lasting.

b. Is usually described as a localized, warm, throbbing sensation.

c. Should not be treated with anticonvulsants, gabapentin, or pregabalin.

d. Arises as a direct consequence of a lesion or disease affecting the somatosensory system.

16. Complex regional pain syndrome is characterized by:

a. Acute pain in a specific region of the body that usually subsides by itself.

b. A peripheral sensory nerve disorder that causes intense pain and is easily treated.

c. Intractable pain in a very specific area of the body that is out of proportion to the trauma.

d. Intractable pain that is out of proportion to the trauma or unrelenting pain that occurs subsequent to a nerve injury.

17. The self-management model of chronic pain management:

a. Is not recommended by the Institute of Medicine or the American Pain Society.

b. Is often the strategy of last resort for chronic pain patients.

c. Is supported by strong evidence for efficacy.

d. Possesses a relatively weak basis for efficacy in chronic pain care.

18. Primary care clinicians:

a. Rarely see patients with intractable pain.

b. Treat about half of chronic pain patients in the United States.

c. Have more time to assess pain than pain management specialists.

d. Generally do not prescribe pain medications.

19. Low back pain:

a. Often begins with symptoms of nausea, vomiting, and sensitivity to light.

b. Is generally not provoked by certain postures.

c. Is the fifth most common reason for all physician visits.

d. Can usually be reliably attributed to a specific disease or spinal deformity.

20. During the initial evaluation for low back pain:

a. The clinician should avoid positions that provoke the patient's pain.

b. An MRI should be ordered prior to the physical examination.

c. A specific disease or spinal abnormality should be identified.

d. Various positions should be assessed in an attempt to provoke the patient's pain.

21. The most commonly performed procedures in interventional pain management are:

a. Epidural injections

b. Conventional thermal radiofrequency

c. Disc replacement

d. Pain pumps

22. Post operative pain:

a. Is not usually related to the presence of drains and tubes.

b. Should be assessed in the morning just after the patient wakes up.

c. Can be well-managed in the hospital where 90% of surgeries occur.

d. Is influenced by multiple factors aside from the extent of the surgical trauma.

23. Breakthrough pain in patients with cancer:

a. Is unrelated to its etiology.

b. Can occur even when normal pain is relatively well-controlled.

c. Is not related to the stage of the disease.

d. Is a temporary flare of pain that occurs even when pain is well-controlled.

24. Best practice guidelines for chronic osteoarthritis focus on:

a. Surgical intervention: joint replacement and joint fusions.

b. Self-management: weight control, physical activity, and pharmacologic support for inflammation and pain.

c. Disease-modifying anti-rheumatic drugs.

d. Use of opioids to control breakthrough pain.

25. In infants, poor or improper management of acute pain has been associated with:

a. Decreased metabolic rate during painful experiences.

b. Increased chance of pain in the abdominal area.

c. Improved ability of infants to self-manage pain.

d. Delayed wound healing and increased risk of infection.

26. The pathophysiologic profile of older adults significantly changes with age. Among the changes are:

a. Decline in organ function, particularly renal and hepatic function.

b. Increases in body fat and water retention.

c. Increased ability to metabolize lipophilic and hydrophilic drugs.

d. An overall decrease in the ability to feel pain.

27. When managing pain at the end of life:

a. Patients and family members should be educated about dosing, compliance, addiction, tolerance, and side effects.

b. Involving the patient and family in establishing goals for palliative pain management is not recommended.

c. Consistent assessment of pain is not necessary because pain tends to stabilize at the end of life.

d. Opioid therapy should be avoided due to fear of causing addiction or hastening death.

28. When assessing pain:

a. A subjective measure should never be used.

b. Only physiologic measures should be used.

c. It should be done on a regular basis using a standard format.

d. Patients with chemical dependency cannot provide an accurate self-report.

29. Pain questionnaires:

a. Are the best pain assessment tools for infants and children.

b. Use words to help patients distinguish among different kinds of pain.

c. Generally measure one aspect of pain.

d. Are effective for non-English speaking patients.

30. When assessing pain in children, keep in mind that:

a. A child’s ability to describe pain increases with age.

b. Behavioral measures of pain may be needed with older children and adolescents.

c. Physiologic measures of pain are rarely related to stress.

d. A child’s ability to describe pain is fairly constant throughout the developmental stages.

31. Assessing pain in cognitively impaired adults presents certain challenges because:

a. They rarely show changes in behavior as a result of pain.

b. Their pain cannot be reliably assessed using a behavior pain scale.

c. They tend to voice fewer pain complaints.

d. They do not feel pain as acutely as younger adults.

32. When assessing pain in a patient with severe dementia:

a. Lack of facial expression may be an indication of severe pain.

b. Positive vocalizations may mask pain.

c. Remember that pain significantly decreases in older patients with dementia.

d. Being unable to console, distract, or reassure a patient with dementia may indicate the presence of severe pain.

33. When chronic pain and depression are considered together:

a. No physiologic correlation has been found.

b. Reducing pain does not lead to a reduction of depressive symptoms.

c. Depression occurs in less than 10% of chronic pain patients.

d. Pain can be a symptom, a cause, or a consequence of depression.

34. NSAIDs are a group of analgesic medications with anti-inflammatory and antipyretic actions. However, some NSAIDs:

a. Have much weaker anti-inflammatory properties than acetaminophen.

b. Have few adverse effects even when taken in high doses.

c. Can decrease the risk of cardiovascular events in patients with known cardiovascular risk factors.

d. Can cause GI complications and increase the risk of heart attacks and stroke to varying degrees.

35. Acetaminophen has good fever-reducing and analgesic properties but must be used with caution due to:

a. Its ability to irritate the GI tract, particularly when taken in large amounts.

b. Serious risk of acetaminophen-related liver damage, particularly when taken in large amounts.

c. Serious and common risk of skin reactions, even when taken in small amounts.

d. The fact that such large amounts are required to reduce pain, the risk of stroke is greatly increased.

36. The effectiveness of cannabis in decreasing pain is thought to be related to:

a. The role of the CB2 cannabinoid receptor.

b. THC, which decreases neuro-inflammation.

c. The role of the CB1 receptor.

d. The ability of cannabis to completely block pain signals.

37. Opioid medications:

a. Do not have a narcotic effect if they are prescribed for medically needed pain management.

b. Have a narcotic effect, induce sedation, and are effective for the management of many types of pain.

c. Are contraindicated for pain management in cancer patients because of excessive side effects.

d. Provide adequate pain control in all patients with few unwanted side effects.

38. Balance between benefits and harm is a critical factor influencing the strength of clinical recommendations. Two practices that are particularly harmful are:

a. The use of opioids with acetaminophen and the use of opioids with alcohol.

b. Prescription drug monitoring programs (PDMPs) and urine drug testing.

c. When opioids are co-prescribed with benzodiazepines and the use of extended release/long-acting (ER/LA) opioid formulations.

d. The use of naloxone for opioid overdose and the risk of abusing heroin after opioids have been stopped.

39. Addiction:

a. Does not occur when pain medications are prescribed by a medical professional.

b. Is easy for clinicians to recognize, especially in patients seeking treatment for chronic pain.

c. Is generally not affected by the social environment of the individual.

d. Is a chronic relapsing disease characterized by compulsive drug seeking and use despite the known, harmful consequences.

40. In treating pain patients with a history of substance abuse disorder (SUD):

a. Keep in mind that the overall prevalence of current SUD in chronic pain patients is over 90%.

b. A single-question screening test is highly sensitive and specific for identifying drug use and drug use disorders.

c. Evidence-based clinical guidelines for managing pain while addressing SUD are available but rarely used.

d. Few screening tools exist that can assist a clinician with determining the presence of or risk for substance abuse.

41. In pain patients who have a substance abuse disorder (SUD) in remission:

a. Opioids should never be used due to the risk of addiction relapse.

b. Use of opioids for pain management rarely leads to relapse of addiction.

c. Clinicians must continually assess the patient’s relative risk for relapse and monitor for its emergence.

d. Assessment of the patient’s relative risk for relapse is generally not needed.

42. Prescription drug abuse:

a. Is generally related to CNS stimulants such as amphetamine and methylphenidate rather than opioids.

b. Is the use of prescription medications in ways or amounts not intended by the prescribing clinician.

c. Is decreasing significantly in recent years due to enforcement of laws related to opioid use.

d. Is uncommon in pain patients because companies marketing prescription pain medications educate patients about the consequences of abuse.

43. Methadone differs from other opioid analgesic in that:

a. It rarely causes death from overdose because it does not act on the respiratory centers in the brainstem.

b. It has a long half-life, delayed onset, and narrow therapeutic window.

c. One dose generally relieves pain for 3 to 5 days.

d. It produces a much stronger euphoric rush than other drugs of abuse.

44. In Oregon:

a. Methadone (prescribed for pain) accounted for 40% of prescription opioid deaths in 2012.

b. Prescription opioid analgesics play only a small role in drug poisoning deaths.

c. Unintentional prescription drug overdose deaths are significantly higher among women.

d. The state has the lowest rate of non-medical use of prescription pain relievers in the nation.

45. Prescription opioid-related overdoses:

a. Are the leading cause of death for 35- to 54-year-olds.

b. Are unrelated to an increase in the availability of prescription pain medications.

c. Represent only a small fraction of the poisoning deaths in the United States.

d. Have decreased significantly in young adults.

46. Among adolescents and young adults:

a. Prescription and over-the-counter drugs were the drugs most abused.

b. Marijuana is by far the most abused drug in this age group.

c. The drug overdose epidemic is most severe in the Northeast.

d. Cocaine is abused at a higher rate than Vicodin.

47. Gender differences in the nonmedical use of prescription drugs include:

a. Women may be much less likely than men to engage in “doctor shopping.”

b. Women are more likely than men to be prescribed prescription painkillers and in higher doses.

c. The number of women who have died from prescription painkiller overdoses has decreased significantly since 1999.

d. Men become dependent prescription painkillers more quickly than women.

48. More than 3 out of 4 people who misuse prescription painkillers:

a. Get them from a primary care physician or dentist.

b. Buy them from a drug dealer or stranger.

c. Use designer drugs, which are formulated to mimic the effects of controlled substances.

d. Use drugs prescribed to a friend or relative.

49. Providing naloxone kits to laypeople has been shown to decrease deaths due to overdose. In 2016:

a. Every state has a program that provides naloxone kits to people at risk of an overdose.

b. The AMA adopted a policy that encourages physicians to co-prescribe naloxone to patients at risk of an overdose.

c. CDC reported that naloxone is ineffective in reversing the effects of opioid overdose.

d. The AMA reported that providing opioid overdose training and naloxone kits to laypeople who might witness an opioid overdose does not reduce opioid overdose mortality.

50. Interdisciplinary pain rehabilitation programs:

a. Utilize practitioners from several locations to treat chronic pain patients.

b. Have replaced physical therapy at many hospitals.

c. Have been shown to be no better than single-discipline treatments in the management of chronic pain.

d. Utilize clinicians from different disciplines working together to create a plan of care.

51. Manual therapy techniques:

a. Involve the application of gentle mechanical force and rhythmic oscillations to a painful joint.

b. Are contraindicated in patients using opioid pain medications.

c. Are recommended by the American of Physicians prior to trying self-management of back pain.

d. Are usually performed by a physician or nurse practitioner.

52. Therapeutic ultrasound, a technique commonly used by physical therapists in the treatment of pain, is thought to:

a. Have a negative effect on nerve conduction velocity.

b. Decrease collagen tissue extensibility.

c. Increase local blood flow and reduce muscle spasm.

d. Work better than opioids in the treatment of chronic pain.

53. Complementary and integrative approaches for the treatment of pain:

a. Are used by only a small percentage of American adults.

b. Should be tried only after self-management and primary care has failed to address the pain complaint.

c. Should not be mixed with or used as an adjunct to conventional care.

d. Have the potential to reduce the need for costly pain medications with harmful side effects.

54. A number of studies showed that yoga practitioners:

a. Have an increased need for pain medication.

b. Tolerate cold pain more than twice as long as the controls.

c. May have less pain tolerance than those who do not practice yoga.

d. The practice has no effect on pain tolerance.

55. Practicing mindfulness meditation appears to be associated with:

a. Decreased ability to deal with pain and stress.

b. Lower pain intensity compared to those who did not meditate while receiving a painful stimulus (saline).

c. Feeling good but likely with no physiologic effects.

d. No impact on anxiety and depression.

56. According to classic acupuncture theory:

a. The power of suggestion can be used to reduce pain and induce a deep feeling of relaxation.

b. All disorders are reflected at specific points, either on the skin surface or just below it.

c. Acupuncture is a single standardized intervention.

d. Acupuncture cannot change the way the brain perceives and processes pain.

57. A major factor contributing to limited knowledge of pain by many healthcare professionals is:

a. A desire to treat other chronic illnesses that may be more important than pain complaints.

b. Limited pain education in undergraduate and postgraduate professional programs.

c. Not enough time during an appointment to adequately assess pain.

d. Inadequate resources to adequately address pain in most patients.

Answer Sheet

OR: Pain, Healthcare's Persistent Challenge, 6 units (191)

Name (Please print your name): _____

Date: _____

Passing score is 80%

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Course Evaluation: OR Pain (191)

Please use this scale for your course evaluation. Items with asterisks * are required.

- 1 = Strongly agree
- 2 = Agree
- 3 = Neutral
- 4 = Disagree
- 5 = Strongly disagree

* Upon completion of the course, I was able to:

a. Explain the original medical use of heroin.

○1 ○2 ○3 ○4 ○5

b. Describe three patient populations that experience undertreatment of pain.

○1 ○2 ○3 ○4 ○5

c. Define government's two major responsibilities under the Central Principle of Balance.

○1 ○2 ○3 ○4 ○5

d. Discuss the purpose of Oregon's prescription drug monitoring program.

○1 ○2 ○3 ○4 ○5

e. Explain three physiologic effects of unrelieved pain.

○1 ○2 ○3 ○4 ○5

f. Define acute pain, chronic pain, and complex regional pain syndrome.

○1 ○2 ○3 ○4 ○5

g. Compare and contrast two overall approaches to pain management.

○1 ○2 ○3 ○4 ○5

h. List five common pain conditions.

○1 ○2 ○3 ○4 ○5

i. Explain one over-reaching issue encountered in the treatment of pain in special populations.

○1 ○2 ○3 ○4 ○5

j. State three practices that all healthcare professionals are encouraged to use in the assessment of pain.

○1 ○2 ○3 ○4 ○5

k. Explain how depression and anxiety are related to chronic pain.

○1 ○2 ○3 ○4 ○5

l. Identify three commonly used pharmacologic components of non-opioid analgesic pain management.

○1 ○2 ○3 ○4 ○5

m. Define prescription drug abuse, tolerance, dependence, and addiction.

○1 ○2 ○3 ○4 ○5

n. List three patient populations that have experienced large increases in prescription opioid overdose deaths in recent years.

○1 ○2 ○3 ○4 ○5

o. Summarize three approaches to curbing prescription opioid abuse.

○1 ○2 ○3 ○4 ○5

p. Identify three traditional, non-pharmacologic treatments that have been shown to be effective in the treatment of pain.

○1 ○2 ○3 ○4 ○5

q. Describe three complementary or integrative approaches that have been shown to be effective in the treatment of pain.

○1 ○2 ○3 ○4 ○5

r. Discuss three barriers to the effective management of pain in the healthcare system.

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* The author(s) are knowledgeable about the subject matter.

1 2 3 4 5

* The author(s) cited evidence that supported the material presented.

1 2 3 4 5

* This course contained no discriminatory or prejudicial language.

Yes No

* The course was free of commercial bias and product promotion.

Yes No

* As a result of what you have learned, do you intend to make any changes in your practice?

Yes No

If you answered Yes above, what changes do you intend to make? If you answered No, please explain why.

* Do you intend to return to ATrain for your ongoing CE needs?

- Yes, within the next 30 days.
- Yes, during my next renewal cycle.
- Maybe, not sure.
- No, I only needed this one course.

* Would you recommend ATrain Education to a friend, co-worker, or colleague?

- Yes, definitely.
- Possibly.
- No, not at this time.

* What is your overall satsfaction with this learning activity?

1 2 3 4 5

* Navigating the ATrain Education website was:

- Easy.
- Somewhat easy.
- Not at all easy.

* How long did it take you to complete this course, posttest, and course evaluation?

- 60 minutes (or more) per contact hour
- 50-59 minutes per contact hour
- 40-49 minutes per contact hour
- 30-39 minutes per contact hour
- Less than 30 minutes per contact hour

I heard about ATrain Education from:

- Government or Department of Health website.
- State board or professional association.
- Searching the Internet.
- A friend.
- An advertisement.
- I am a returning customer.
- My employer.
- Other
- Social Media (FB, Twitter, LinkedIn, etc)

Please let us know your age group to help us meet your professional needs.

- ○ 18 to 30
- ○ 31 to 45
- ○ 46+

I completed this course on:

- ○ My own or a friend's computer.
- ○ A computer at work.
- ○ A library computer.
- ○ A tablet.
- ○ A cellphone.
- ○ A paper copy of the course.

Please enter your comments or suggestions here: _____

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Registration Form

Please print and answer all of the following questions (* required).

* Name: _____

* Email: _____

* Address: _____

* City: _____ * State: _____ * Zip: _____

* Country: _____

* Phone: _____

* Professional Credentials/Designations:

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Your name and credentials/designations will appear on your certificate.

* License Number and State: _____

* Please email my certificate:

○ Yes ○ No

(If you request an email certificate we will not send a copy of the certificate by US Mail.)

Payment Options

You may pay by credit card or by check.
Fill out this section only if you are **paying by credit card.**
6 contact hours: $35

Credit card information

* Name: _____

Address (if different from above): _____

* City: _____ * State: _____ * Zip: _____

* Card type:

○ Visa ○ Master Card ○ American Express ○ Discover

* Card number: _____

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