

EVALUATION AND ASSESSMENT OF OPIATE PRACTICES IN GERIATRIC PATIENTS AT AN ACADEMIC MEDICAL CENTER

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(Under the Direction of Susan C. Fagan)

ABSTRACT

Background: In the United States, the opioid crisis has been considered a major public health concern. In 2015, approximately 11.5 million U.S. citizens reported misusing prescription opioids. The purpose of this evaluation is to compare the pain management practices in an academic medical center with the current guidelines, focusing on prescription opioids in geriatric patients. **Methods:** Three months medication orders in 2018 were used, targeting prescription opioid analgesics/opioid analgesic combinations. Patients included were geriatric patients over ≥ 65 years. **Results:** AGS guidelines recommend acetaminophen as the drug of choice for musculoskeletal pain. Our analysis showed that patients who had musculoskeletal disease pain were the highest users of opioid prescriptions. Our results showed that tramadol had the highest number of PRN prescriptions. AGS recommend that patients taking opioids should be reassessed for safe medication use; however, tramadol had the highest number of refills with 62 individual prescription up to 5 refills.

INDEX WORDS: Opioid; Addiction; Misuse; Pain; Geriatrics

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BY

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Pharm.D., Taif University, Saudi Arabia, 2014

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DEDICATION

I dedicate this thesis to my family, my father, Abdullah Alshuqayhi, my mom, Najat Beyari, my brother and my sisters, Saad, Sara, and Salwa, for being supportive throughout my master's degree journey.

My parents have always been encouraging me to pursue my dreams. They helped me to overcome all of the obstacles that I have faced in my life. They have taught me that with determination and persistence everything can be possible to accomplish. My parents are my role model of all time because they have sacrificed a lot just to make sure that my future is secured. They have raised me on three concepts: Family, Respect, and Integrity. Finally, I thank God who gave me this amazing and supportive family, and I thank him for giving me the opportunity to complete my master's degree.

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CHAPTER ONE

1. Introduction and Literature Review:

1.1. Narcotic Analgesics and the Risk of Addiction:

Narcotic analgesics are medications that are known for their potency as pain relievers. They are compounds that bind to opiate receptors and exhibit their effect to modulate pain through the central and peripheral nervous systems (Rosenblum, Marsch, Joseph, & Portenoy, 2008). Tolerance is considered a common result of the alterations that occur in the brain after opioid misuse (Kosten & George, 2002). Sometimes these alterations can outweigh the beneficial effects of opioids as pain relievers and instead cause health deterioration. Addiction can be caused by consistent misuse of opioids without a compelling indication, such as chronic severe pain (Kosten & George, 2002). Prescription opioids are one of the primary contributors to addiction and overdose deaths (Koenig, 2018). The dramatic increase in opioid addiction and overdose deaths among citizens of the United States are the main reasons that the government declared the opioid crisis in 2017 (Koenig, 2018).

1.2. Impact of the Opiate Crisis in the United States:

In the United States, the opioid crisis has been considered a major public health concern with devastating implications for several years. According to the Substance Abuse and Mental Health Services Administration (SAMHSA), in 2015, approximately 11.5 million U.S. citizens reported misusing prescription pain

management medications such as opioids (Lipari, Williams, & Van Horn, 2013). In 2013, the Center for Disease Control and Prevention (CDC) estimated that the cost of the crisis was approximately \$78.5 billion per year (Florence, Zhou, Luo, & Xu, 2016). This immense cost comprises the costs of healthcare services, dependence treatment, loss of productivity due to dependence and confinement, and the criminal justice system.

1.3. The History of the Opiate Epidemic:

In the early 1800's, pain was long believed to be associated with aging (Meldrum, 2003). At that time, opioid use in nonmalignant pain was common without any regulations. Subsequently, the Harrison Narcotic Control Act of 1914 was issued to regulate the misuse of opioids, which in return raised awareness among clinical practitioners and the public. As a result, the common phrase "opiophobia" was used in most literature. As a consequence, in the 1950s, most healthcare providers undertreated severe pain due to apprehension regarding misuse and addiction development from opioids (Morgan, 1985). In the 1980s, opioids were believed to be non-addictive medications if they were used therapeutically (Porter & Jick, 1980) but, in the 1990s, published literature indicated that severe pain such as postsurgical or cancer pain remained undertreated (Melzack, 1990). Consequently, opioid analgesic prescriptions increased even for chronic non-malignant pain. Moreover, the American Pain Society issued their famous campaign, titled "pain as the fifth vital sign," which encouraged one to identify and properly treat pain, which was also supported by the Veteran's Health Administration in 1999 (Mularski et al., 2006). By this stage, the pharmaceutical companies that

manufactured narcotics and narcotic analgesic combinations heavily promoted the use of prescription opioids to control and relieve pain. Opioid prescription use increased sharply due to the false assurances that were given by the pharmaceutical manufacturers to the prescribers that the risk of addiction to medically manufactured opioids was low (Van Zee, 2009). Additionally, in 2000, the Joint Commission released pain management guidelines to encourage pain treatment (Baker, 2017). Moreover, the Federation of State Medical Boards and the Drug Enforcement Agency were less strict about prescription opioid analgesics (Joranson, Gilson, Dahl, & Haddox, 2002). All of this encouragement for proper pain management precipitated unintentional consequences, including the opioid epidemic and the misuse of prescription opioids (Frasco, Sprung, & Trentman, 2005).

1.4. Demographics of Patients who Misuse Opiates:

Patients who received an opiate prescription in an inpatient setting and were then discharged after hospitalization are at a high risk of misusing prescription opioids (Jena, Goldman, & Karaca-Mandic, 2016). Also, other research showed that patients who have a history of illegal drug use or depression are at increased risk of prescription opioid overuse (Cochran et al., 2016). Over several decades, the overuse of prescription opioids among all ages has increased dramatically, including geriatric patients ages over 65 years old (Martin, 2008).

1.5. Pharmacokinetic Changes with Aging and the Reasons for the Elderly Being at High Risk of Prescription Opioids Misuse:

The pharmacokinetic parameters of many medications change as a result of increasing age. First, gastrointestinal changes are commonly observed with aging. Absorption may be delayed because of the slowing of gastrointestinal transit time and the bowel dysmotility due to opioid therapy can worsen this. Second, changes in the distribution of fat-soluble medications (higher proportion of fat) is commonly noticed with aging. Third, impaired liver metabolism with aging can cause the accumulation of medications in the body. Fourth, a decreased glomerular filtration rate with aging may result in a decrease of the excretion of various medications. Finally, increased anticholinergic adverse effects are commonly noticed with aging (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009). Due to these pharmacokinetic and pharmacodynamics changes, elderly patients are at increased risk of the misuse and adverse effects from opioid analgesics.

1.6. Potential Adverse Effects of Long-Term Opioid Therapy in Elderly:

Serious adverse effects that could lead to therapy discontinuation are commonly observed in geriatric patients. Respiratory depression, as a result of long-term opioid therapy or an interaction with other sedative drugs such as benzodiazepines, alcohol, and barbiturates, is the most severe such adverse event. Moreover, opioid therapy may decrease the production of some hormones, such as testosterone, which can cause depression and decreased sexual drive. Long-term prescription opioid treatments could result in misuse and finally addiction. Signs of addiction include excessive use, persistent use even with harm, and craving (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in

Older, 2009). Opioid Risk Tools (ORT) and Screener and Opioid Assessment for Patients with Pain (SOAPP) are tools that assess the predisposed risk factors and it is hoped that their use could minimize prescription opioid misuse (Webster & Webster, 2005) (Butler, Fernandez, Benoit, Budman, & Jamison, 2008).

1.7. Types, Prevalence, and Causes of Pain in Geriatrics:

Geriatric patients are individuals whose age is either equal or above 60 or 65 years old (Gagliese, 2009). Older patients typically experience changes in their physical and psychological states (Gagliese, 2009). With these changes, pain is generally a sign of the deterioration in overall health. Pain can be classified into two subcategories: acute and chronic pain. Acute pain lasts less than 3 to 6 months and occurs in situations such as acute injury, while chronic pain lasts more than 3 to 6 months and is typically associated with a chronic disease or has no physical origin, such as psychological pain (Ali et al., 2018; Grichnik & Ferrante, 1991).

In general, older patients suffer from an increased incidence of pain (Patel, Guralnik, Dansie, & Turk, 2013). Precisely, geriatric patients with depression, obesity, and musculoskeletal conditions such as degenerative spine and arthritis are at higher risk of pain. Additionally, older female patients are also at increased risk of pain (Patel et al., 2013). Moreover, neuropathic, ischemic, bone fracture, and cancer pain are the most common forms of pain in elderly patients (Ali et al., 2018).

1.8. Recommended Pharmacological Approaches for Pain Management in Geriatric Patients:

1.8.1 Nonopioid medications:

Acetaminophen is considered the first-line therapy for pain management in the elderly due to its high safety profile relative to other pain medications. Acetaminophen has no adverse effects on the gastrointestinal, renal, or cardiovascular systems when used in recommended doses (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009). As recommended by the American Geriatric Society, an increase in the dosage of acetaminophen to 1,000 mg is recommended before switching to another potent pain management medication. Acetaminophen or Nonsteroidal Anti-inflammatory Drugs (NSAIDs) are recommended to treat persistent musculoskeletal pain, which is one of the most common causes of pain in geriatric patients (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009). NSAIDs are recommended for the pain management that is associated with inflammatory conditions. Some cautions should be considered while using NSAIDs in elderly populations who have chronic kidney or cardiovascular diseases: Patients who are using NSAIDs or selective COX 2 inhibitors should be monitored closely and assessed regularly for gastrointestinal, renal, or cardiovascular toxicity.

1.8.2. Opioid medications:

Opioid medications should be considered only in geriatric patients who suffer from moderate to severe pain that is associated with functional impairment or impaired quality of life. Around the clock dosages should be considered in elderly patients who are consistently in pain. All healthcare providers should assess any possible adverse events that could be associated with opioid therapy. All patients who are using

prescription opioids should be monitored and assessed regularly for the attainment of treatment goals, side effects, and safe medication use (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009).

1.9. Purpose of the Study:

The purpose of this evaluation is to assess pain management and care practices, focusing on prescription opioids in geriatric patients at an Academic Medical Center.

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Specific aim

Determine the degree and nature of use of opiates in the management of chronic pain in elderly patients at an Academic Medical Center:

Perform an analysis on medication orders, over a time frame of three months in 2018, to evaluate the pain management practices in elderly who are ≥ 65 years old. Moreover, compare the results of the analysis with the current guidelines for the pain management in geriatric patients, in order to identify areas for potential improvement.

Chapter 2

**Evaluation and Assessment of Opiate Practices in Geriatric Patients at an
Academic Medical Center**

CHAPTER 2

Evaluation and Assessment of Opiate Practices in Geriatric Patients at an Academic Medical Center

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Evaluation and Assessment of Opiate Practices in Geriatric Patients at an Academic Medical Center

ABSTRACT

Background: In the United States, the opioid crisis has been considered a major public health concern. In 2015, approximately 11.5 million U.S. citizens reported misusing prescription opioids. The purpose of this evaluation is to compare the pain management practices in an academic medical center with the current guidelines, focusing on prescription opioids in geriatric patients. **Methods:** Three months medication orders in 2018 were used, targeting prescription opioid analgesics/opioid analgesic combinations. Patients included were geriatric patients over ≥ 65 years. **Results:** AGS guidelines recommend acetaminophen as the drug of choice for musculoskeletal pain. Our analysis showed that patients who had musculoskeletal disease pain were the highest users of opioid prescriptions. Our results showed that tramadol had the highest number of PRN prescriptions. AGS recommend that patients taking opioids should be reassessed for safe medication use; however, tramadol had the highest number of refills with 62 individual prescription up to 5 refills.

INDEX WORDS: Opioid; Addiction; Misuse; Pain; Geriatrics

Introduction

Opioid misuse is considered one of the major causes of death in the United States, with more than 130 deaths every day (CDC/NCHS, Mortality). In 2017, about 1.7 million people were harmed because of the opioids misuse (Substance Abuse and Mental Health Services Administration; 2018). One major source of opioid availability is prescription opioids, prescribed to patients who are in chronic pain, resulting in approximately 21 to 29 percent of misusers (Vowles et al., 2015). This adds up to 12 percent of new opioids abuse among patients who have been prescribed an opioid medication (Vowles et al., 2015). Therefore, in order to spread the awareness and control this devastating problem, the government of the United States declared the opioid crisis as a major public health concern in 2017 (Koenig, 2018).

Chronic pain is the type of pain that persists for more than 3 to 6 months (Ali et al., 2018). It can result in a huge impact on quality of life among patients (Macfarlane et al., 2012), and it is the most common condition that leads to the disability in older patients (Soldato et al., 2007). Prior studies have proven that geriatric patients are at increased risk of the incidence of chronic pain (Malec & Shega, 2015). A systemic review showed that the incidence of pain could reach its maximum point at the age of 65 and more (Gibson & Lussier, 2012). Therefore, proper treatment for chronic pain in geriatric patients and the avoidance of repetitive use of opioid prescriptions are recommended by following the current guidelines such as Beers Criteria and American Geriatric Society guidelines (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009) (By the American Geriatrics Society Beers Criteria Update Expert, 2019).

As is known, geriatric patients are at increased risk of adverse events from opioid medications due to their functional impairment with aging. Slowing in gastric empty time, the decrease in both liver metabolism and renal clearance, and the change of drug distribution are main functional changes that occur with aging. Consequently, opioid addiction, overdose, misuse, and adverse effects could develop more frequently in geriatric populations (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009).

In general, opioid addiction is chronic brain disease characterized by an individual pathologically pursuing reward and/or relief by opioid use. It also characterized by a powerful, compulsive urge to use opioid drugs, even when they are no longer required medically. Opioid addiction happens when repetitive high opioid doses stimulate the mu receptor in the brain. Opioids could cause two significant alterations that lead to addiction. First, opioid tolerance which is the need of higher doses to reach the pleasure effect of previous low doses. Second, opioid dependence which happens when withdrawal effect occurs (Kosten & George, 2002).

In the current evaluation, medication orders were used that captured different opioid medications to evaluate and assess chronic pain management practices in elderly patients compared to current treatment guidelines.

1. Patients and methods:

1.1. Patient Population:

A total number of 668 patients, 202 patients in April, 223 patients in May, and 243 patients in June, were included in the study. All were patients of AU Medical Center and its related clinics. Eligibility included geriatric patients at the age of ≥ 65 years who had malignant or nonmalignant chronic pain. All emergency room/observation patients were excluded from the study. Malignant pain included patients who had chronic cancer pain. Nonmalignant chronic pain included patients with one or more of the following conditions: amyotrophic lateral sclerosis, bone fracture, cardiac disease, foot pain, herpes zoster, Human Immunodeficiency Virus (HIV), ischial pain, kidney pain, knee pain, lumbar/spinal stenosis, lymphadenopathy, migraine headache, neuropathy, Paget's bone disease, pancreatitis, radicular pain, restless leg syndrome, suprapubic pain, surgery pain, trigeminal neuralgia, and musculoskeletal diseases. Musculoskeletal diseases included: arthritis, arthralgia, avascular necrosis of the hip, degenerative disease, fibromyalgia, gout, intervertebral disc disease, lower back pain, lumbar spondylosis, mitochondrial myopathy, and myofascial pain.

1.2. Medication Orders generation:

Medication orders, over a time frame of April, May, and June of 2018, were used to evaluate pain management practices, targeting prescription opioid analgesic and opioid analgesic combinations. The medication orders included in the study were discharge and outpatient prescriptions. The source of the medication orders was the QS/1 and Cerner pharmacy programs. QS/1 is a pharmacy software system that

provides an effective management of pharmacy prescriptions. Cerner is pharmacy software designed to help pharmacists deliver effective and safe medication therapy to patients by accessing the patient's prescription history. The electronic medical record was accessed to identify the indication for the opiate prescription in each patient.

1.3. Opioids Prescriptions:

The medication orders captured hydromorphone, methadone, morphine, oxycodone, tramadol, fentanyl, acetaminophen-codeine, hydrocodone-acetaminophen, and oxycodone acetaminophen. Prescriptions of schedule II medications, according to the drug classification by the United States Drug Enforcement Administration (DEA), were single prescriptions. Schedule III-V medications could include refill prescriptions.

1.4. Statistical Analysis:

Microsoft Excel data analysis was used to analyze and determine the degree of prescription opioid practice in the Academic Medical Center, focusing on geriatric patients.

2. Results

2.1. Tramadol was most frequently prescribed opioid medication for all of the three months of medication orders followed by acetaminophen-oxycodone.

Medication	Total # of Prescriptions for April 2018	Total # of Prescriptions for May 2018	Total # of Prescriptions for June 2018	Grand Total # of Prescriptions
Tramadol	54	60	75	189
Acetaminophen-oxycodone	51	52	45	148
Acetaminophen-hydrocodone	35	38	47	120
Oxycodone	28	39	29	96
Morphine	16	12	19	47
Acetaminophen-codeine	5	7	12	24
Fentanyl	9	7	10	26
Methadone	3	3	3	9
Hydromorphone	1	5	2	8

2.2. Tramadol had the highest average number of tablets dispensed per prescription per month.

Our analysis showed that tramadol was associated with the highest number of tablets dispensed per prescription for the months of April and May with an average of 104 and 89 tablets, respectively; followed by oxycodone with an average number of 84 and 69 tablets and capsules, respectively (Figure 1A). In the June medication orders, hydromorphone had the highest average number with 112 tablets. However, the number of prescriptions was 2 which was not considered significantly high. Moreover, oxycodone scored the second highest narcotic medication that was dispensed in an average of 96 tablets followed by tramadol 80 tablets and capsules (Figure 1A).

2.3. *High number of cases of chronic pain related to musculoskeletal diseases associated with opioid prescribing.*

The relationship between several conditions and the number of opioid prescriptions was evaluated. During the month of April, May, and June, nonmalignant pain associated with the musculoskeletal diseases had the highest number of cases associated with opioid prescribing with 37%, 29%, and 39% of the total patients, respectively. Malignant pain associated with different types of cancer came after with 18%, 19%, and 21% of the total cases per report; correspondingly (Figure 2A).

2.4. *Tramadol had the highest number of prescriptions associated with musculoskeletal diseases.*

To determine which opioid medication was prescribed the most in different pain conditions, we assessed the three-month medication orders and found that tramadol had the highest number of prescriptions associated with musculoskeletal

diseases with 38%, 37%, and 45%, respectively; followed by acetaminophen-hydrocodone with 28%, 25%, and 21% total number of prescriptions for the month of April, May, and June, respectively (Figure 3A). On the other hand, the opioid medications that were prescribed for different types of cancer were morphine, oxycodone, and acetaminophen-oxycodone (Figure 3B).

2.5. *Scheduled vs as needed (PRN), refill prescriptions.*

Our analysis determined that tramadol was associated with the highest number of prescriptions that were ordered as prn prescriptions followed by acetaminophen-oxycodone and acetaminophen-hydrocodone with 87%, 87%, and 70% of the total prescriptions for the month of June 2018, respectively (Figure 4A). Additionally, tramadol prescriptions had the highest inclusion of refills by 83% of the total prescriptions for June report (Figure 4B).

2.6. *Percent of narcotic analgesics vs narcotic analgesic combinations orders.*

The analysis of June order showed that the percent of orders that were narcotic analgesics were higher than narcotics analgesic combinations with 58% vs 42%, respectively (Figure 4C).

3. Discussion & Conclusion

Between 1950 and 1990, the concept of undertreated pain was popular because of the phobia of using opioid medications and their high risk of addiction (Schnoll & Weaver, 2003). Later, the behavior of the undertreatment of severe pain conditions changed as a result of the encouragement to improve the quality of life (Reid et al., 2002). Therefore, the increase in prescription of opioids was one of the main reasons that lead to the development of opioid crisis.

According to the CDC guidelines for prescribing opioids for chronic pain, all opioid medications are not preferred to use in chronic pain, however using nonpharmacological and nonopioid pharmacological approaches are thought to be preferred (category A recommendation type 3 evidence). This applies to all patients and emanates from observational studies or randomized clinical trials with major limitations (Dowell, Haegerich, & Chou, 2016). Our results indicate that some prescribed opioid medications for chronic pain had high average number of tablets/capsules such as tramadol that averaged 104 tablets/capsules per prescription for the month of April, yet, within the normal range of medication dispensing because the recommended dose of tramadol can be up to 50-100 mg orally every 4-6 hours for chronic pain (Medscape, 2019). However, oxycodone was the second highest opioid medication with an average of 96 tablets/capsules dispensed per prescription for the month of June. It is high considering recommended dose for chronic pain which is 10 mg of the controlled release tablets/capsules every 12hr and can be titrated every 1-2 day by the increase of 25-50% with 12hr dosing interval. Moreover, a dose of more than 40 mg or total daily

dose of more than 80 mg are only used for patients who are tolerant to opioid medications (UpToDate, 2019, April).

Pain that is related to various musculoskeletal diseases is considered the most common source of pain in elderly (Ghenou, Cepparo, Rosca, & Cotten, 2012). According to the American Geriatric Society (AGS) guidelines for the management of pain in elderly, acetaminophen is considered the safest and drug of choice in musculoskeletal diseases pain (high quality of evidence; strong recommendation) (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009). Even though the guidelines recommended acetaminophen as the first-line of therapy for these conditions, our results for the three month reports demonstrated that among all of the 668 patients, patients who had nonmalignant pain due to any musculoskeletal diseases had the highest number of opioid prescriptions with 74, 65, and 94 prescriptions more than the malignant cancer pain which were 37, 42, and 50 prescriptions. Whether these patients had failed or were intolerant to acetaminophen was unclear from the data we collected and would be an important consideration for future investigation.

The AGS guidelines recommended that patients with continuous pain on a daily basis may be treated with around-the-clock opioid therapy while our results showed that tramadol had the highest number of prescriptions that were written as PRN among all the other medications (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009). Moreover, the AGS recommended that patients taking opioids should be reassessed for treatment goals, adverse effects, and safe medication use (moderate quality of evidence,

strong recommendation) (American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older, 2009), however, the analysis showed that tramadol, which is classified as schedule IV medication according to the DEA, had the highest number of prescription refills with 62 individual prescriptions and up to 5 refills. Use of refills could lead to excessively long duration of use, if not closely monitored and reassessed by the provider. Nevertheless, the DEA has recommended that the medications that classified as schedule II are the only medications that should have one prescription without any refills (Drug Enforcement Administration, 2019).

Oral narcotic analgesic combinations are usually prescribed for patients who suffer from chronic pain in ambulatory care settings (Rosenblum et al., 2008). Even though our results showed that most of the chronic pain cases were treated in ambulatory care setting, the analysis of the month of June showed that 58% of orders were originally narcotic analgesic while 48% were narcotic analgesic combinations.

Our recommendation is to individualize treatments for every patient and start palliative therapy for different types of nonmalignant chronic pain with nonopioid analgesics. Afterward, start to titrate the medications for pain management by increasing of the dose of the current regimen or the initiation of opioid therapy.

Before starting opioid therapy, healthcare providers should evaluate the benefit risk ratio of the therapy and the decision of the initiation of opioid therapy should be based on result of the evaluation for every individual case.

Opioid therapy for nonmalignant chronic pain, starting with narcotic analgesic combinations is preferable since it has less opioid concentration, which could decrease the incidence of opioid misuse.

Continuous assessment for treatment goals and safe use of opioid medication is recommended to achieve the maximum treatment efficacy for the pain managements.

All patients should be aware of the adverse effects of opioid therapy, so any harmful effect can be prevented before the damage occur such as respiratory depression, constipation, depression disorder, and addiction.

Figure 1: The analysis of the average number of tablets/capsules dispensed per prescription April, May, and June 2018: Bar charts demonstrating that tramadol had the highest number of tablets dispensed followed by oxycodone compared to the other opioid medications.

Figure 1
A

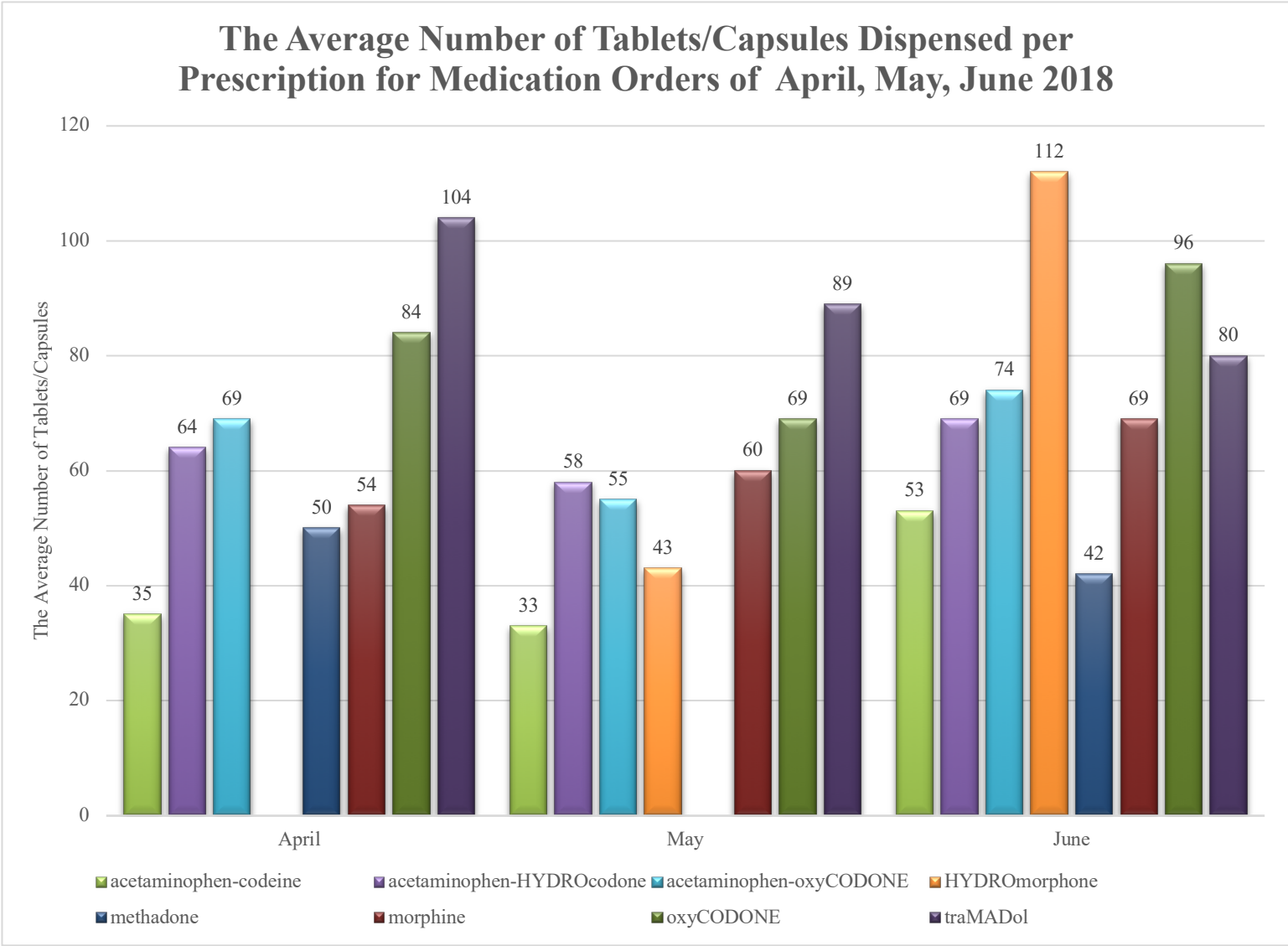


Figure 2: The analysis of the conditions in association with opioid prescriptions April, May, and June 2018: Bar charts showing that pain that associated with the musculoskeletal diseases had the highest number of opioid prescriptions for all of the three medication reports followed by malignant cancer pain.

Figure 2
A

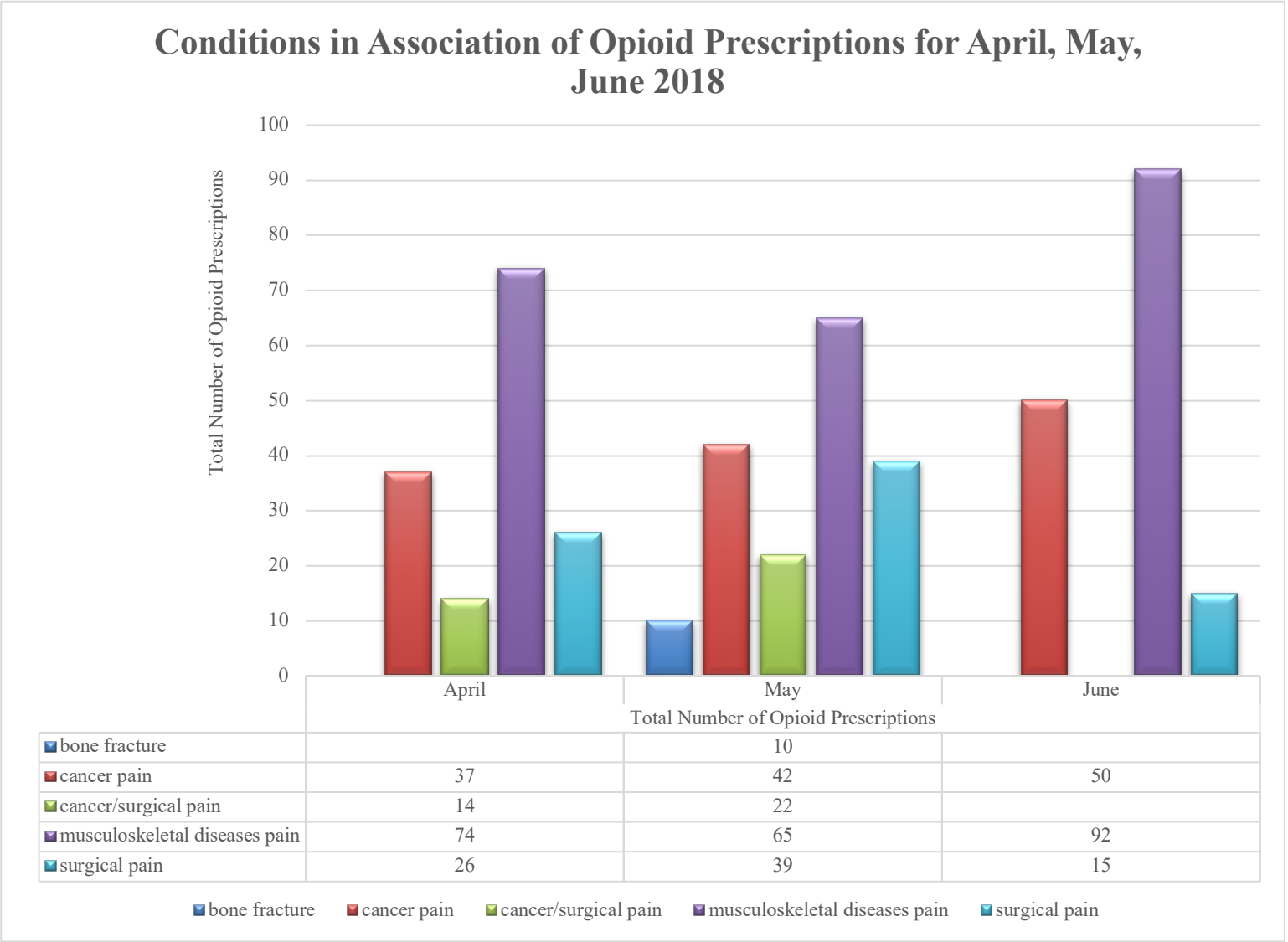


Figure 3: The analysis of the total number of prescribed medications in association with Conditions April, May, and June 2018: Bar charts demonstrating tramadol had the highest number of prescriptions associated with musculoskeletal diseases followed by acetaminophen-hydrocodone. Whereas morphine, oxycodone, and acetaminophen-oxycodone were the highest prescribed opioid medications for malignant cancer pain conditions.

Figure 3

A

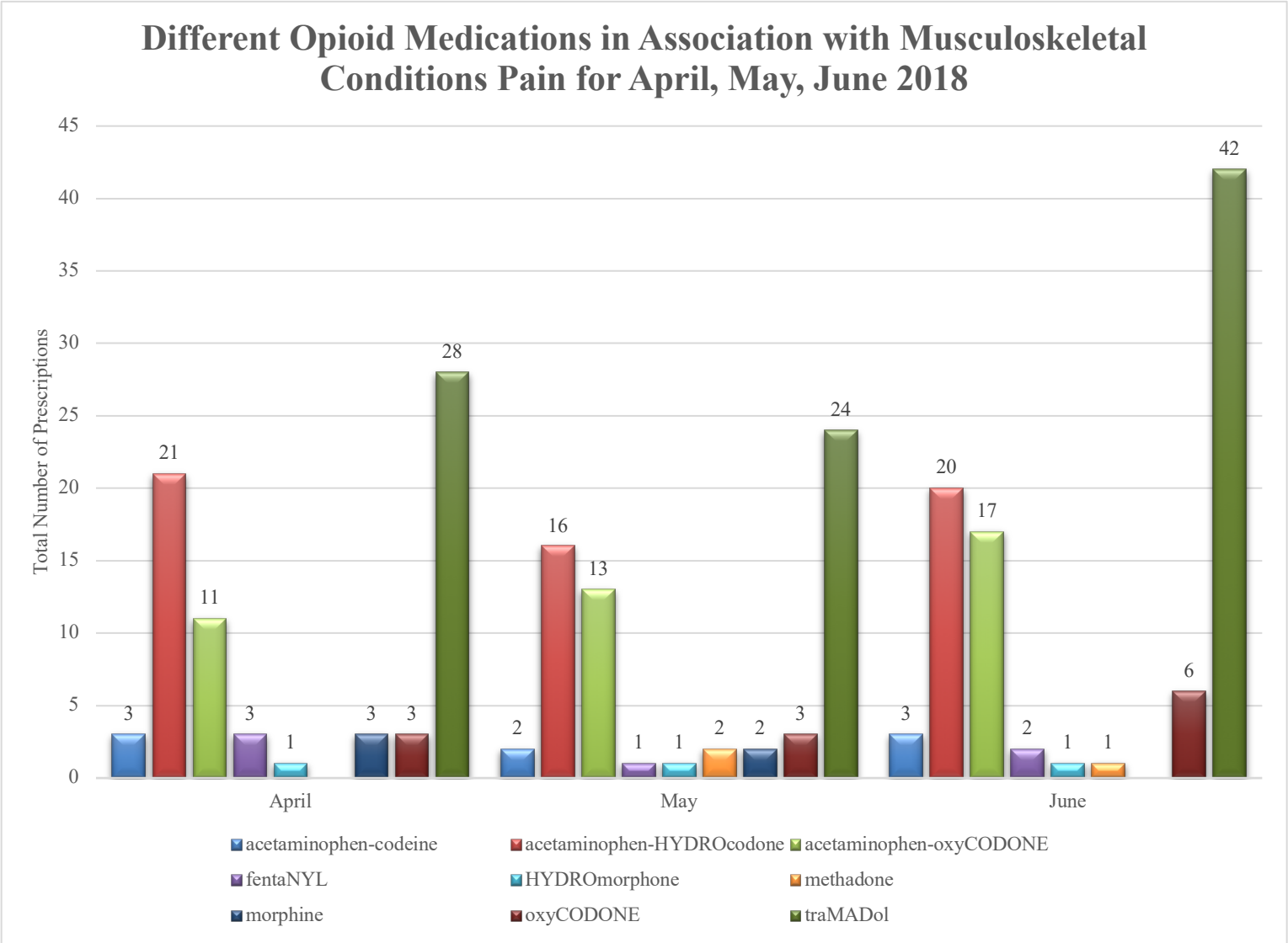


Figure 3

B

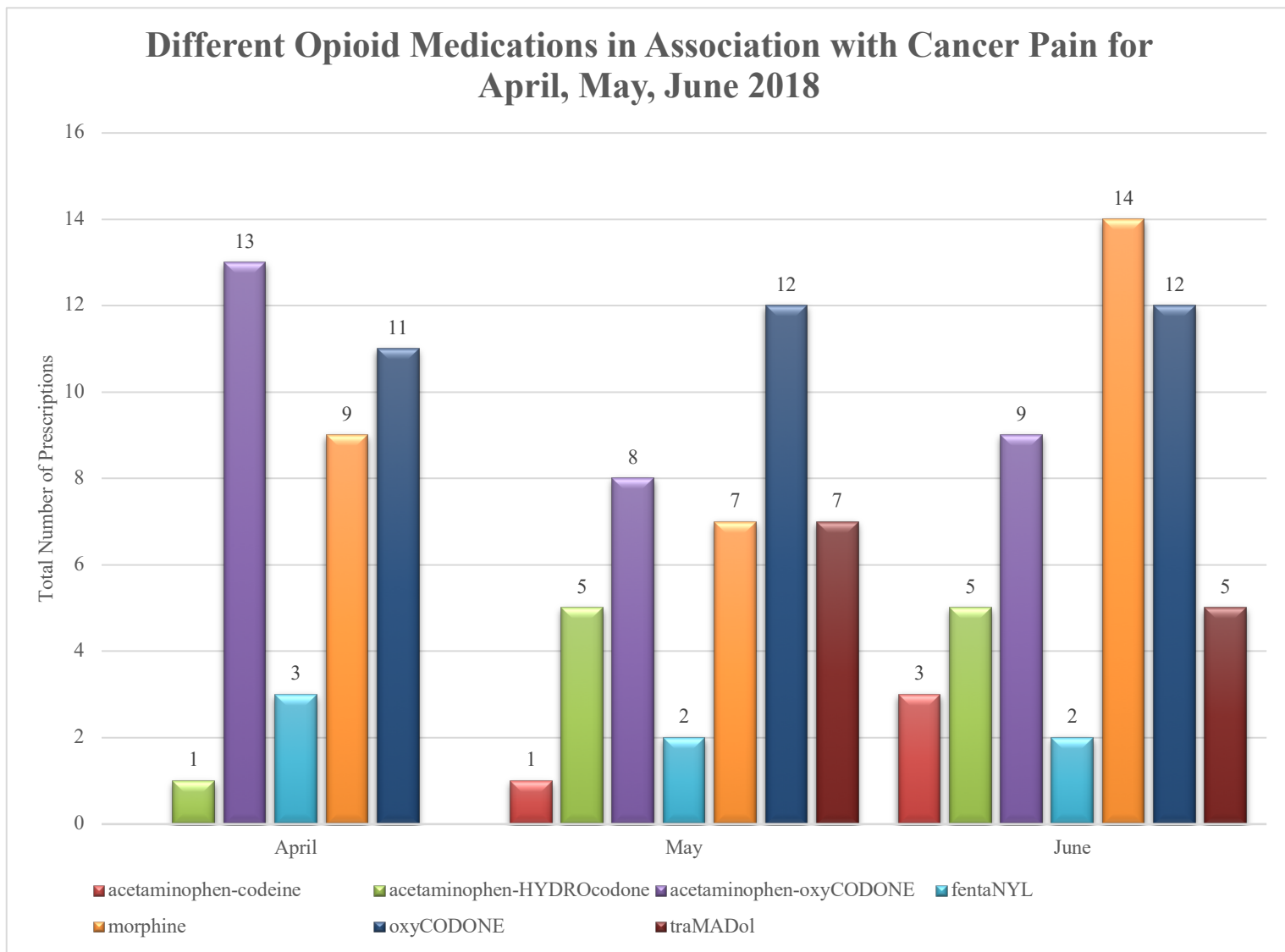


Figure 3

C

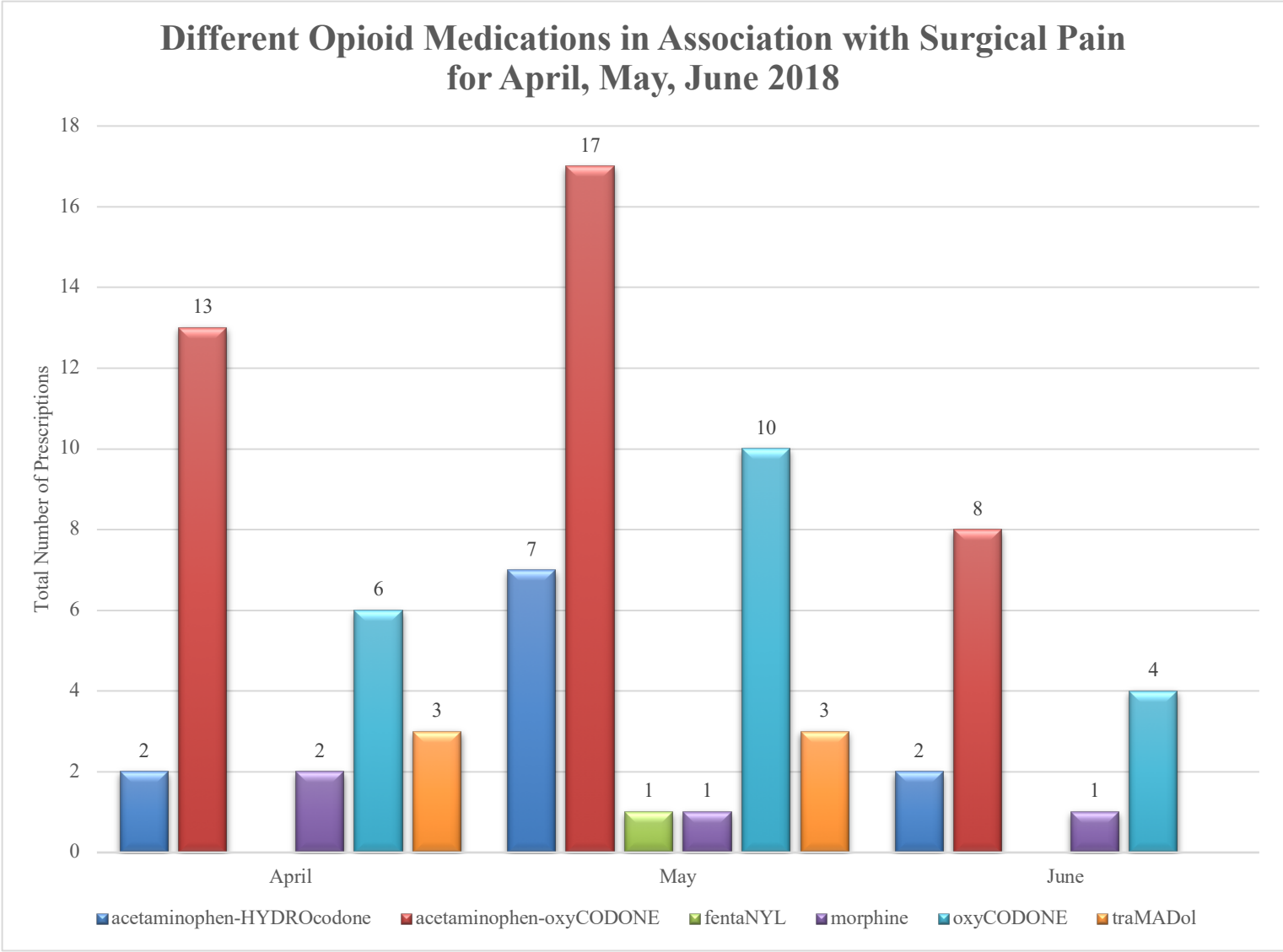


Figure 4: Detailed analysis of the July medication orders: (A) scheduled vs as needed prescriptions: Our result showing that most of the opioid prescription were written as PRN prescriptions. (B) Narcotic analgesics/narcotic analgesic combinations prescriptions that has refills: The results demonstrate that tramadol had the highest number of prescriptions refills among all other opioid medications. (C) Percent of orders (narcotic analgesic combinations vs narcotic analgesic): Pie chart showing that 58% of the prescription orders were narcotic analgesics.

Figure 4
A

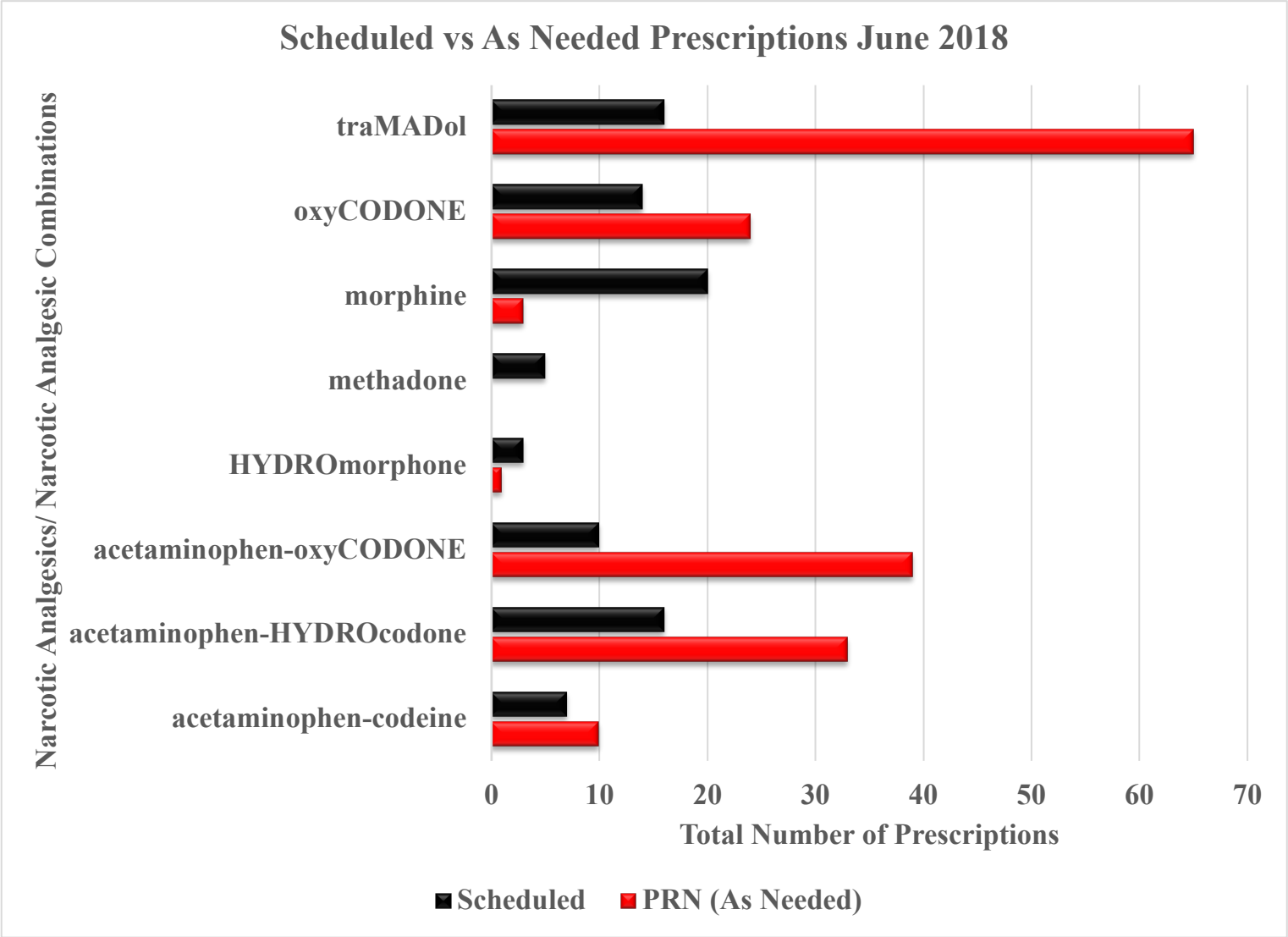


Figure 4

B

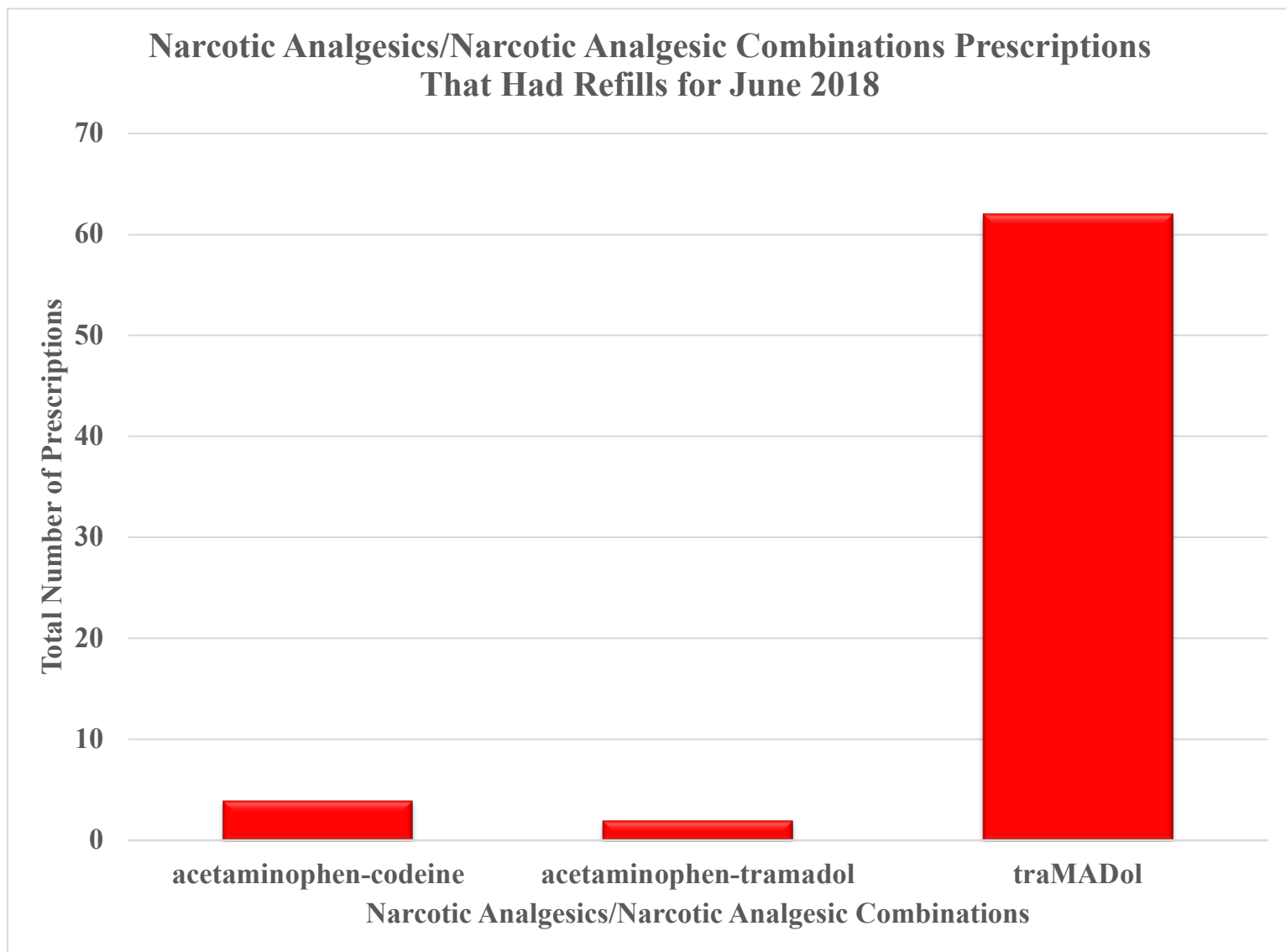
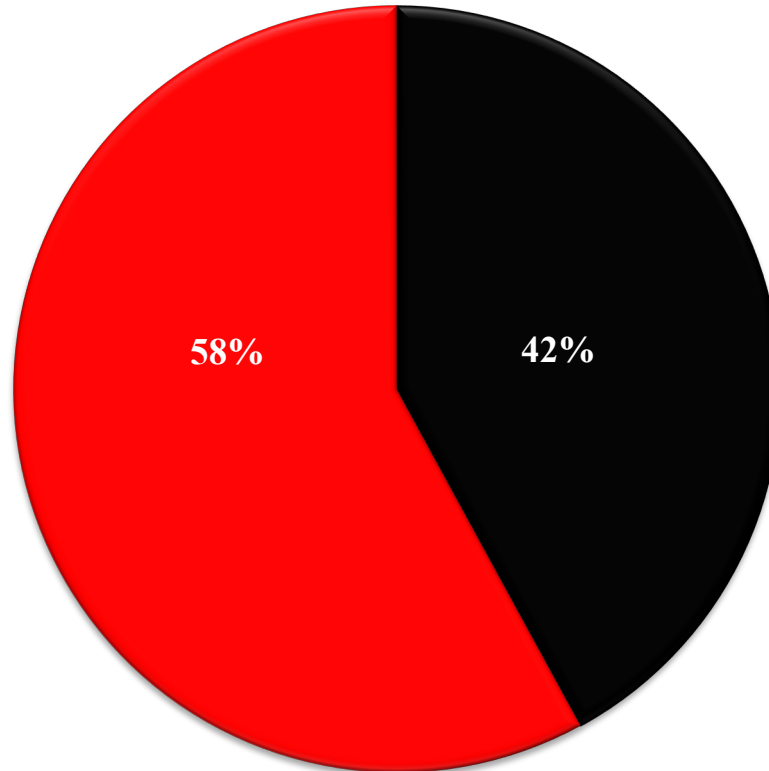


Figure 4

C

Percent of Orders (Narcotic Analgesic Combinations vs Narcotic Analgesic) June 2018



■ Narcotic Analgesic Combinations ■ Narcotic Analgesic

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